

Lesson Title: What's Made From Trees?

Brief: Students will learn how trees are processed into different products and experiment in making paper.

Grade: 4-6

Materials:

Duration of Lesson: 2-3 days

How Paper is Made handout

What is Made From Wood? Handout

Tape measures to measure out a cord of wood

String or tape to mark out a cord of wood

Helpful website: University of Minnesota- How Paper is Made:

<http://www.forestprod.org/cdromdemo/pf/pf8.html>

Useful website: What Are Trees Used For? [http://www.co.st-](http://www.co.st-louis.mn.us/slcportal/Portals/0/Departments/Land/People%20and%20forests/lisfromtrees.pdf)

[louis.mn.us/slcportal/Portals/0/Departments/Land/People%20and%20forests/lisfromtrees.pdf](http://www.co.st-louis.mn.us/slcportal/Portals/0/Departments/Land/People%20and%20forests/lisfromtrees.pdf)

Sponge

Window screening (mold)

Wood frame (old picture frame can be used too) (deckle)

Plastic basin/tub (large enough to totally immerse frame)

Blender

White felt or flannel fabric

Staples or tacks (for tacking screen on frame)

Liquid starch (optional)

Key Terms

Cord, mill, chippers, pulp/slurry

Standards / Objectives

NGSS 4. Energy

Disciplinary Core Ideas, ESS3.A: Natural Resources

Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)

NGSS 5. Earth's Systems

Disciplinary Core Ideas, ESS3.C: Human Impacts on Earth Systems

Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)

NGSS MS. Interdependent Relationships in Ecosystems

Disciplinary Core Ideas, LS4.D: Biodiversity and Humans

Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.

Math Common Core 4. Measurement and Data

Solve problems involving measurement and conversion of measurements from a larger unit to smaller unit. 1. Know relative sizes of measurement units within one system of units. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.

Arts Content Standard 1: Students create, perform/exhibit, and respond in the Arts.

2. Select a variety of materials and sources to demonstrate a specific art form.

Arts Content Standard 2: Students apply and describe the concepts, structures, and processes in the Arts. 3. MEDIUM-Visual Arts: select a course of action using a two-dimensional process.

Arts Content Standard 6: Students make connections among the Arts, other subject areas, life, and work. 2. Utilize interrelated elements among the Arts and other subject areas.

<u>Understanding(s) /Big Ideas:</u> Trees are used to make a variety of products, used all parts of the tree. Trees are an important natural resources that humans rely on. It is possible to make usable paper from recycled paper	<u>Essential Question(s):</u> What types of products are made from processed trees? How do you make paper?
<u>Students will know:</u> Trees are processed into many different products. What a cord of wood is. Paper can be made easily from recycled paper.	<u>Students will be able to:</u> Make paper and explain to others how they did it. List a variety of products made from trees.
Performance / Observations	
<u>Performance Task(s):</u> Students will discuss products made from trees and use handouts to aid conversation.	<u>Other Evidence:</u> Students will create new paper from recycled paper in the classroom. This can be done as a group—different groups can experiment with different types of recycled paper.
Learning / Inquiry Activities	

Introduction: There are thousands of products made from wood. Things that we use every day were once trees, from the paper we write on to the houses we live in. It takes land, air, water, sun, and time to grow the wood needed for these products. Then it takes technology to make impressive quantities of things that can be made from wood. One way we use wood is for firewood to heat our homes. There are also many other uses for a cord of wood.

A cord of wood is a pile of wood 4' x 4' x 8' (80 cubic feet). 20% of a cord of wood may be bark. Bark is not wasted though, it provides more than half of the US forest industry's

energy needs. Wood byproducts are also put to good use in many different products such as paper.

The paper making process is a very interesting one. Trees are brought into paper mills. All bark is removed from the trees since it cannot be made into paper. Big machines called chippers cut the logs up into small chips. Wood chips are cooked in water and chemicals in big pressure cookers. The chips turn into mushy fibers called pulp or slurry. The pulp is washed and put on big screens to drain the water. The pulp is then dried and pressed flat between rollers.

Ancient Egyptians invented the first substance like the paper we know today called Papyrus. Papyrus scrolls were made by taking slices of the inner part of the papyrus stem, flattening then pounded into a hard, thin sheet. The word "paper" comes from the word "papyrus". The Paper that we know today was invented by Ts'ai Lun in A.D. 105, it is believed that he mixed hemp, mulberry bark, and rags with water, mashed it into a pulp, pressed out the liquid and hung it to dry in the sun. Paper was born and this humble mixture would set off one of mankind's greatest communication revolutions.

Learning / Inquiry Activities:

1. Brainstorm with students about the different products that are made from wood. What is made from wood in the classroom? In the building? At their home? Give students the *What is Made From Wood?* handout. Explain what a cord of wood is and have students measure out how big that would be with a tape measure. Have them use string or tape to mark off the area.
2. Tell students about the paper making process and give them the handout called How Paper is Made.
3. Tell students that there are many kinds of paper that have many uses. Brainstorm on the whiteboard on some ways that paper is used (notebooks, gift wrap, candy wrappers, receipts, etc.)
4. Make paper! Visit <http://www.pioneerthinking.com/makingpaper.html> for a demonstration. Types of paper that can be used:
 - Computer paper (unprinted)
 - Newspaper (If you want a grayish colored paper)
 - Magazines
 - Egg cartons
 - Old cards (for heavier paper)
 - Toilet paper
 - Paper bags
 - Non-waxed boxes (pre-soak in warm water)
 - Office paper
 - Tissue paper (for finer paper)
 - Typing paper

- Napkins
- Construction paper

5. Rip the paper into small bits, and place into the blender (about half full). Fill the blender with warm water. Run the blender slowly at first then increase the speed until the pulp looks smooth and well blended (30 -40 seconds). Check that no flakes of paper remain, if there are, blend longer.
6. The next step is to make a mold. The mold, in this case, is made simply by stretching fiberglass screen (plain old door and window screen) over a wooden frame and stapling it. It should be as tight as possible.
7. Fill the basin about half way with water. Add 3 blender loads of pulp (the more pulp you add the thicker the finished paper will be). Stir the mixture.
8. Now is the time to add the liquid starch for sizing (this is not necessary but if the paper is going to be used for writing on, you should add some, the starch helps to prevent inks from soaking into the paper fibers). Stir 2 teaspoons of liquid starch into the pulp.
9. Place the mold into the pulp and then level it out while it is submerged. Gently wiggle it side-to-side until the pulp on top of the screen looks even.
10. Slowly lift the mold up until it is above the level of the water. Wait until most of the water has drained from the new paper sheet. If the paper is very thick, remove some pulp from the tub. If it is too thin, add more pulp and stir the mixture again.
11. When the mold stops dripping, gently place one edge on the side of a fabric square (felt or flannel square). Gently ease the mold down flat, with the paper directly on the fabric. Use a sponge to press out as much water as possible. Wring the excess water from the sponge back into the large plastic tub.
12. Now comes the tricky part. Hold the fabric square flat and slowly lift the edge of the mold. The wet sheet of paper should remain on the fabric. If it sticks to the mold, you may have pulled to fast or not pressed out enough water. It takes a little practice. You can gently press out any bubbles and loose edges at this point.
13. Repeat the steps above, and stack the fabric squares on a cookie sheet. Save one fabric square to place on the top of the stack to cover the last piece of paper. Use another cookie sheet to press the remaining water out of the stack (do this outside or in the bathtub, it can make a mess).
14. After you press the stack, gently separate the sheets. They can be dried by hanging on a clothesline or laying them out on sheets of newspaper. When they have dried peel them off the fabric and voila! You have paper!

We invite you to send photos or information on your experience teaching the lesson to the

Montana Department of Agriculture's Ag in the Classroomlbrenneman@mt.gov

This lesson was adapted from Agriculture in Montana Schools, aginmontanaschools.com

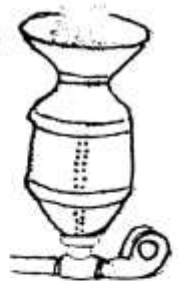
How Is Paper Made?

1. Paper is made from trees. Trees are chopped down in a forest. Trucks take the logs to a paper mill. Do you see the splinters in the wood? These are used in making paper. Feel the texture.

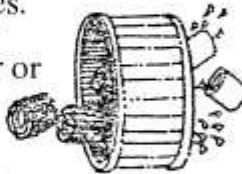


Display with a log.

4. Wood chips are cooked in water and chemicals in huge pressure cookers. The chips turn into mushy fibers called **pulp** or **slurry**.

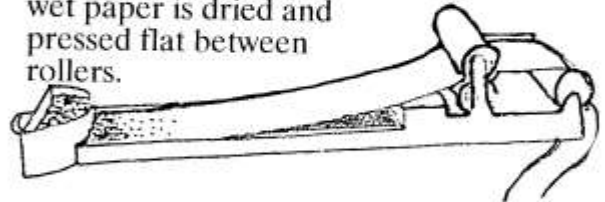


2. At the mill, bark is removed from the trees. Bark is used for other things... like kitty litter or garden mulch.

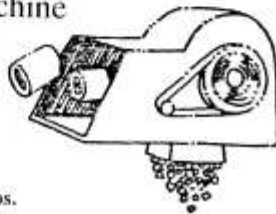


Display with bark chips and kitty litter.

5. The **pulp** is washed clean and put on big screens. The water drains off. The wet paper is dried and pressed flat between rollers.

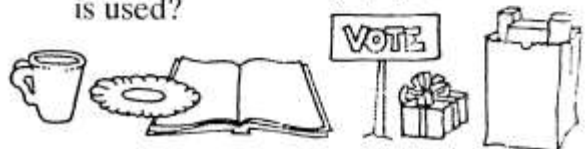


3. The logs are cut into small chips in a big machine called a **chipper**.



Display with wood chips.

6. There are many kinds of paper with many uses. What are some ways paper is used?



What is Made From Wood?

Thousands of products come from wood. Different products require different kinds of trees, but for general information, a cord of wood will yield the following quantities of products. (A cord equals a pile of wood 4' x 4' x 8' - 80 cubic feet of solid wood)

- 4,000 one gallon milk cartons
- 7,500,000 toothpicks
- 1,000-2,000 lbs. of paper (depending on the process)
- 61,370 #10 envelopes (standard)
- 460,000 personal checks
- 2,700 copies of the average daily paper (35 pages)
- 250 copies of the New York Times
- 12 dining room tables (seating for 8)



- *A cord equals a pile of wood 4' x 4' x 8' - 80 cubic feet of solid wood*
- *Building an average 1,800 square foot home uses 10,000 board feet of lumber—equivalent to 20 cords*
- *Trees can reduce traffic noise by up to 50%*
- *Trees consume carbon dioxide and give off oxygen*

All Bark, No Bite

20% of a cord may be bark. Bark and waste wood provide over half of the US forest industry's energy needs. Bark is also a source of many chemicals and is used in mulches.

Wood by-products also become vitamins, plastics, explosives, toothpaste and many more!