Wood Magic

A wood science curriculum for nine to eleven year olds

Authors: Audrey Zink-Sharp, Associate Professor, Wood Science, Virginia Tech

Julia Bussey, Technology Education Specialist, Virginia Tech

Acknowledgements

Kathleen Jamison, 4-H Curriculum and Learning Specialist, Virginia Tech

Jeff Kirwan, Extension 4-H Specialist, Virginia Tech

2005 Publication 388-807

Virginia Cooperative Extension

Knowledge for the CommonWealth

Virginia Tech

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

VIRGINIA STATE UNIVERSITY

Produced by Agriculture and Extension Communications

Table of Contents

Introduction

Studies of environmental education show that students do not lack concern for the environment, they lack knowledge. The Wood Magic materials are designed to help school teachers teach children about environmental science, particularly wood science and forestry. The activities engage the students in doing, reflecting, and applying wood science to their daily world. These materials present factual information in an entertaining, engaging, and interactive way.

The underlying themes include how wood adds value to our quality of life, the role of wood utilization in a sustainable future, and how science is used to improve the production of recyclable forest products. The events and curricula are designed around Virginia's Standards of Learning. Students discover the ways wood impacts their daily lives and how wood utilization influences our natural environment. The students formulate relationships between wood, science, and technology, and they experience real-world applications for the theoretical knowledge they learn in their regular science courses.

Youth take part in a variety of activities, demonstrations, and experiments. They learn to make a wood sandwich out of wood veneer and adhesive film, they test a piece of wood and learn how houses are designed with the knowledge of the bending properties, they get wet up to their elbows making paper from wood fiber, and they learn that each of them used three pounds of wood and forest products that day and that five trees are planted for every one harvested.

Wood Magic is designed for fourth- and fifth-grade classrooms. It is designed to be a supplement to information that students study in their existing science curriculum. Teachers may select and implement one or more of these activities without drastically altering their current curriculum. Implementing each Wood Magic activity requires approximately one-half to one hour. The teachers may choose to spend additional amounts of time with each activity if they so choose. These activities can be also be altered to fit other grade levels by adapting the information to match the developmental levels of the students.

Basic Features of the Wood Magic Activities

Each Wood Magic Activity has three major components: Materials, Preparation, and Procedures.

Lesson Plan

Virginia Standards of Learning

Each activity is aligned with the Math and Science Standards of Learning for grades 4 and 5.

Life Skill

Each activity identifies the life skill or skills that will be achieved through the process of completing the activity.

Content Skill (Objective)

Each activity identifies the lesson objective for the students. The objective states what the students will be learning and how they will be learning the information.

Time Needed

This section identifies the time needed for each activity. The time required may vary, depending on the number of students and the classroom setting.

Activity Summary

This section summarizes what the students will be doing throughout the activity.

Materials

All materials needed for each activity are listed. The materials are separated between the introduction of the activity and the activity itself.

Preparation

This section identifies the procedures and items that need to be prepared before class begins.

Procedures

This section explains the procedures used during the activity.

Enrichment Activities

This section lists additional ideas for students to do when they have completed the original work. This section can also assist the teacher with the process of extending the activity to achieve higher levels of learning.

Wood Journal

This sections identifies questions the students should be able to answer after completing the activity. This section lists ideas to get the students to reflect on what they have learned.

Reproducible Materials

These are the activity sheets, handouts, and transparency masters.

Wood Facts

This section provides additional information related to this lesson.

How to Use This Material

Wood Magic provides a series of wood activities and experiments to engage students in learning that wood is truly a remarkable and magical material. This curriculum provides background material, introductory activities, questions, and step-by-step instructions for each activity.

This curriculum is arranged in five chapters. Each chapter consists of an introduction to the wood properties being examined and a supporting activity. The materials in each chapter are designed to be part of the whole curriculum but can be taught as separate lessons. The chapter materials are not dependant on the information from another chapter. The activities are hands-on, multisensory activities that introduce students to the magic of wood.

Each chapter begins with an introduction that provides background information and facts for the topic. This information will assist you in understanding the focus of the activity and the applicability to the students' daily lives. This information will also aid you in answering the students' questions.

Each chapter includes a list of the applicable Virginia Standards of Learning. The Life Skill and Content Skill are listed, giving more specific information as to what the lesson will cover. The materials needed and the approximate amount of time needed for the activity are listed in a text box. The activities are geared toward children ages nine to eleven. The activities can be adjusted to accommodate the needs of most students.

Lesson Descriptions

Rock Stars

This lesson introduces youth to growth rings in wood, the direction of growth, and how the direction of growth affects the strength of wood.

Wet Elbows

This lesson teaches students that paper is made up of small pieces of wood, called fibers or cells. Youth learn that wood products can be reused, making the use of paper advantageous to the environment.

Bubbling Bazookas

This lesson shows students that wood is made of tiny cells that resemble and function like straws. The hollow cells are like straws allowing for water and food distribution. Some trees plug these cells to prevent dehydration. Each tree is different and each piece of wood is truly unique. This activity demonstrates the open and plugged cells of red oak and white oak.

Wood Sandwich

This lesson demonstrates how to make a composite material from thin sheets of wood and regular wood glue – a wood sandwich – and shows the influence of grain direction on stiffness.

Daily Wood

This lesson teaches students the importance of wood in our daily lives and how we use it every day.

Suggestions to Teacher/Leader:

- Run through all activities before trying them with a class of students. It is better to discover your needed materials and changes before the students arrive. This will save you time in the long run.
- Keep plenty of towels and cleanup supplies handy. Some of the activities can be messy.
- Safety is of the utmost importance. Each child and instructor should wear safety glasses when working with the breaking of wood activity.

Introduction

- An approximate time allotment for the entire lesson is provided. The time allotment will vary, depending on the number of students, the room arrangements, and assistance with the activity.
- Use the questions provided with each activity to challenge students to think past doing the activity.
- Assessment and reflection are key to the reinforcement of learning. Use the evaluation and journal writing at the end of each activity to assist with this process.
- The Enrichment Activities can be used to further build on the information of the original activity.
- Encourage the students to think beyond the norm. Assist the students in predictions, theorizing, and brainstorming throughout the activity. Allow them to learn through their mistakes. Allow them to find a better answer and therefore, a better understanding of what is taking place through the activity.
- Go beyond the activities that are contained in this curriculum to reinforce the magic of wood. Include as many areas of study as possible. Have the students read, write, draw, etc. where applicable. The more connections the students make with their existing knowledge and world the more they will remember and use in their daily lives.
- Encourage the students to use wood. It is a natural resource that can be regrown for use later.

Virginia Standards of Learning for Grades 4 – 5

The following Standards of Learning are addressed through the Wood Magic activities.

4th Grade: 4.1 – Scientific Investigation, Reasoning, and Logic
- a. distinctions are made among observations, conclusions, inferences, and predictions
- b. hypotheses are formulated based on cause-and-effect relationships
- c. data are displayed using bar and basic line graphs

4.4 – Life Processes

4.8 – Resources
- b. animals and plants
- d. forests

5th Grade: 5.1 – Scientific Investigation, Reasoning, and Logic
- a. data are collected, recorded, and reported using the appropriate graphical representation (graphs, charts, diagrams)
- b. an understanding of the nature of science is developed and reinforced.

5.5 – Living Systems

Lesson Design

Each lesson was designed to follow the Experiential Learning Model. Each activity begins with a doing experience. After the experience, the students share and process what they learned. They then decide how to apply that information to a different situation. "Experiential learning takes place when a person involved in an activity looks back and evaluates it, determines what was useful or important to remember, and uses this information to perform another activity." John Dewey (1938).

Some activities have an introduction section to be used as a warm up or to provide basic information needed for the lesson. This is often in an experiential format.

Lesson 1: Rock Stars

Standards of Learning

4th Grade: 4.1 – Scientific Investigation, Reasoning, and Logic
a. distinctions are made among observations, conclusions, inferences, and predictions
b. hypotheses are formulated based on cause-and-effect relationships

5th Grade: 5.1 – Scientific Investigation, Reasoning, and Logic

Life Skill

Learning to Learn – Draws upon previous knowledge and experiences of "weights" and "strength" and applies new knowledge and experiences concerning wood.

Content Skill (Objective)

Adding rocks or sand as weights to an attached bucket, the students will test a piece of softwood (1/2" square X 24") to determine the amount of weight it can hold before breaking; testing for bending strength.

Time Needed

45 minutes

Activity Summary

The children learn that the direction of the growth rings in wood affects its strength.

Science
SOL 4.1.a,
4.1.b, 5.1

Lesson 1: Rock Stars

Materials

Introduction

Extra pieces of wood for the students to observe and test for strength.

Activity

3 pairs of safety goggles

2 S hooks

1 bucket

1 table or 2 sawhorses or 2 tables (to work on)

1 crosscut disk of a tree to show growth rings

1 softwood stick per test (1/2" square X 24" along the wood grain) (wood without knots works best; knots weaken the wood.) Examples: pine, fir, spruce, hemlock

8 school books

1 scale

1 chain

2 volunteers

1 sand shovel

70 pounds (approximately) of small pebbles or sand or several rocks

Preparation

1. Have small sticks of softwood cut before class begins.

2. Make two stacks of books, four books per stack, on the table (or the two sawhorses or two tables), allowing approximately a third of each book to hang over the edge of the table. Do this for both sets of books placing them approximately one foot apart, making both stacks of books of equal height.

3. Make a chart on the board to record your observations.

Sample	Hypothesized Weight	Weight Held	Direction of Wood Grain
Blue X			
Red X			

Science SOL 4.1.a, 4.1.b, 5.1

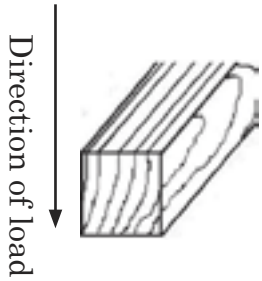
Procedures

Introduction (5 minutes)

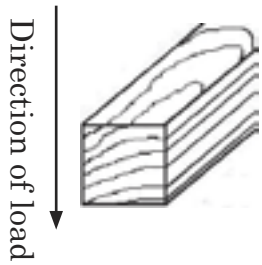
As the students enter the classroom, write directions on the board asking them to examine several different pieces of wood, some with a **blue X** and some with a **red X.** Each student should examine the wood, trying to determine which pieces are stronger. After making observations and comparing answers with their classmates, the students will write down their observations on ***Work Sheet 1A.***

Note: Each piece of wood is cut the same way. The load testing for the Blue X should be done so that the load is applied parallel to the growth rings – see direction of arrow. The load testing for the Red X should be done against the growth rings.

BLUE X – Mark some of the wooden sticks with Blue Xs. The color will indicate that the stick needs to be tested parallel to the growth rings. (These sticks should hold a heavier load.)



RED X – Mark some of the wooden sticks with Red Xs. The color will indicate that the stick needs to be tested perpendicular to the growth rings. (These sticks should hold less than those being tested with the growth rings parallel to the direction of the load.)



Science
SOL 4.1.a,
4.1.b, 5.1

Lesson 1: Rock Stars

Do

Students will make a comparison of two pieces of wood to determine which piece is stronger.

Explain the setup (Blue X – load parallel to the growth rings, and Red X – load across or perpendicular to the growth rings)

1. Show the students the growth rings in each piece of wood.
2. Tell the students to move through the steps.

- Step 1 – Put on safety glasses.
- Step 2 – Place the wood across the gap between the stacks of books (Double check the direction of the growth rings. This will affect your test.)
- Step 3 – Hang the chain and bucket from the center of the piece of wood.
- Step 4 – Add rocks or sand **SLOWLY** until the wood breaks.
- Step 5 – Weigh the bucket and the rocks or sand to determine how much weight it took to break the piece of wood.
- Step 6 – Record the weight on the chalk board.
- Step 7 – Test the second piece of wood in the same manner. (Double check the direction of the growth rings, making sure they are running perpendicular to the first stick's growth rings.)

Science
SOL 4.1.a,
4.1.b, 5.1

When you are finished explaining the setup of the activity

Tell the Students

1. Hypothesize how many pounds of rocks or sand the stick will hold before it breaks.

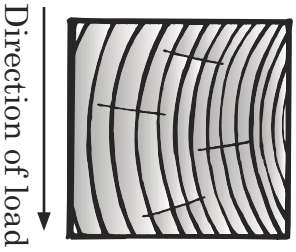
Use example to show students different weights to assist them in their hypothesis. (Select a student from the class and weigh him/her. Ask the class if they think the wood will hold that person. The wood being tested with the growth rings parallel to the load should hold any where from 50 to 70 pounds.)

2. Write the students' responses on the board.

3. Experiment Together

   - Select two volunteers to assist with the experiment.
   - Have yourself and each volunteer put on a pair of safety glasses.
   - FOLLOW THE STEPS LISTED ABOVE FOR SETUP
   - **SLOWLY,** begin to fill the buckets with rocks or sand using the shovels, until there is enough weight to break the stick.
   - Place the filled bucket on the scale to determine its weight.

10 min. Using ***Work Sheet 1A*** and recalling observations made during the opening activity, have the students record the results for each board tested.



Wood is stronger, in bending when weight is placed parallel with the growth rings.

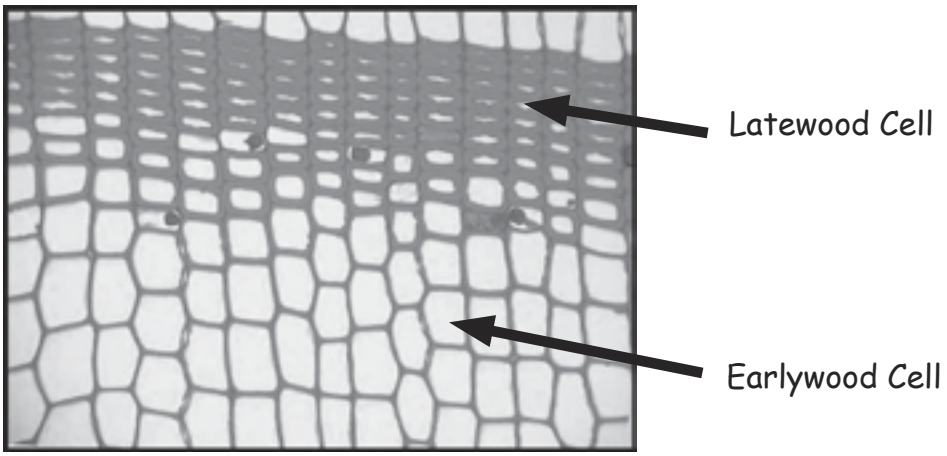
Science
SOL 4.1.a, 4.1.b, 5.1

Reflect – Share and Process

Ask

- Which wood held the most weight?
  (The wood tested with the direction of the load parallel to the growth rings should hold more weight, Blue X.)
- How much weight did the wood hold?
  (One stick should hold anywhere from 50 to 70 pounds. Refer back to the student weighed earlier in class or other objects that may have approximately the same weight.)
- How does the direction of the growth rings affect the strength of the wood?
- What did you learn about your "findings"?
  (If you look closely at a cross section of wood, you'll notice that the wood has dark concentric circles starting in the center. These are called *growth rings* and each ring represents one cycle of growth! The samples tested with the load parallel to the latewood are stronger because of their consistent structure. This structure gives them extra strength when weight is applied.)

You may have noticed that growth rings in the softwoods being used are made up of a light and a dark area – a light and a dark ring together make up one year of growth. Note: not all tree have these visible growth rings.



Microscope slide of redwood cross section, 40X

Science
SOL 4.1.a,
4.1.b, 5.1

Lesson 1: Rock Stars

The reason there appears two colors in a growth ring is because they are actually two different types of wood! The light wood is known as earlywood because the tree makes it during spring. The dark wood is called latewood because the tree makes it in late summer.

Latewood cells are stronger because the cell walls are thicker and the cells are more uniform in shape. On the other hand, earlywood is weaker because of thin cell walls and less uniform shape. (Transparency)

- How can we use this information in our daily lives?
  (Items that we use on a daily basis rely on the strength of the wood they are constructed from. We depend on this strength without acknowledging the importance.)

Have the student write their reflections in their Wood Journal.

Apply

10 min. Why is the strength of wood important to us?

Allow the students to answer and then give them examples of where wood strength plays a part in the selection of wood. Refer to your wood fact sheet for detailed information.

- Beds
- Benches
- Desks
- Shelves
- Floors and Stairs
- Chairs
- Railroad Ties
- Barrels
- Baseball Bat
- Bridges
- House Construction
- Power-line Pole

Evaluation

After observing the wooden sticks break and discussing the results with the class, have the students complete ***Work Sheet 1B***.

Science
SOL 4.1.a,
4.1.b, 5.1

Lesson 1: Rock Stars

Enrichment Activities

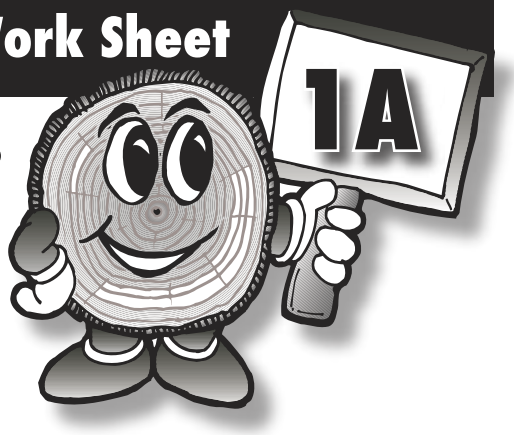
Take the students for a walk around the school, a field, or a park.

- Ask them to find examples of the uses of wood.
- Students should write down their observations.
- Students can discuss if the strength of the wood used for the object is important for its purpose.

Wood Journal

Have the students write two important facts or concepts they learned through "Rock Stars" and how they relate or are used in their daily lives.

Science
SOL 4.1.a,
4.1.b, 5.1



ROCK STARS

Name _____

Date_____

Observations	Blue X	Red X
1		
2		
3		
4		
5		

1. Which piece of wood broke the easiest?

_____

_____

2. Did most of your classmates have the same results?

_____

_____

_____

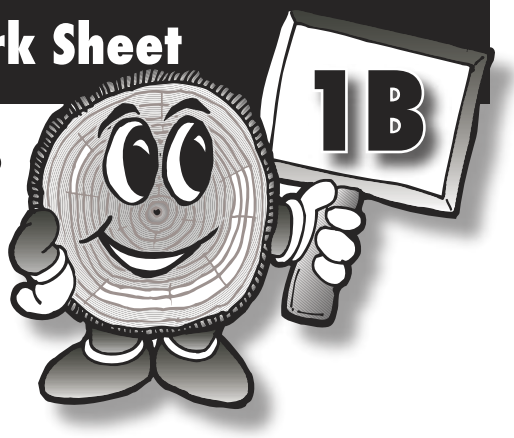
3. Why are some pieces of wood stronger than others?

_____

_____

_____

_____



ROCK STARS

Name _____

Date_____

1. Name two different aspects of wood that would affect its strength

_____

_____

2. What direction of the growth rings of wood is stronger when loaded in bending?

With the growth rings?

Against the growth rings?

3. Give three different examples of where wood is being used because of its strength.

a. _____

b. _____

c. _____

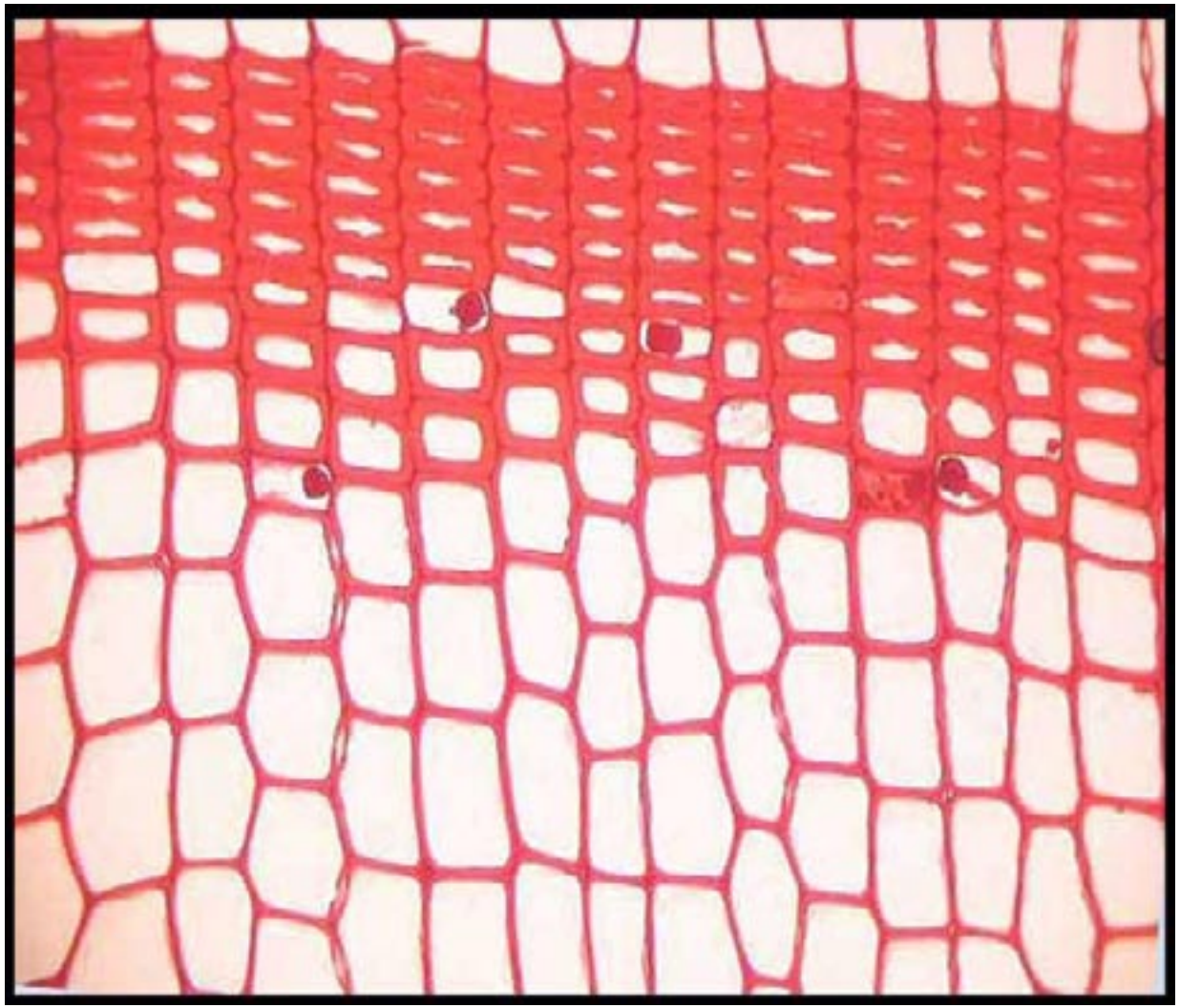
4. How would you compare a piece of oak to a piece of pine when considering wood strength?

_____

_____

_____

Wood Journal



Microscope slide of redwood cross-section, 40X

Lesson 1: Wood Facts 1

How Strong Is Wood?

If you look closely at a cross-section of wood, you'll notice that the wood has dark concentric circles starting in the center. These are called growth rings and each ring represents one year of growth!

You may have noticed that each growth ring in the softwoods being used are made up of a light and a dark area – a light and a dark ring together make up one year of growth. Note: not all trees have these visible growth rings.

The reason two colors appear in a growth ring is because they are actually two different types of wood! The light wood is known as earlywood because the tree makes it during spring. The dark wood is called latewood because the tree makes it in late summer.

Latewood cells are stronger because the cell walls are thicker and the cells are more uniform in shape. On the other hand, earlywood is weaker because of thin cell walls and less uniform shape.

Strength can be measured in many different ways! Being clear about how you measure strength in wood is very important. Wood cells normally grow in the same direction. Wood is not equally strong in all directions! **Wood is very strong!**

Uses of Strong Wood

Baseball bats are made from ash. Ash is a very hard wood and won't change shape or splinter when it receives a hard impact (like from a baseball).

Floors and stairs are often made from oak. Oak is a very dense, strong wood and can endure the everyday walking and moving of people. A less dense wood would be worn away more quickly.

Power-line poles are usually made from pine trees. This is because pine trees are strong, yet flexible. They are strong enough to support the heavy lines, yet are flexible enough to bend and not break when the wind blows.

Science
SOL 4.1.a,
4.1.b, 5.1

Lesson 2: Wet Elbows

Standards of Learning

4th Grade: 4.1 – Scientific Investigation, Reasoning, and Logic

b. hypotheses are formulated based on cause-and-effect relationships

4.8 – Resources

d. forests

5th Grade: 5.1 – Scientific Investigation, Reasoning, and Logic

h. an understanding of the nature of science is developed and reinforced

Life Skill

Learning to Learn – Draws upon previous knowledge and experiences of paper products and applies new knowledge and experiences concerning wood and its use for making paper.

Wise use of resources – Recognize the importance of reusing and recycling paper.

Content Skills (Objectives)

1. In a laboratory setting, the students will make a piece of paper using wood fibers and water to gain an appreciation for the reuse of wood fibers.

2. On a Work Sheet and in a journal, the students will identify the steps in making a piece of paper from wood slurry.

Time Needed

50 minutes (10 to 12 hours needed for paper to dry)

Lesson 2: Wet Elbows

Activity Summary

Students learn that paper is made of small pieces of wood called fibers or cells. They learn that wood products can be reused, making the use of paper advantageous to the environment.

Materials

Introduction: Work Sheet "Paper"

Water, 1 gallon or enough to fill tub half full	
Fluffy toilet paper (10 to 15 sheets for one sheet of handmade paper)	Large tub (6" or more deep, 1' square or bigger)
Cookie cutters	Empty 16-oz plastic cup
Screen (window screen)	Old-fashioned wringer or rolling pin
Hand mixer	Table to work on
2 sheets of felt per student	Plastic bag or sheets of plastic
Glitter, confetti, or dried leaves, flowers, seeds, etc.	3 different types of paper for beginning activity

Preparation

1. Obtain enough materials for each student in the classroom to complete one piece of paper.
2. Place three different types of paper on each student's desk. (Opening activity)
3. Choose a location to complete this activity that is easy to clean.
4. Place the table in the center of your work area.
5. Fill the tub half full with water. (Warm water works best, but is not necessary.)

Science
SOL 4.4,
4.5, 4.6,

6. Tear the toilet paper in small pieces and place them in the water
7. Lay the following items on the table in the correct order so the students will use them in the correct order.

   a. screen

   b. cookie cutters

   c. plastic cup

   d. 2 sheets of felt

   e. rolling pin

Procedures

Introduction (Do)

10 min. As the students enter the classroom, ask them to examine the several different types of paper found on their desks.

a. construction paper

b. newsprint

c. toilet paper

d. paper towels

e. poster board

The students should complete ***Work Sheet 2A*** on their desks.

Introduction (Reflect – Share and Process)

10 min. Discuss the differences that the students discovered from their observations and record their observations in a chart on the board for further reference.

Same	Different

Science SOL 4.4, 4.5, 4.6,

Lesson 2: Wet Elbows

Introduction (Ask)

- What do you know about paper?

  (Learning to Learn)

- What do the pieces of paper have in common?

  (Thin, made of wood, can be written on, etc.)

- How is each piece of paper different?

  (Color, thickness, size, etc.)

- What can we use paper for?

  (Toilet paper, writing, paper bags, wrapping gifts, etc.)

- Once the paper is used, can we reuse it?

  (Yes the fibers can be reused! This a wise use of resources.)

Refer to the ***Wood Facts 2B.***

Activity (Do)

20 min. Before talking to the students, complete these preparations.

- Place 10 to 15 torn-up sheets of toilet paper per student in the water when you begin to explain the process of the activity. This will give the paper time to start becoming workable.
- Select a student to use the hand mixer to break up the paper. Mix until liquidy! You can add confetti, dried leaves, etc. to the mixture at this point.

Direct the students' attention to the setup for making paper.

Verbally explain the objectives of the activity and the process.

Explain that new toilet paper has been added to water, allowing it to break down into a slurry.

Science
SOL 4.16,
4.1, 4.2,

Lesson 2: Wet Elbows

Have the students complete the following procedures.

1. Place a cookie cutter on a screen.
2. Hold the screen over the tub of slurry.
3. Using your cup, scoop up the pulp mixture from the bottom of the tub.
4. Pour the pulp into the center of the cookie cutter on the screen.
5. Evenly distribute pulp in the cookie cutter (approximately 1/4 inch thick).
6. GENTLY shake the screen side to side to distribute the pulp evenly.
7. Gently press down on the pulp with your fingers to form a flat layer inside the cookie cutter.
8. Allow the excess water to drip out of the screen.
9. CAREFULLY remove the cookie cutter.
10. Place a sheet of plastic (plastic bag) on top of the pulp on the screen.
11. Flip the screen over, while holding the plastic and pulp sheet in hand. (Teacher's assistance needed.)
12. Remove the screen, and hold the plastic and wood pulp sheet in your hand.
13. Place one piece of felt on top of the pulp.
14. Flip the felt, pulp, and plastic over.
15. Peel the plastic from the pulp sheet.
16. Place the second sheet of felt on remaining side of the pulp.
17. Place the felt and pulp on the table.
18. GENTLY, using a rolling pin, squeeze out any extra water.
19. Remove the felt.
20. Allow the paper to dry for several hours.
21. Use your paper.

Science
SOL 4.16,
4.1, 4.2,

Lesson 2: Wet Elbows

Activity (Reflect)

5 min. After the students have completed the process of making a piece of paper, direct them back to their seats. Have the students answer the questions on ***Work Sheet 2B.***

Ask

1. What happened when the toilet paper was placed in the water?

   (The toilet paper turns into a wood slurry. The water separates the wood fibers that make up the toilet paper. When the slurry dries, the fibers bond together again making a piece of paper.)

2. When paper is made, what is the importance of wood?

   (Most paper is made of wood fibers. The fibers themselves bond together to form the paper. This picture of a magnified piece of paper shows the wood fibers.)

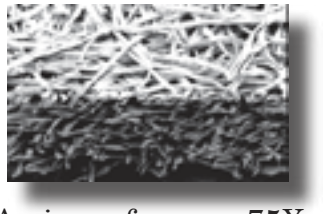
Show transparency of wood fibers.

3. What happens to your homework papers after you have completed them and taken them home?

   (Most of them are thrown away with little thought of reuse.)

4. What are the advantages of recycling and reusing paper?

   (Paper can be reused many times and made into other paper products.)



A piece of paper, 75X

Activity (Application)

Once all students have made their paper and have had a chance to answer the questions, brainstorm ideas of what the students can do to aid in the process of recycling or reusing paper products.

Follow through with their ideas as applicable to the school setting.

Evaluation

The students will complete the Work Sheet "Wet Elbows."

The students will make a piece of paper.

Science
SOL 4.16,
4.1, 4.2,

Lesson 2: Wet Elbows

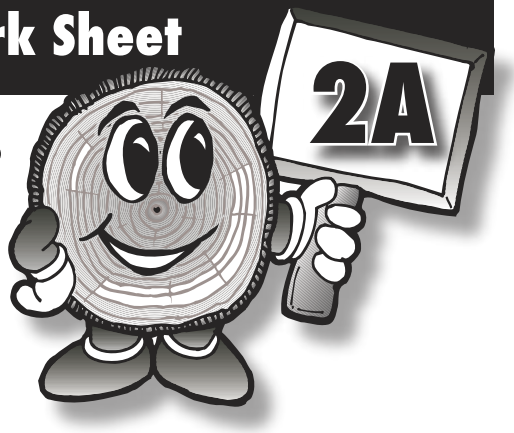
Enrichment Activities

1. Arrange for the students to set up a paper-recycling station in the school.
2. Have each student go home and collect 5 different types of paper, book, grocery bag, toilet paper, notebooks, wrapping paper, etc.
3. Visit a paper making facility.
4. Have the students write stories or poetry for a selected topic on their piece of paper.

Wood Journal

Have the students reflect on the process of making paper. Have them include at least two ideas of how they can reuse paper in their daily lives.

Science
SOL 4.16,
4.1, 4.2,



Name_____

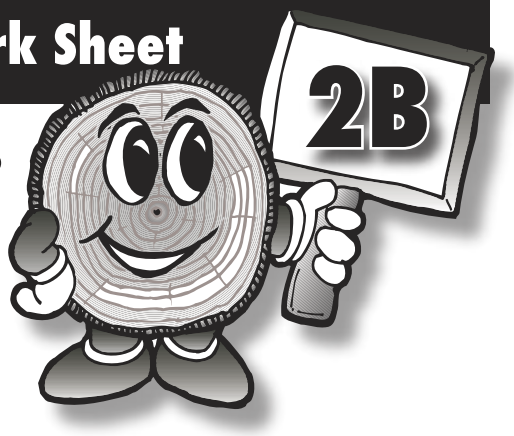
Date _____

Wet Elbows

Examine the three pieces of paper lying on your desk. What is the same about these papers? What is different about these papers? Write your answers in the chart below.

Same	Different

Science
SOL 4.16,
4.1, 4.2,



Name _____

Date _____

Wet Elbows Activity

1. What happened when the toilet paper was placed in the water?

_____

_____

_____

2. When you make paper, what is the importance of wood?

_____

_____

_____

3. What happens to your homework papers after you have completed them and taken them home?

_____

_____

_____

4. What are the advantages of recycling and reusing paper?

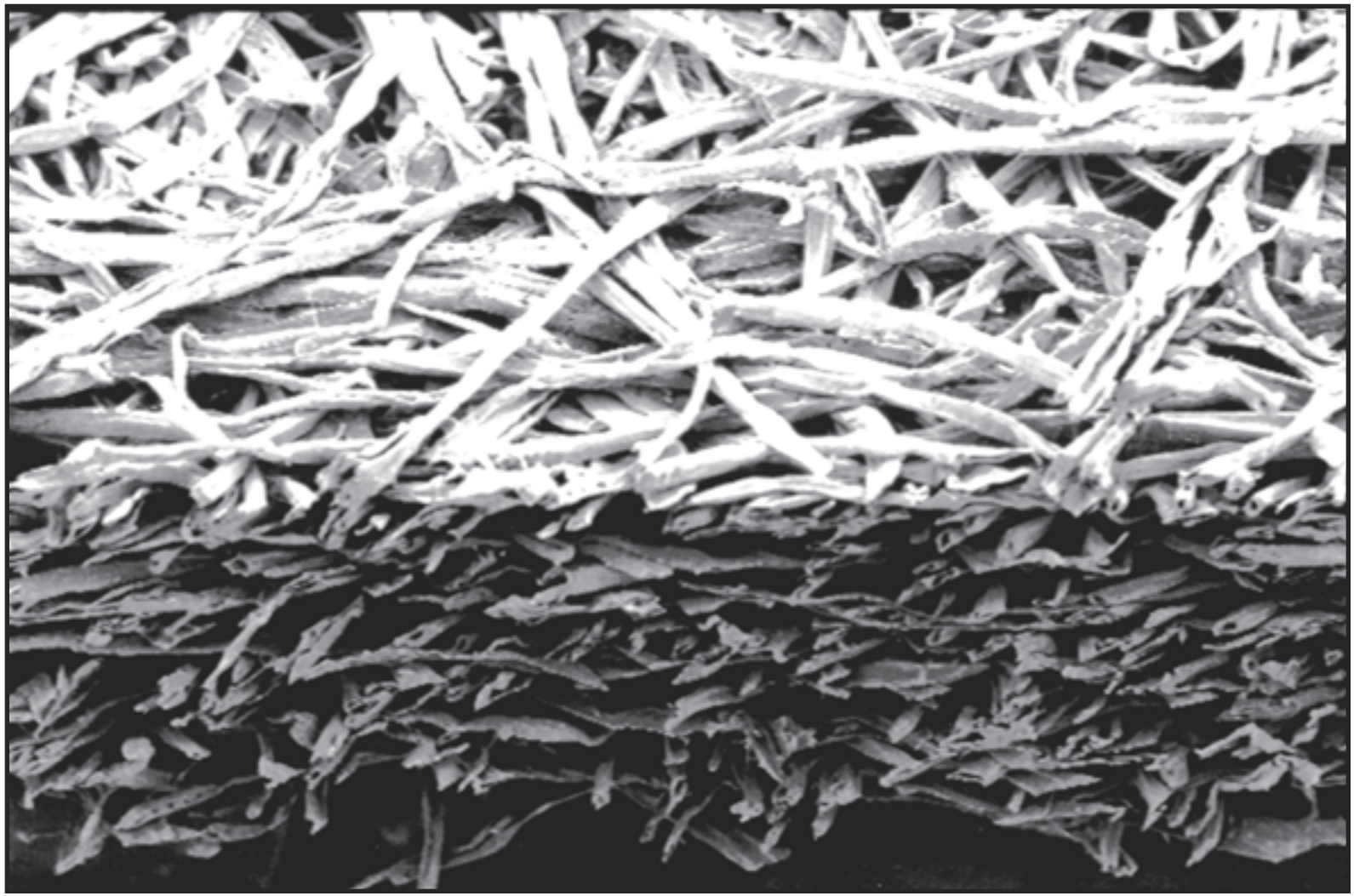
_____

_____

_____

Science
SOL 4.16,
4.1, 4.2,

Wood Journal



Picture of a piece of paper taken with a scanning electron microscope. This picture shows both the paper surface (top part of picture) and the cross section (bottom part of picture) which was cut with a razor blade. Magnification is 75X

Steps for making paper

First, wood is broken into very small pieces (fibers), or wood pulp. This can be done mechanically (usually with a stone grinder) or chemically.

Second, the fibers are suspended in water to be washed and/or bleached. Washing the fibers gets rid of chemicals that might still be on the wood. Bleaching the fibers makes the paper white. Not all paper is bleached – think of a piece of writing paper and a grocery bag. The writing paper is bleached, but the grocery bag isn't!

Third, the pulp is beaten. Beating the pulp unravels the fibers a little. This makes them stick together better. The pulp is beaten by putting it through two very close metal disks. The disks grind the fibers up.

Fourth, a slurry is made by mixing the wood pulp with water.

Fifth, the slurry is poured onto a screen forming a mat. The water drains away and leaves lots of fibers on the screen!

Sixth, since it's still a little damp, the paper has to be thoroughly dried. This is usually done by rolling the paper on big warm drums.

When the paper is dry, you've got finished paper!

Until the paper is used, it's stored on giant rolls. (They look like huge toilet-paper rolls!)

Science
SOL 4.1,
4.2, 4.4,

Lesson 2 : Wood Facts 2B

Wet Elbows

Paper is one of the most common uses of wood. We use paper every day, so much paper, that we don't realize how important it is for all of us. It is used in books, grocery bags, toilet paper, notebooks, and wrapping paper … the list goes on and on.

Paper was invented in China about 2000 years ago! Even though it's been around for that long, it was a long time before people around the world started making paper.

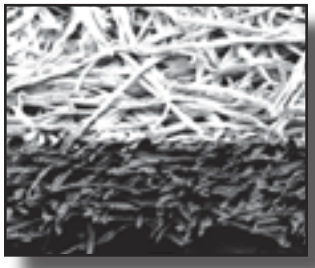
Before there was paper, people used different things for recording words. For example, the ancient Sumerians used clay tablets! – not nearly as convenient as paper. Can you imagine how heavy a book made from clay tablets would be?

Another good thing about paper is that it can be recycled! The fibers that make up paper can be used over and over!

Paper is made up of small pieces of wood called fibers or cells. Paper is wood that has been modified. When wood is modified before it is used, we say it is processed. Things made from processed wood are called wood products.

Nothing is wasted in the conversion of logs to lumber! Sawmill residue such as edges, slabs, trimmings, and bark are chipped and sold to other companies that make paper and mulch. Sometimes the residue is burned to produce heat at the sawmill.

When you look at paper through a microscope, it looks something like this: Different kinds of paper are made in different ways. For example, you make writing paper differently than you make cardboard boxes.



A piece of paper, 75X

However, paper is generally made in the same way. What you basically do is break down wood into very, very small particles and make a mat of those particles. Of course, making paper is a little more complicated than that.

Science SOL 4.1, 4.2, 4.4,

Lesson 3: Bubbling Bazookas

Standards of Learning

4th Grade: 4.1 – Scientific Investigation, Reasoning, and Logic

4.4 – Life Processes

4.8 – Resources

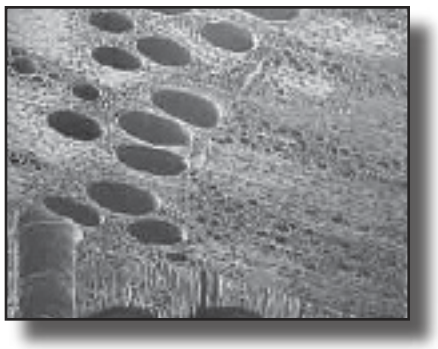
5th Grade: 5.1 – Scientific Investigation, Reasoning, and Logic

5.5 – Living Systems

Life Skills

Learning to Learn – Draws upon previous knowledge and experiences of wood use and applies new knowledge and experiences concerning wood.

Critical Thinking – Predicting the results of the activity based on the knowledge gained concerning wood cells.



Cross section of a piece of oak, 50x

Content Skills (Objectives)

Before dipping their dowels into the soap, students will predict if their dowels will blow bubbles when air is blown through them.

Based on the understanding of plugged wood cells, students will determine if the wooden dowels they selected have open or plugged cells after dipping them into soap and blowing on the opposite end.

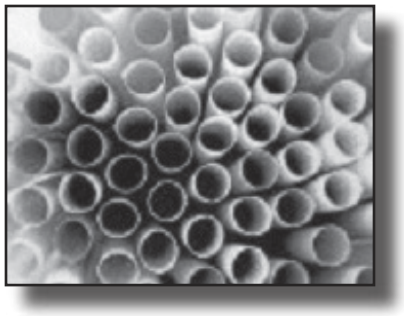
Time Needed

45 minutes

Science
SOL 4.1,
4.2, 4.4,

Lesson 3: Bubbling Bazookas

Activity Summary



This activity shows that wood is made of tiny cells that look and act like straws. The hollow cells are like straws allowing for water and food distribution. Some trees plug these cells to prevent dehydration. Each tree is different and each piece of wood is truly unique. This activity demonstrates the open and plugged cells of red and white oak.

Materials:

Introduction: bundle of drinking straws taped together (20 straws)
3 straws for each student

Activity:

Item	Details
white oak dowels red oak dowels	Dowels can be purchased from the hardware or home improvement store; get the ones that are about 3/8 inch in diameter, and be sure to get oak.
bubbles	Mr. Bubble (liquid bubble bath), dishwashing liquid, or liquid bubble soap
cups for bubbles	Paper cups
paper towels	For cleaning up messes
photos of cross-sections of oak wood	(www.woodmagic.vt.edu)

Preparation

Answer the following questions before planning for this activity.

1. How many students will be participating in this activity at one time?
2. Will the students be working in groups or individually? (This will determine the number of dowels and cups needed for the activity.)
3. Will the instructor bring the bubbles to the students or will the students go to the bubbles?

Science SOL 4.1, 4.2, 4.4,

Lesson 3: Bubbling Bazookas

Prepare the materials and work area.

4. Cut dowels approximately 3 inches long.
5. Cover your working area with newspaper to allow for easy clean up.
6. Determine the number of groups of students.
7. Allow one cup for each group or individual.
8. Pour each cup half full of liquid soap.

Introduction (Do)

As the students enter the classroom have them examine and play with the three straws on their desks. Have each student begin ***Work Sheet 3A*** on his or her desk. (10 min.)

Introduction (Reflect – Share and Process)

Discuss what the students discovered from their observations and experimentation.

Ask (The following questions are found on ***Work Sheet 3A***.)

1. What can you do with the straws?
   (The straw can be bent, blown through, stuck together, etc.)
2. What happens when you blow on the straw?
   (Air travels through it.)
3. What happens when you bend the straw then blow on it?
   (The airflow is blocked if bent completely. The airflow is limited if not bent completely.)
4. What happens when you put your finger over the end of the straw?
   (No air is allowed to flow through the straw.)

10 min. Direct the attention of the students to the setup for Bubbling Bazookas.

Science
SOL 4.1,
4.2, 4.4,

Lesson 3: Bubbling Bazookas

Activity (Do)

Pass out **one** 3" dowel to each student.
Explain the process of the activity to the students.

- Students will be determining if the vessels in the dowel are open or closed by blowing bubbles.
- **Step 1** – The students will dip their dowels in the container of bubbles.
- **Step 2** – Students should then blow through the opposite ends of the dowels. (not the ends with the bubbles)
- **Step 3** – Students should record what happened when they blew on the ends of their dowels.

Activity (Reflect)

10 min. After the students have completed the process of blowing bubbles through their dowels, direct them back to their seats. Have the students answer the questions at the bottom of ***Work Sheet 3A.***

1. What happened when you blew air through your dowel? (One of two possible results could occur – bubbles or no bubbles.)
2. Did you get the same results as other students in the class?
   (All members of the class will not get the same results if the red and white oak dowels were mixed.)

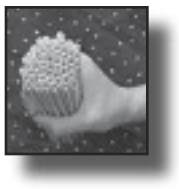
Activity (Apply)

15 min. Discuss the results with the students and make a comparison to the properties of wood cells.

Refer to ***Wood Facts 3*** corresponding to Bubbling Bazookas.

Ask

1. What happened when you blew air through your dowel?
   - Wood cells are like straws.
   (Hold the bundle of straws vertically in your hand to represent the wood cells.)
   - The straws represent the cells which are hollow, allowing for water and food distribution.



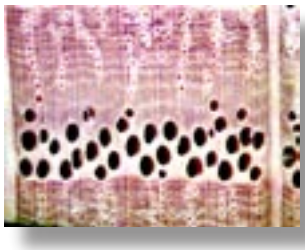
2. Did you get the same results as other students in the class?
   - All trees are different.
   - Some trees prevent dehydration by naturally plugging some of the cells (straws) with adjacent cells. (White Oak)

Science SOL 4.1, 4.2, 4.4,

- Some trees do not plug their cells. (Red Oak)
- Show the picture of the white oak and red oak wood cross sections taken through a microscope. (Transparency 1)

3. Based on your results, what type of wood is your bazooka made of?
   - Because the vessels of white oak are plugged with other cell walls, it is most likely that you were not able to blow through the bazooka creating bubbles.
   - Red Oak will allow you to blow bubbles because the cells are usually not plugged allowing air to flow and form bubbles.

Have the student complete the questions on ***Work Sheet 3B.*** When finished with Work Sheets, students should work in their Wood Journals.



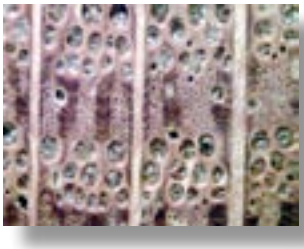
Red Oak, 20X

Evaluation

The students will complete ***Work Sheet 3A*** and ***Work Sheet 3B***.

The students will blow bubbles with a 3" oak dowel.

The students will record in their Wood Journal their findings through this activity.



White Oak, 20X

Enrichment Activities

1. Set up a learning center allowing the students to view cross sections of red oak and white oak, using a hand lens or microscope to see the vessels.
2. Have students explore their neighborhood and home to identify items made of red oak or white oak. Students should be able to explain which type of oak should or could be used for each item and why.

Wood Journal

Have the students write a reflection of what they learned through the Bubbling Bazookas lesson.

Were you able to predict what would happen when you blew on the wooden dowel?

What did you learn about wood today?

(Some vessels are plugged in trees to prevent further dehydration and some are not.)

Science SOL 4.1, 4.2, 4.4,

Lesson 3: Bubbling Bazookas

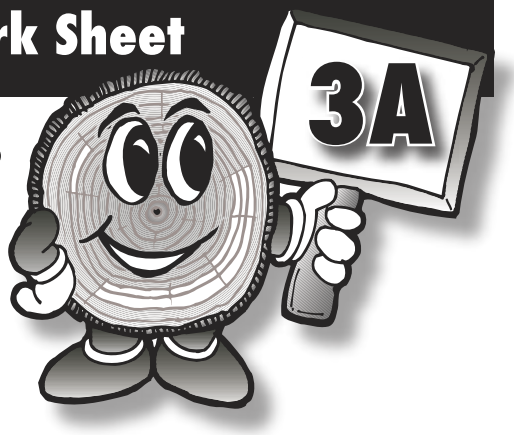
How can you use this information in your daily life?

(The properties of the wood determine its uses in daily life. Example, wooden barrels that are made to hold liquids are usually made of white oak because their cells are plugged.)

Copy the following information onto the chalk board

Uses of Red Oak	**Uses of White Oak**
furniture	furniture
flooring	flooring
	barrels or kegs that hold liquid

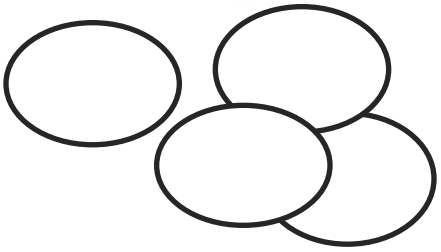
Science
SOL 4.1,
4.2, 4.4,



Name _____

Date _____

Bubbling Bazookas



Examine the three straws lying on your desk.
Answer the following questions about the straws.

1. What can you do with the straws?

_____

_____

_____

2. What happens when you blow through a straw?

_____

_____

_____

3. What happens when you put your finger over the end of the straw and try to blow air through it?

_____

_____

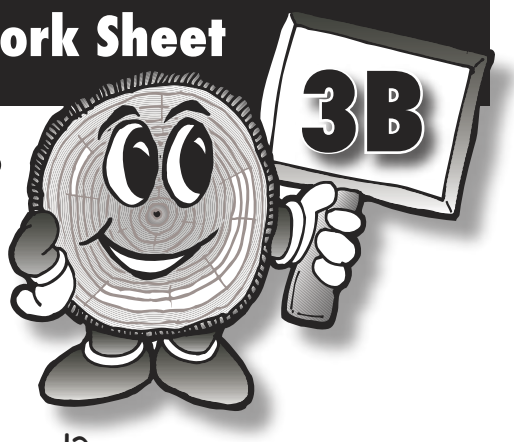
_____

4. What happens when you bend a straw and try to blow air through it?

_____

_____

_____



Lab Activity Reflection

1. What happened when you blew air through your dowel?

_____

_____

_____

2. Did you get the same results as other students in the class?

_____

_____

_____

3. Based on your results, what type of wood is your bazooka made of?

_____

_____

_____

4. Your bazooka was made of _____ oak.

   What is this type of wood used for?

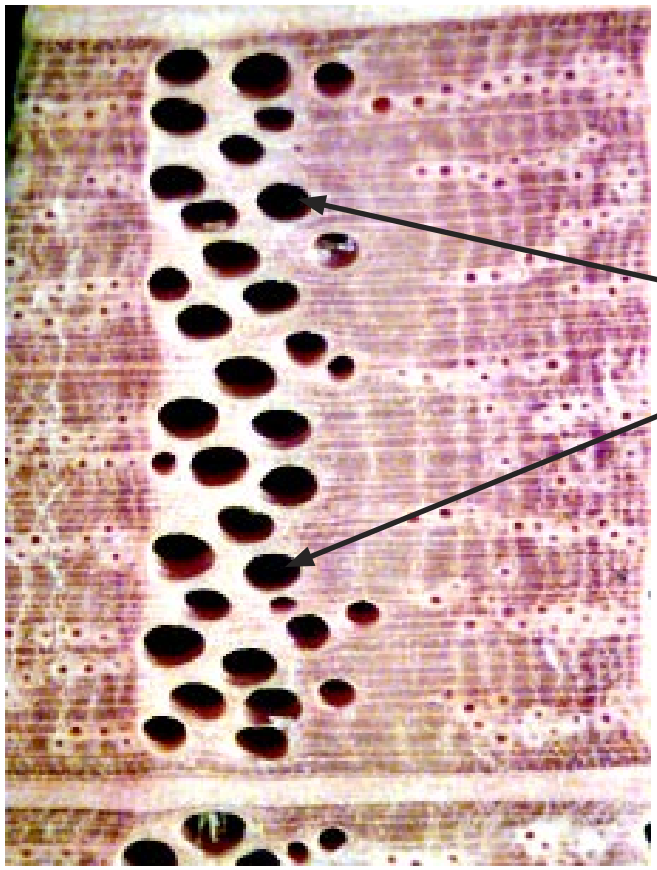
_____

_____

_____

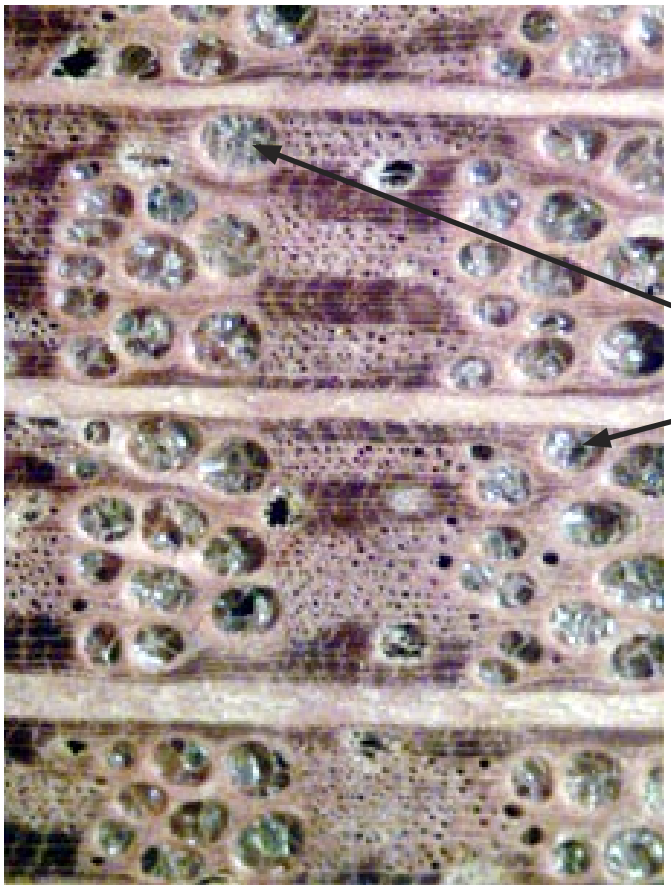
Wood Journal

Lesson 3: Bubbling Bazookas - Transparency



Open Vessels

Red Oak, 20X



Plugged Vessels

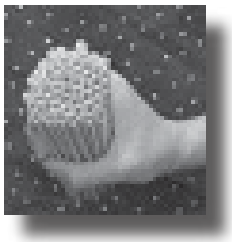
White Oak, 20X

Lesson 3: Wood Facts 3

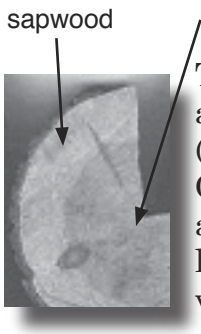
Bubbling Bazookas

Wood is like any other material – it's made up of lots of different parts! Each part has its own job and function. One of the most important parts of a tree is xylem. Xylem is the woody part of a tree.

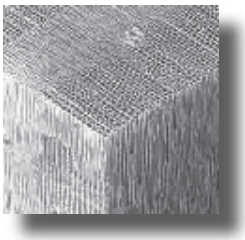
When you're looking at a piece of wood, what you're actually looking at is called xylem (pronounced "ZEYE-lem"). The xylem's job is to carry water for the tree from the roots to the leaves and other parts of the tree.



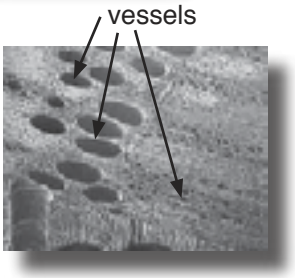
Not all xylem is alive and works. Heartwood is dead xylem and sapwood is live, working xylem. Xylem is made up of long, skinny cells. A really good way to think of wood or xylem in a tree is to picture a handful of straws. The straws are like the fibers, sucking up water from the roots!



The xylem of hardwoods (angiosperms) and the xylem of softwoods (gymnosperms) have many differences! One of the main differences in hardwood and softwood xylem has to do with very large cells called vessels. Hardwoods have vessels, but softwoods don't.



Softwood Xylem
(no vessels), 100X

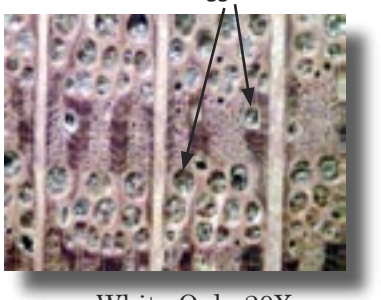


Hardwood Xylem
(has vessels), 50X

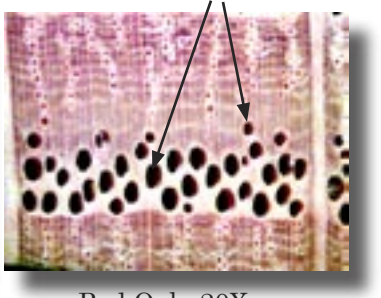
Vessels are HUGE water-carrying cells! Notice how big the vessels are in comparison to the other cells! Some vessels are so big they can be seen without magnification. The large, hollow vessels in red oak allow us to blow bubbles through red oak pieces.

Just like all trees are different, the wood in their trunks is all different. In some trees, the wood straws (vessels) are plugged up. Things change when sapwood changes to heartwood. In some trees, some of the cells next to the vessels grow into the hollow part of the cell and plug up the cell so that water cannot flow anymore. The vessels (straws) in red oak usually are not plugged up with other cells. However, the vessels in white oak usually are plugged.
This is a natural process in these two kinds of trees, but many other trees have plugged cells, hickory and locust for example.

When we do our Bubbling Bazookas activity, we will use white oak and red oak so that we can compare them.



White Oak, 20X



Red Oak, 20X

Lesson 4: Wood Sandwich

Standards of Learning

4th Grade: 4.1 – Scientific Investigation, Reasoning, and Logic
- a. distinctions are made among observations, conclusions, inferences, and predictions
- b. hypotheses are formulated based on cause-and-effect relationships

5th Grade: 5.1 – Scientific Investigation, Reasoning, and Logic
- h. an understanding of the nature of science is developed and reinforced

Life Skill

Learning to Learn – Draws upon previous knowledge and experiences of wood strength and wood grain and applies new knowledge and experiences concerning wood strength and stiffness.

Content Skills (Objectives)

After making observations concerning the stiffness of veneer when the grain of wood is running in the same direction, students will bend the three veneer sheets having the middle piece of veneer turned so that the grain is running in the opposite direction testing for stiffness.

By placing glue between the three veneer sheets and using heat and an iron or a press to bond the veneer together, the students will illustrate the formation of plywood and make observations about stiffness.

Time Needed:

25 minutes

Activity Summary

This activity will demonstrate how to make a composite material from thin sheets of wood and regular wood glue – the wood sandwich – and shows the influence of grain direction on stiffness.

Science
SOL 4.1,
4.2, 4.4,

Lesson 4: Wood Sandwich

Materials

Introduction: ten drinking straws for each student, tape

Activity:

Material	Details
3 6"-square sheets of veneer (per group or student)	Wood veneer can be bought at home improvement stores or ordered from catalogs (see suppliers).
regular wood glue (permanent bond)	This can be purchased at your local lumber store.
Weights, approximately 50 lbs.	Books, heavy objects to apply evenly distributed pressure
1 roll aluminum foil	
4 #5 binder clips (per group)	Most office supply stores carry this item.
1 6"-square piece of 3/4" plywood	This can be purchased at your local lumber store. Some stores may donate a small piece.

Preparation

Make preparations for this activity based on your response to the following statements or questions.

1. Will the class work in groups or individually?
2. Cut 6"-square veneer before beginning activity.
   (Cut enough for each person or group to have three.)
3. Tape ten straws together for each student or group for use with the beginning activity.

Procedures

Introduction (Do)

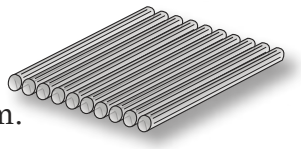
10 min. As the students enter the room, have them do the activity and answer the questions on ***Work Sheet 4A***.
(Each student or group will need ten drinking straws to complete the activity.)

Science
SOL 4.1,
4.2, 4.4,

Lesson 4: Wood Sandwich

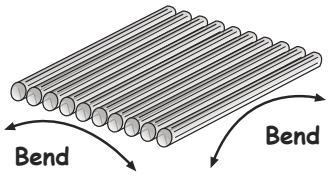
Lay the straws flat on the table and tape them together before the students arrive. This will aid the students with **Work Sheet 4A.**

Have the students try to bend the straws end to end and then side to side.

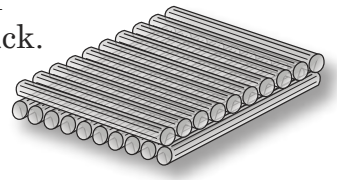


At the end of your allotted time discuss the students' results with them.

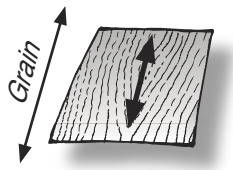
Introduction (Reflect)



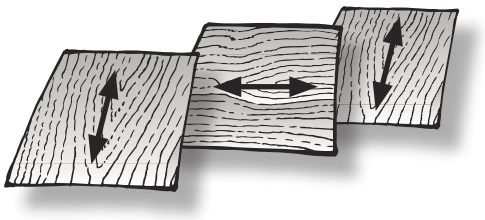
- What happened when you bent the straws from side to side?
  (The straws are easy to bend from side to side.)
- What happened when you bent the straws from end to end?
  (Bending from end to end should be more difficult.)
- Now put two sets of straws together in a stack so that each set of straws is perpendicular to the other and then try to bend the stack.



- What happened when you tried to bend the straw stack?
  (The stiffness will increase in both directions making the straws more rigid in all directions.)
- Have you ever tried to bend a piece of wood?
- How can we use this information?
  (A piece of veneer (thin sheet of wood) is easily bent with the grain of the wood.)



Show – "Wood Sandwich" transparency.
Explain that plywood is much like a wood sandwich.



Science
SOL 4.1,
4.2, 4.4,

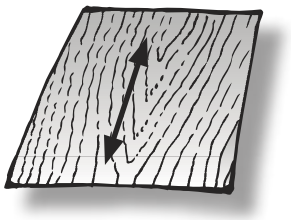
Lesson 4: Wood Sandwich

Activity (Do)

20 min. Direct the students' attention to the setup for making a "Wood Sandwich."

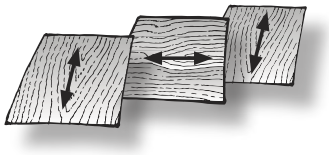
Explain that they will be making a wood sandwich, much like the plywood that can be purchased at a lumber yard.

Go through each step of the procedure before allowing the students to work, answering any questions. Make sure you cover any safety issues at this time.



The students follow and do the steps.

- Step 1 – Pick up 3 6"-square pieces of veneer from the resource table.
- Step 2 – Make observations of each piece of veneer, locating the direction of the grain.
- Step 3 – Using a pencil, mark the direction of the grain of wood with an arrow. (Picture on ***Work Sheet 4B.***)
- Step 4 – **Gently** bend one piece of veneer feeling for stiffness. Be careful not to bend the veneer too far to avoid breaking it.
- Step 5 – Stack all three sheets of veneer together with the arrows all going **the same direction**.
- Step 6 – Bend the veneer in the same manner you previously did, using three sheets and being careful not to bend it too far.



Record the students' observations on the chalk board.

	Veneer in same direction	Second veneer turned	Veneer after glued
Observations made by students			

- Step 7 – **Change the direction of the middle piece** of veneer, so that the grain of the veneer is in opposition to the other two.
- Step 8 – Repeat the same bending test as above. **Try bending the veneer**, observe the change in the stiffness.
  (When veneer is stacked and glued together, alternating the direction of the wood grain, the stiffness of the veneer increases. This concept is being used when plywood is created.)

Science
SOL 4.1,
4.2, 4.4,

Lesson 4: Wood Sandwich

Continuing the doing by creating the "Wood Sandwich"

- Step 1 – Spread a uniform layer of regular wood glue (permanent bond) on the top of one piece of veneer.
- Step 2 – Place the second piece of veneer on top of the glue layer just made, making sure the direction of the grain of the second piece of veneer is in opposition to the first piece of veneer.
- Step 3 – Spread a uniform layer of regular wood glue on top of one of the pieces of veneer.
- Step 4 – Place the last piece of veneer on top of the glue layer just made making sure the direction of the grain of the third piece of veneer is in opposition to the piece of veneer with the glue.
- Step 5 – Place a piece of aluminum foil on either side of the stack.
- Step 6 – Clamp all four sides of the veneer with #5 clips, securing the stack of veneer and aluminum foil.
- Step 7 – Apply weight to the stack overnight or for several hours (teacher assistance needed).
- Step 8 – Allow the 3-ply stack to thoroughly dry.

Students should record the information from the board to their Wood Journal.

Say – Wood is stronger along the grain!

Activity (Reflect)

Ask

10 min. 1. When doing the bending test, which way was the grain of the wood going when the piece of veneer was the stiffest?
(The wood should be the stiffest with the grain of wood.)

2. What happens to the stiffness when two pieces of veneer are placed together with the grain running in the same direction?
(The stiffness of the wood does not increase a noticeable difference when the grain is running in the same direction.)

3. What happens to the stiffness when two pieces of veneer are placed together with the grain running in opposing directions?
(The stiffness of the wood increases significantly when the grain of the second piece of veneer is running perpendicular to the first piece of veneer.)

Science SOL 4.1, 4.2, 4.4,

Lesson 4: Wood Sandwich

Review

Refer to the *Wood Facts 4.*

Plywood is one of the most widely used wood products. Its main use is in the construction of homes and other buildings. Plywood is used underneath almost everything you see in a building. For example, there is plywood sheathing under the floor, the walls, and the roof!

Plywood is good to use because it's light-weight and strong. Plywood is also convenient to use because it comes in sheets, which are much easier to handle than boards! Plywood is basically very thin sheets of wood glued together.

- Show an example of a commercially made piece of plywood and have the students complete ***Work Sheet 4B***.

Activity (Apply)

10 min. Have the students write in their Wood Journals two ways they have used or observed the use of plywood in their daily lives.

How is plywood used in our daily lives? How else could it be used?

- Construction of homes and other buildings
  - floors
  - walls
  - ceilings
  - cabinets

Evaluation

After making the wood sandwich (plywood), the students will complete their Wood Journals and recap what they have learned.

Enrichment Activities

1. Take the children for a walk around the school, a field, or a park. Ask them to find examples of plywood. Students should write down their observations.

2. Have several different pieces of plywood of varying thicknesses for the student to observe and manipulate, testing for stiffness.

Science SOL 4.1, 4.2, 4.4,

Lesson 4: Wood Sandwich

Wood Journal

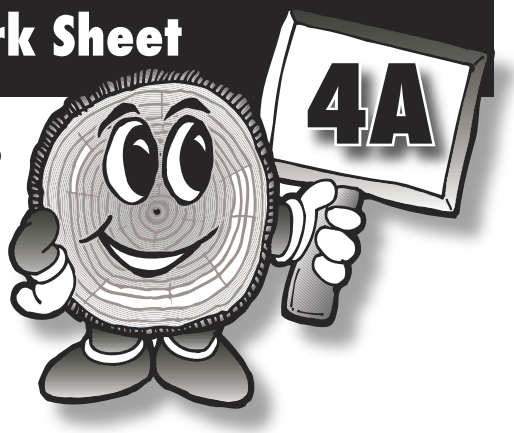
Have the student write two ways they have used or observed the use of plywood in their daily lives.

Have the students write a reflection of what they learned through the activity wood sandwich.

Have the students explain why plywood is an excellent type of wood to use. (light-weight and strong)

Science
SOL 4.1,
4.2, 4.4,

Lesson 4: Work Sheet



Name _____

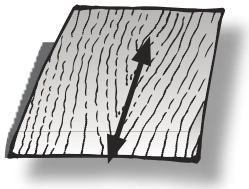
Date _____

Try This!

Use the ten straws laying on your desk and do the following activity.

Answer the questions on this Work Sheet as you work.

1. Hold the ten straws by their sides.
2. Bend the straws back and forth.
   The straws are like the grain in wood.



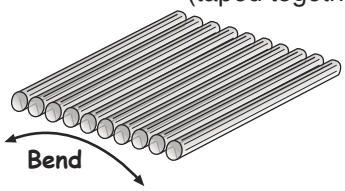
3. Hold the ten straws by their ends and try bending them.
4. Which direction is it more difficult to bend the straws?

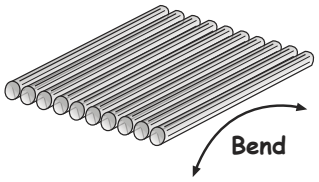
_____

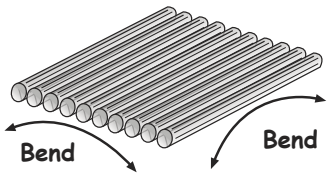
_____

_____

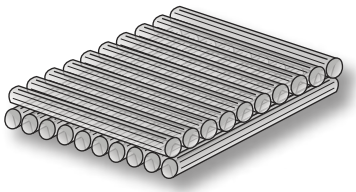
(taped together)







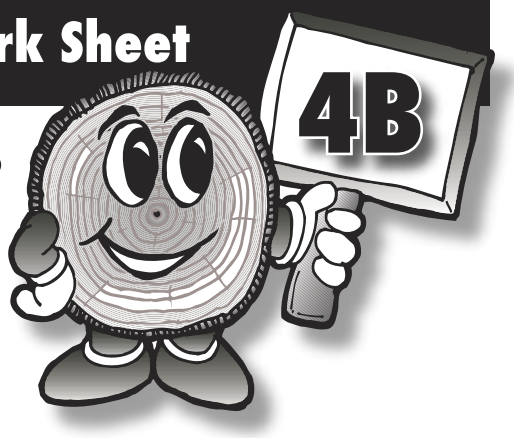
The straws should be stiffer when bending from end to end.



5. Now, hold two sets of straws together so that they are perpendicular to each other.
6. Bend the straws.
7. Did you find your straws to be stiff in both directions? Why?

_____

_____



Name _____

Date _____

Wood Sandwich

Answer the questions on this Work Sheet after you have completed or during the process of making a wood sandwich out of veneer.

1. When doing the bending test, which way was the grain of the wood going when the piece of veneer was the stiffest? Draw a picture to better show your explanation.

   _____

   _____

   _____

2. What happens to the stiffness when two pieces of veneer are placed together with the grain running in the same direction?

   _____

   _____

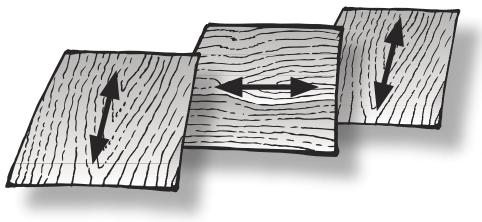
   _____

3. What happens to the stiffness when two pieces of veneer are placed together with the grain running in opposing directions?

   _____

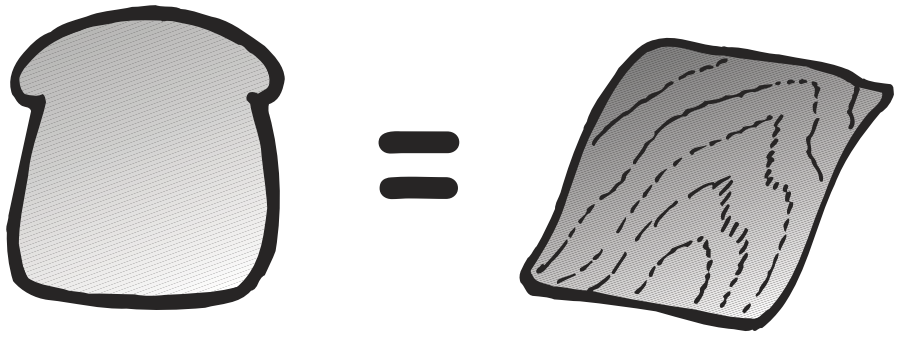
   _____

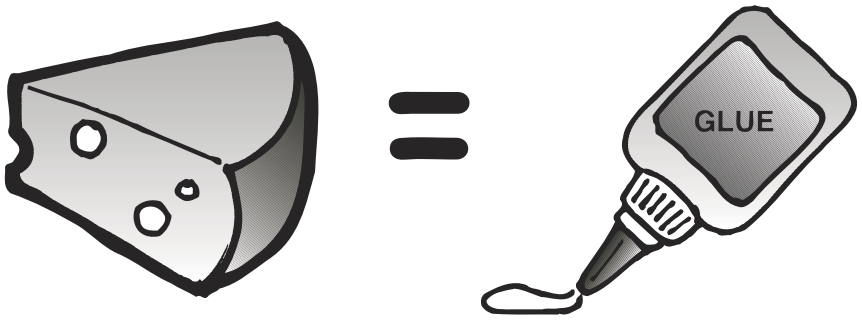
   _____

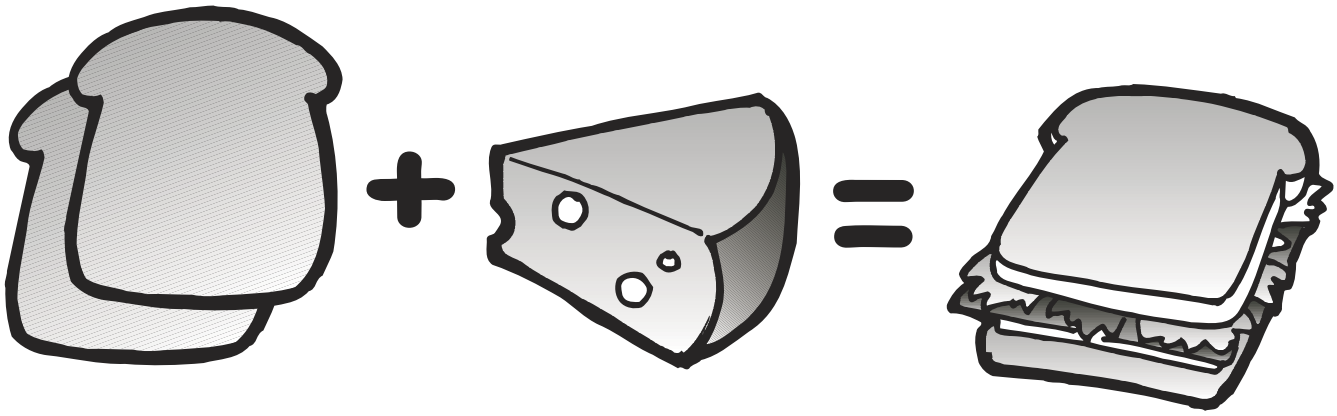


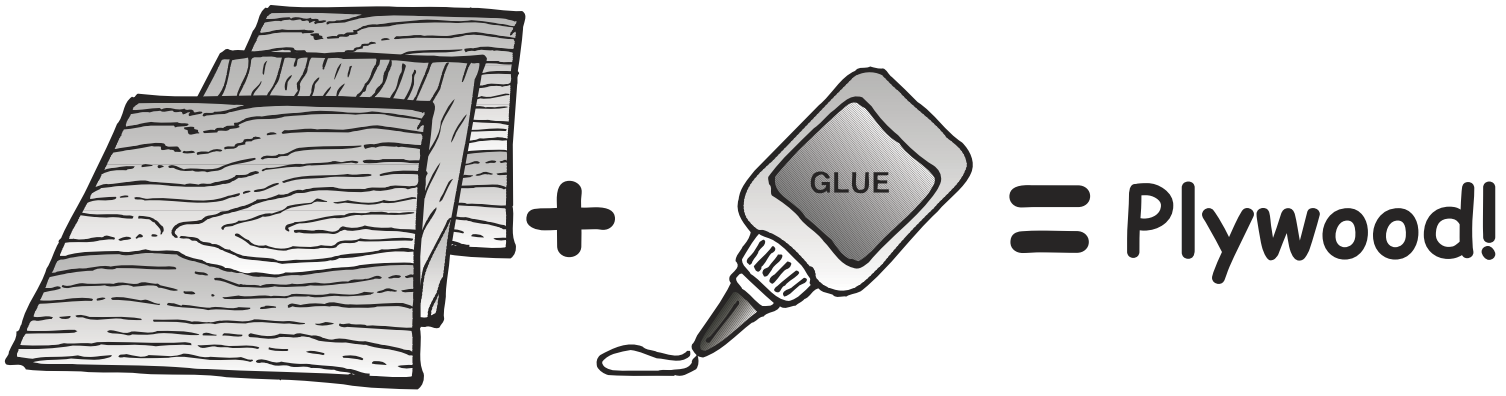
Lesson 4: Wood Sandwich - Transparency

Plywood is like a Sandwich!









Wood Sandwich

Plywood is one of the most widely used wood products. Its main use is in the construction of homes and other buildings. Plywood is used underneath almost everything you see in a building. For example, there is plywood sheathing under the floor, the walls, and the roof!

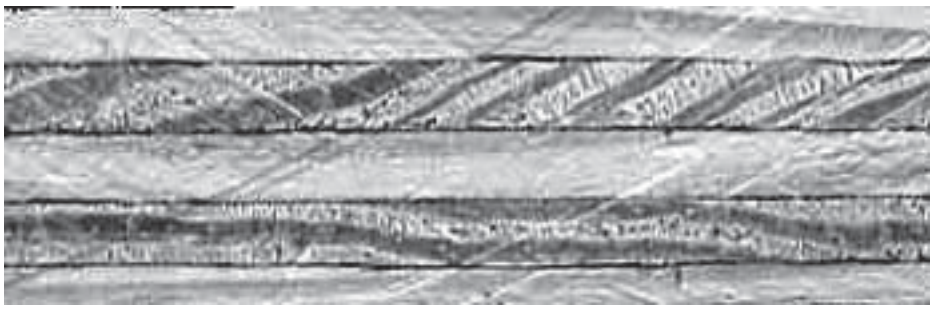
Plywood is good to use because it's light-weight and strong. Plywood is also convenient to use because it comes in sheets, which are much easier to handle than boards! Plywood is basically very thin sheets of wood glued together.

The thin layers of wood are peeled with a knife lathe (like unrolling a roll of paper towels). These layers of wood are called veneer! The veneer are glued together with the grain in opposite directions.

Plywood is strong and stiff. Stiff just means "hard to bend." The strength and stiffness of wood depend on which direction the grain is going.

If you look closely at a piece of wood, you can see the grain. The grain is the wood cells and is formed by the way in which the tree grows. Wood is much stronger and stiffer in the direction of the tree stem – parallel to the grain and less in the other direction. The grain only runs one direction. If you try to bend a thin piece of wood in the direction of the grain, it will be difficult to bend; it's stiff.

When plywood is made, each layer of veneer is set so that the grain runs perpendicular to the grain of the previous layer. In this way, we make a relatively thin sheet that is surprisingly strong and stiff!



Pictured above is a cross-section of plywood. You can see that the grain runs in different directions in each layer.

Plywood is like a Wood Sandwich!

Lesson 5: Daily Wood

Standards of Learning

4th Grade: 4.1 - Scientific Investigation, Reasoning, and Logic

f. data are displayed using bar and basic line graphs

4.8 – Resources

b. animals and plants

5th Grade: 5.1 – Scientific Investigation, Reasoning, and Logic

e. data are collected, recorded, and reported using the appropriate graphical representation (graphs, charts, diagrams)

Life Skill

Keeping Records – Record observations made of the various types and amounts of objects observed in the classroom and school that contain wood or a by-product of wood.

Content Skill (Objective)

Students will record their observations of wood products and note their importance while touring their classroom and school, recording 10 to 20 different items identified.

Time needed:

65 minutes

Activity Summary

This activity teaches the importance of wood in our daily lives and how we use it every day.

Science
SOL 4.1,
4.2, 4.4,

Lesson 5: Daily Wood

Materials:

Introduction: ***Work Sheet 5A*** – "I Am Made of Wood!"

Activity:

Material	Details
10 – 20 items that are made of wood or wood by-products	See the wood facts sheet "**Goods from the Woods"** to obtain ideas for common items used by most students on a daily basis.
10 – 20 items that are **NOT** made of wood or wood by-products.	
Ice Cream – enough for each student to have a small portion	Purchase at local grocery store.

Preparation

Several days before teaching this lesson begin collecting items that contain wood. Refer to ***Wood Facts 5.***

Procedures

Introduction (Do)

5 min. As the students enter the room, have them begin to sort the items you have brought into the classroom into categories. (Try to have a variety of items.)

Allow the students to create their own categories for organization.

Write the students' organization schemes on the board.

Ask

How did you organize the items that were on the table?

(Each student may have a different idea as to how the items should be organized. Allow them to think and verbalize those ideas. Write the students' ideas on the board, allowing them to be a reference for further use.)

What do the items have in common?

Say

"Many products are made of wood or forest products."

Science SOL 4.1, 4.2, 4.4,

Lesson 5: Daily Wood

10 min. Pass out ***Work Sheet 5A*** to the students.

Based on the information you discussed, have the students select the items from the list that contain wood or forest products.

(The list could change depending on the products that you bring to class. Refer to your ***Wood Facts 5*** sheet for detailed information concerning wood products.)

Introduction (Reflect-Share)

- Why is wood important?

  (Trees help us breathe by providing oxygen and taking in carbon dioxide that we exhale. They provide thousands of items we depend on everyday.)

- How many pounds of wood does the average person in the United States use each day? (Three)

  (Show a wood object that weighs approximately 3 pounds)

- How many trees are planted for each one cut down for wood products? (Five)

Review

30 min. Verbally recap what has just been discussed about wood and forest products.

- Wood comes from the stems of trees.
- We have more wood fiber available in the world today than we did in 1900 because of reforestation activities. (Replanting of trees)
- Wood provides for our daily needs.
- There are over 5,000 items made with wood and forest products that we use everyday.
- Wood is renewable so we can continue to use it.

Science
SOL 4.1,
4.2, 4.4,

Lesson 5: Daily Wood

Activity (Do)

Organize students for a walking tour of the school and the school grounds.

Say

We will be looking for items around the school that are made of wood or wood products. (Explain the objective of the walking tour.)

Please take paper and a pencil with you.

While we are making our observations you need to write down the objects we identify that are made of wood.

You will need this information when we return to the classroom from our tour.

(Students will be required to list observations when they return to the classroom.)

Take students on the walking tour visiting the school grounds. Assist them in making observations of wood products.

- library – books, shelves, newspapers
- restrooms – toilet paper, paper towels, soap
- classroom – glue, writing paper, pencils, desks, shelves, books, crayons, tape, door, chairs (if not plastic), cardboard box
- nurse's office – medicines
- lunchroom – instant hot chocolate, soft drinks, ice cream
- playground – equipment made of wood
- outside of school – plywood under the roof

Science
SOL 4.1,
4.2, 4.4,

Activity (Reflect)

10 min. When the tour is complete, return to the classroom and discuss what observations the students made of wood and wood products. Write the students' responses on the board.

Ask

What wood products did you observe in the

- library
- restrooms
- classroom
- nurse's office
- lunchroom
- playground
- outside of school

(The order of the school observations will change depending on the layout of the school facilities.)

Say

Wood is **everywhere**!

Each of us use three pounds of wood every day!

Activity (Apply)

10 min.

Say/Do

Record the information from the board concerning the walking tour of the school in your **Wood Journal**.

Write reflective thoughts concerning two new discoveries you made today about where wood and wood products are used.

Give each student ***Work Sheet 5B*** to take home and complete with their parents.

Students should circle the items made of wood and write the names of those items in the chart.

When students return with their completed Work Sheets, using the **transparencies**, go through each room of the house and identify the items made of wood.

Science
SOL 4.1,
4.2, 4.4,

Lesson 5: Daily Wood

Outside we found:

- plywood sheathing under the roof
- plywood under the siding
- shingle siding made from wood
- and the wood deck

In the Kitchen we found:

- spices which come from trees
- wood knife holders, knife handles, and a cutting board
- a wood salt shaker, rolling pin, and basket
- wood cupboards
- basket
- wood wall boards

In the Living Room we found:

- wood flooring
- wood under the floor
- a wood picture frame
- wood floor and door molding
- a newspaper and magazines made from paper which comes from wood
- a rayon scarf and a Tencel® shirt; both made from wood products

In the Dining Room we found:

- lots of books!
- wood bookcase, table, and chairs
- wood paneling, molding, framing, and sheathing
- wood picture frame

In the Bedroom we found:

- wood sheathing
- carpet backing which is made from a wood product
- a wood bed frame, window frame, and mirror frame

Science
SOL 4.1,
4.2, 4.4,

Lesson 5: Daily Wood

In the Bedroom we found:

- wood sheathing
- carpet backing which is made from a wood product
- a wood bed frame, window frame, and a mirror frame
- a pillow made from rayon, which is made from a wood product

In the Bathroom we found:

- medicine
- toothpaste
- mouthwash
- facial tissue
- a wood picture frame, shelves, and a stool

Evaluation

Each student will be evaluated on the Work Sheets they return from home, labeling the wood products found in the pictures.

Enrichment Activities

1. Take students on a field trip to a plant that makes products from wood.
2. Have a guest speaker from the local university come in and speak to the class.

Wood Journal

- Have students write a reflection of at least two items they observed during the walking tour that were made of wood or wood products.
- Have students reflect on a the amount of wood we use on a daily basis.

Science
SOL 4.1,
4.2, 4.4,

Name _____

Date _____

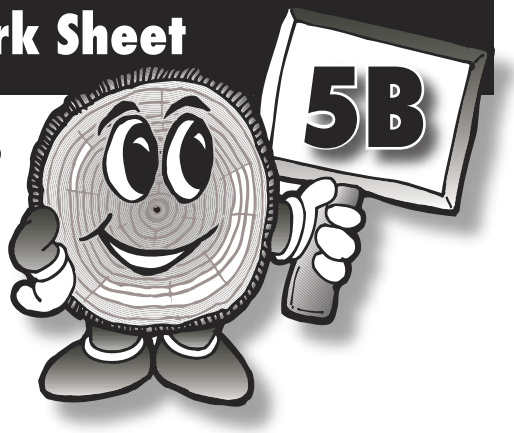
I Am Made of Wood!

Instructions

Which of these items have wood or a forest product in them?

Examples

- ☐ paper towels
- ☐ glue
- ☐ toothpaste
- ☐ shoe polish
- ☐ cinnamon
- ☐ wooden spoons
- ☐ vitamins
- ☐ rayon and Tencel® fabric
- ☐ rubber bands
- ☐ hair spray
- ☐ ice cream
- ☐ orange soda pop
- ☐ books
- ☐ photographic film
- ☐ cellophane tape
- ☐ musical instruments
- ☐ ketchup
- ☐ crayons
- ☐ aspirin
- ☐ car wax
- ☐ furniture
- ☐ toilet paper
- ☐ tool handles
- ☐ artificial vanilla flavoring



Name _____

Date _____

Daily Wood at Home

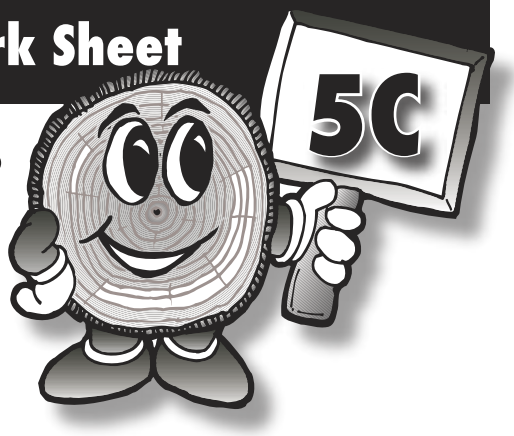
Wood is one of the most useful and versatile materials available. We use wood in many different ways everyday!

Let's take a tour of this house to see some of the uses of wood and things made of wood. You'll be surprised at just how much wood we use!

As your tour this house, make a list of the items in each room that are made of wood or contain a wood product.

	Name the items made of wood used on the outside of this house
1	
2	
3	
4	

Lesson 5: Work Sheet



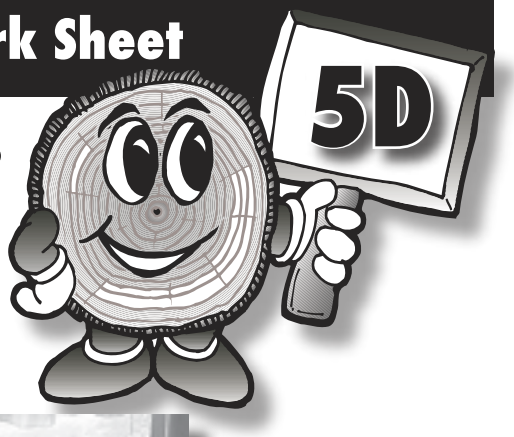
When you come inside, you will see lots of wood in the house!

What wood is there in this living room? There's some things you can't see, but is right there!

	Name the items made of wood or wood products used in the living room.
1	
2	
3	
4	
5	
6	
7	

Can you think of anything else? Remember that plywood is underneath almost everything!

Lesson 5: Work Sheet



When we go into the kitchen, there are many more wood products!

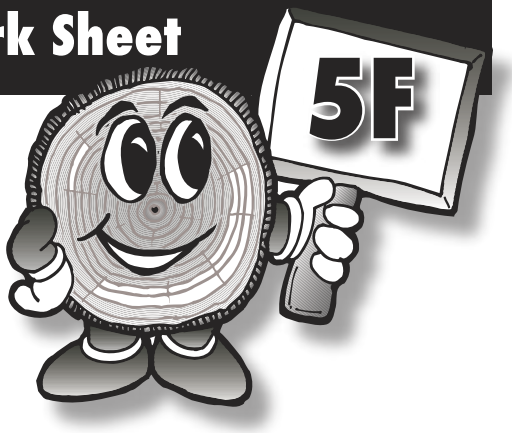
	Name the items made of wood or wood products used in the kitchen.
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

Lesson 5: Work Sheet

There's lots of wood in this dining room, too!

	Name the items made of wood or wood products used in the dining room.
1	
2	
3	
4	
5	
6	
7	
8	

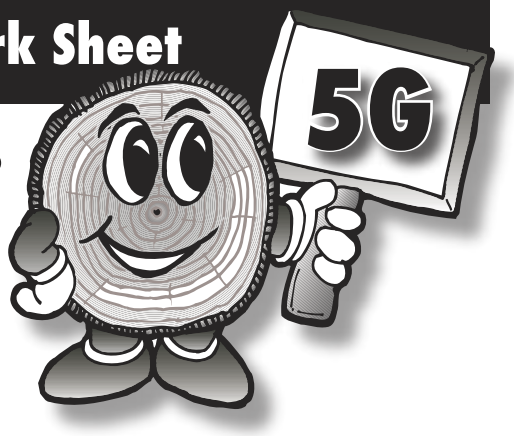
Lesson 5: Work Sheet



When we go into the bedroom, there are still many wood products everywhere!

	Name the items made of wood or wood products used in the bedroom.
1	
2	
3	
4	
5	
6	
7	

Lesson 5: Work Sheet



Even in the bathroom, there is lots of wood!

	Name the items made of wood or wood products used in the bathroom.
1	
2	
3	
4	
5	
6	
7	

Wood Journal

The House

Plywood is underneath the roof as roof sheathing.
This deck is made of wood.

This house has wood shingles.
Plywood is also underneath the shingles.

Kitchen

Salt shaker, rolling pin, basket, wall boards,
cupboards, cartons, knife holder,
knife handles, cutting board, and
window frames are all wood products.

Cinnamon, nutmeg, and vanilla come from trees.

Lesson 5: Daily Wood Transparency

Living Room

Newspaper, chair, window frame, magazines, rayon scarf, tencel shirt, floor, door molding, picture frame are all wood products.

Dining Room

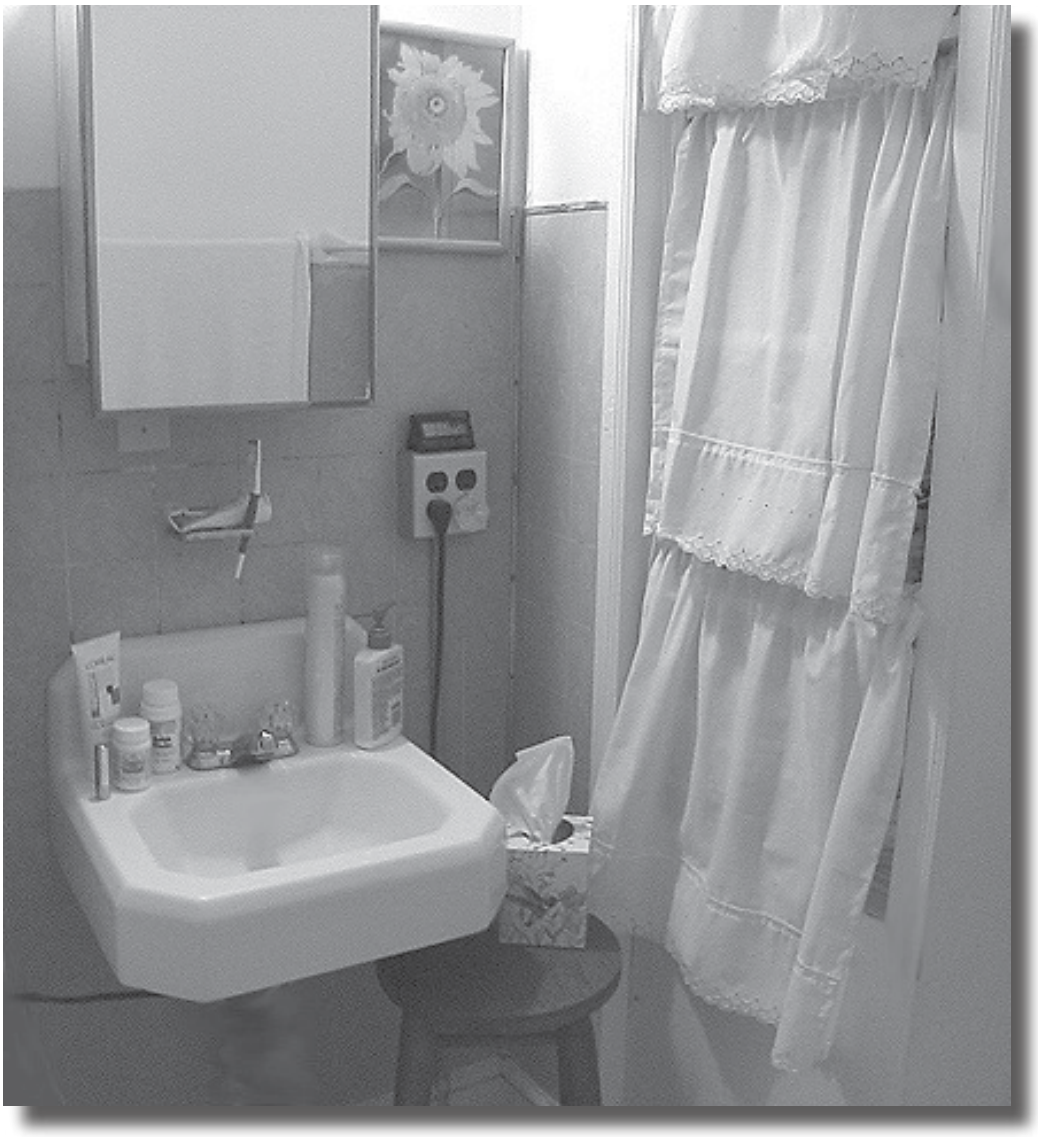
Books, lots of books, table, chairs, paneling,
more books, bookcase, molding, framing, picture frame,
and plywood sheathing behind here are all wood products.

Bedroom

Furniture, carpet backing, window frame,
bed frame, rayon, mirror frame,
and the plywood sheathing behind the walls,
ceiling, and floor are all wood products.

Lesson 5: Daily Wood Transparency

Bathroom



Facial tissue, stool, shampoo, vitamins, aspirin, lipstick picture frame, shelves, hair spray, lotion, and toothpaste are all wood products.

Lesson 5 : Wood Facts 5

Goods from the Woods

Through research and advances in technology, we have learned to convert tree fibers and paper-pulping residues into a wealth of products, like the ones listed below. In fact, there are more than 5,000 wood and paper products that make our lives better each day – everything from baby food and ice cream to rayon and paint, to toothpaste, cosmetics, medicine, and household cleaners.

But what makes all of these products special is that they come from a renewable resource – trees. Unlike fossil fuels, metals, and plastics, wood can be harvested, used, regrown, and harvested again and again in a never-ending cycle. With proper management of our forests, we can enjoy thousands of products and still have plenty of trees for wildlife habitat, recreation, and aesthetic beauty today and in the future.

Read on to discover more about "Goods from the Woods."

Shipping Crates: Wooden crates are made from sweetgum, tupelo, yellow-poplar, and maple.

Toothpaste: Terpenes, which are derived from wood, are used to make licorice flavor as well as to sweeten the spearmint and peppermint flavor of many toothpastes and mouthwashes.

Soft drinks: many citrus-flavored soft drinks contain esters, which are derivatives of trees used to assure a uniform distribution of the citrus flavor throughout the drink.

Facial tissue: Papers, including facial tissue, toilet paper, paper towels, newspapers, and writing papers, are made from wood pulp.

Lotion: Many products, including lotions, contain vitamins A and E, which come from wood extracts.

Glue: Glues and adhesives can be made from hard resins, which come from trees.

Dishwashing liquid, soap, and shampoo: Detergents, as well as many soaps and shampoos, are made from crude fatty acids derived from wood. The lemon scent of some dishwashing liquids and furniture polishes comes from trees during pine turpentine processing.

Science
SOL 4.1,
4.2, 4.4,

Lesson 5 : Wood Facts 5

Chewing gum: Chewing gum is made by using the rosin or storax of trees such as spruce. Chewing gum may also be artificially flavored with peppermint and spearmint, which comes from a group of pine derivatives called terpenes.

Medicine: Aspirin tablets and other medicines in tablet form are held together with lignin, which is a natural part of wood. The essential elements of aspirin come from the bark of willow trees. Other medicines used treat diseases such as high blood pressure and Parkinson's disease contain various wood derivatives.

Spices: Many spices used in cooking – such as nutmeg, bay leaves, and cinnamon – come from trees. Cinnamon comes from the bark of laurel trees.

Crayons: Carnauba wax, a resin produced by the leaves of the carnauba tree, is the waxy component of crayons. Carnauba wax is also used in car wax, and as a finish coating on furniture, produce such as apples and pears, and a wide variety of other products. The pharmaceutical industry uses it to coat pills. It is a major ingredient in lipstick and other cosmetics.

Instant hot chocolate: Instant hot chocolate contains the thickening and preserving agent cellulose or methyl cellulose, the main building block of wood.

Hair spray: Hair spray, as well as adhesives, is made from tree resins, sticky liquid substances that usually harden when exposed to air.

Tape: Cellophanes are derived from the sugar components of wood during the pulping process and are used in making such products as wrap and tape.

Source: North Carolina Forestry Association - *http://www.ncforestry.org/*

Science
SOL 4.1,
4.2, 4.4,

Resources

Paper

TAPPI - Technical Association of the Pulp and Paper Industry
http://www.tappi.org/

AF&PA - American Forest & Paper Association
http://www.afandpa.org/

Wood Structure

Structure of wood - SWST
http://www.swst.org/teach/teach1/structure1.ppt (This link will automatically download a PowerPoint file.)

Anatomy of Wood
http://waynesword.palomar.edu/trjuly99.htm

Trees and Wood Structure
http://www.microscopy.fsu.edu/trees/index.html

International Association of Wood Anatomists
http://www.kuleuven.ac.be/bio/sys/iawa

Wood Properties

Properties - SWST
http://www.swst.org/teach/teach2/properties2.ppt (This link will automatically download a PowerPoint file.)

Activities - SWST
http://www.swst.org/teach/teach2/activities2.ppt (This link will automatically download a PowerPoint file.)

Forest Products Laboratory at Madison, Wisconsin
http://www.fpl.fs.fed.us

Downloadable PDF files of documents from Forest Products Laboratory
http://www.fpl.fs.fed.us/documnts/FPLGTR/fplgtr113/fplgtr113.htm

Wood Products

Made in the USA – from wood - SWST
*http://www.swst.org/teach/teach1/madeusa1.ppt (*This link will automatically download a PowerPoint file.)

Center for Biodiversity and Conservation Biology (Wood Cells), "Plants with plumbing; the structure of wood"
http://www.rom.on.ca/biodiversity/herbaria/wood.html

Directory of Forest Products
http://www.forestdirectory.com

The Magic of Wood and more activities and lessons with wood
Wood Magic
http://www.woodmagic.vt.edu

Suppliers

Carolina Biological Supply Company
Burlington, N.C.
(800) 334-5551
http://www.carolina.com

Grainger
Charleston, Mass.
(888) 361-8649
http://www.grainger.com

Craftsman Power and Hand Tools
Maneno, Ill.
(800) 290-1245
http://www.sears.com

Woodworkers Library
Linden Publishing
Fresno, Calif.
(800) 345-4447
http://www.lindenpub.com

Woodworker's Supply Inc.
Casper, Wyom.
(800) 645-9292
http://www.woodworker.co

Rockler Woodworking and Hardware
Medina, Minn.
(800) 233-9359
http://www.rocklerpro.com

Woodcraft Supply Corp
Parkersburg, W.V.
(800) 225-1153
http://www.woodcraft.com

Further Reading

Wood Structure and Properties

Bowyer, J.L, R. Shmulsky, J. G., Haygreen. 2003. *Forest Products and Wood Science – An Introduction, 4th ed.* Iowa State Univ. Press, Ames, Ia.

Hoadley, R.B. 1980. *Understanding Wood: A Craftsman's Guide to Wood Technology.* Taunton Press, Newtown, Conn.

Panshin, A.J. and C. deZeeuw. 1980. *Textbook of Wood Technology, 4th ed.* McGraw Hill Book Company, New York, N.Y.

The Nature of Wood and Wood Products. 1996. CD ROM, Forest Products Society, Madison, Wisc. *http://www.forestprod.org/*

Wood Identification

Core, H.A., W.A. Cote, and A.C. Day. 1979. *Wood Structure and Identification, 2nd ed.* Syracuse University Press, Syracuse, N.Y. Note: This book is out of print but occasionally available at used book stores and via the Internet.

Flynn, J.H. and C.D. Holder (Eds.) 2001. *A Guide to Useful Woods of the World.* Forest Products Society, Madison, Wisc. *http://www.forestprod.org/*

Hoadley, R.B. 1990. *Identifying Wood: Accurate Results with Simple Tools.* Taunton Press, Newtown, Conn.

Milius, S. 2002. The Wood Detective. *Science News* Vol. 162 No. 12, pages 184-185. *http://www.sciencenews.org*

Panshin, A.J. and C. deZeeuw. 1980. *Textbook of Wood Technology, 4th ed.* McGraw Hill Book Company, New York, N.Y.

Further Reading

Wood Structure and Wood Chemistry

Core, H.A., W.A. Cote, and A.C. Day. 1979. *Wood Structure and Identification, 2nd ed.* Syracuse University Press, Syracuse, N.Y. Note: This book is out of print but occasionally available at used book stores and via the internet.

Fengel, D. and G. Wegener. 1984. *Wood: Chemistry, Ultrastructure, Reactions.* W. DeGruyter, New York, N.Y.

Hoadley, R.B. 1990. *Identifying Wood: Accurate Results with Simple Tools.* Taunton Press, Newtown, Conn.

Kozlowski, T.T. and S.G. Pallardy. 1997. *Physiology of Woody Plants, 2nd ed.* Academic Press, San Diego, Calif.

Panshin, A.J. and C. deZeeuw. 1980. *Textbook of Wood Technology, 4th ed.* McGraw Hill Book Company, New York, N.Y.

Sjostrom, E. 1981. *Wood Chemistry: Fundamentals and Applications.* Academic Press, New York, N.Y.

The Nature of Wood and Wood Products. 1996. CD ROM, Forest Products Society, Madison, Wisc. *http://www.forestprod.org/*

Further Reading

Use of Wood

Flynn, J. H. and C.D. Holder (Eds.) 2001. *A Guide to Useful Woods of the World.* Forest Products Society, Madison;, Wisc. *http//www.forestprod.org/*

Bowyer, J.L, R. Shmulsky, J. G., Haygreen. 2003. *Forest Products and Wood Science – An Introduction, 4th ed*. Iowa State Univ. Press, Ames, Ia.

Howard, J.L. 2001. U.S. timber production, trade consumption, and price statistics 1965-1999. Res.Pap.FPL-RP-595. USDA Forest Service, Forest Products Lab., Madison, Wisc. *http://www.fpl.fs.fed.us/welcome.htm*

Leavell, C. 2001. Forever Green, *The History and Hope of the American Forest.* Longstreet Press, Inc., Marietta, Ga.

Lincoln, W., A. Peters, L. Leech, J. Marshall, A. Walker, and L. Hughes. 1993. *The Encyclopedia of Wood*. Quarto Publishing plc, London.

Moore, P. 2000. *Trees are the Answer*. Greenspirit Enterprises Ltd. Vancouver, B.C., Canada.

Perlin, J. 1991. *A Forest Journey: The Role of Wood in the Development of Civilization.* Harvard University Press, Cambridge, Mass.

Glossary

growth rings	The concentric circles found in wood starting in the center; each ring represents one year of growth!
earlywood	The light wood the tree makes during spring.
latewood	The dark wood the tree makes in late summer.
xylem (**ZEYE**-lem)	The woody part of the tree stem that carries water for the tree from the roots to the leaves and other parts of the tree.
heartwood	Heartwood is dead xylem.
pulp slurry	A dilute mixture of wood fibers and water.
sapwood	Sapwood is live, working xylem.
veneer	A thin sheet of wood.
wood grain	The grain is the wood cells and is formed by the way in which the tree grows.