Paper Makers

SF Environment
Our home. Our city. Our planet.

Grades K-5

Lesson Summary

Students will broaden awareness about conserving natural resources while learning to make recycled paper.

Overview

In this lesson, students will:

- Identify what natural resources are made into paper
- Discuss the value of intact forests
- Determine ways to use less paper

Time

45 minutes to prepare lesson; 75 minutes for lesson

Background

Paper is something we all use every day. Whether in schools, hospitals, offices or homes, paper plays an important role in meeting societies needs. Historically, most paper has been made from plants besides trees. Ancient Egyptians first made paper from papyrus reeds. Tree-free paper has also been made out of kenaf, bamboo, rice straw, hemp, flax and old cotton rags. The Declaration of Independence was drafted on hemp paper. Today however, most of the paper we use comes from trees. In fact, two billion trees are cut down every year to be turned into paper. While trees can be replanted, certain logging practices—such as clear-cut logging that cuts down every tree in an area—create problems of erosion, mudslides, and habitat destruction. Since many native plant and animal species depend on intact forest ecosystems to survive, it's important to protect our forests in order to maintain the biodiversity that makes our planet healthy.

Along with providing the structure for a forest ecosystem, trees play other important roles like providing food and medicine. Additionally, their intake of carbon dioxide helps reduce the threat of global warming or climate change. Because climate change is partly caused by excess carbon dioxide in the atmosphere, trees can offset this unwanted greenhouse gas by absorbing carbon dioxide. Trees are a storehouse of carbon. When trees are cut down, not only can they no longer absorb carbon dioxide, but they release their stored carbon into the atmosphere as carbon dioxide, thereby further accelerating the problems that cause climate change.

It is not necessary to cut down trees to make paper. We can get paper from a variety of other plants—most notably from agricultural waste like leftover corn stalks and wheat straw. Rather than bury or burn this agricultural residue, farmers can sell these materials to be turned into excellent tree-free paper. We can also

get paper by recycling used paper. This is called "post-consumer waste" and is an important ingredient in 100% recycled paper.

Vocabulary

- Natural resources
- Biodiversity
- Post-Consumer
- Tree-Free

Materials

Ingredients for the Pulp

- ❑ Several pounds of scrap paper of various types and colors (junk mail, old magazines,)
- ❑ Water
- ❑ Fallen leaves and flower petals (optional)

Tools and Supplies

- ❑ Wire mesh screen with 1/16" holes—one square foot per 3 student team
- ❑ Heavy 2" masking tape
- ❑ Measuring cup
- ❑ Blender
- ❑ Electrical outlet
- ❑ Basins, tubs, or big bowls for holding scraps & pulp
- ❑ Stacks of newspapers for use as blotters
- ❑ Reusable rags or large sponges

- ❑ Large piece of sturdy, flat board about 2'x 2'

Decorations (optional)

- ❑ Rubber stamps
- ❑ Glitter and glue
- ❑ Markers and pens

Preparation

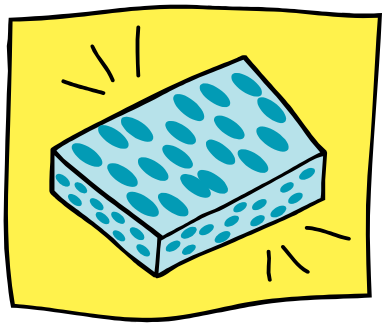
- Put 5 cups of scrap paper into a bowl—there should be one bowl per team of three students.
- Make paper molds by taking the screen and running a double thickness of tape around the edges in order to guard against sharpness. Fold the taped screen edges up about 2 inches all around to make a shallow 8"x 8" box.
- Except for the decoration materials, place all remaining materials, tolls, and supplies on a counter or large table top. Ideally, work near a sink.
- One or two parent volunteers or teacher aides are very useful in this project.

Pre-Activity Questions

1. Read background information on front page.
2. Hold up a piece of paper and ask the following:
   - ✓ Why is paper important? (*Our society uses it every day to meet our needs at school, home, offices and hospitals.*)
   - ✓ What different types of paper products are there? (*writing paper, books, newspapers, magazines, paper towels, toilet paper, paper plates, paper cups, wrapping paper, etc.*)
   - ✓ What is this paper made from? (*trees, unless it's tree free*)
   - ✓ How many trees get cut down in one year to make paper? (*Two billion. Write number on board to show zeroes.)*
   - ✓ Why are trees important to the environment? (*They create forests; provide animal habitat; provide food and medicine; make oxygen; absorb carbon dioxide and help stop climate change; they hold the soil in place and help prevent mudslides and flooding.)*
   - ✓ What are some ways we can save trees by using less paper? (*use both sides of a sheet of paper; use reusable cups and plates; use cloth napkins at home and school; use cloth bags; wrap gifts in old fabric or the comic pages.)*
   - ✓ Is it possible to make paper from other things besides trees? (*plants like kenaf, bamboo, hemp, cotton, flax, old rags, used paper, and agricultural waste. Discuss ancient Egypt's use of papyrus and Declaration of Independence being drafted on hemp paper.)*
   - ✓ What does "post-consumer" recycled paper mean? (*It's when paper is made from recycled paper that was previously used, like old homework, mail, and newspapers. Pre-consumer recycled paper (often just called "recycled paper") means that fresh paper scraps from the cutting floor at the paper factory were thrown back into the paper mill.*)

Procedure

1. Tell students they are going to help save trees and forests by making 100% post-consumer recycled paper. Divide the class into groups of three. If desired, ask students to shred the scrap paper (see "Preparation). Otherwise ask them to place newspaper and tubs on counters or tabletop.
2. Each team should be given one bowl with 5 cups of shredded paper and a measuring cup with at least 1 cup of water. (They can also measure out the five cups or estimate and measure the volume of paper already in the bowl.) Ask students to add approximately 1 cup of water to their bowl of paper. (The ratio of 1 cup of water to 5 cups of shredded paper is important.)
3. When the paper is soaked, each team can take turns pouring their wet paper into the blender. Be careful not to overfill the blender, and make sure the mixture is not too thick. Blend the water and paper until it is a smooth pulp.
4. Pour batches of pulp into a tub—adding a little water if it is too thick—until there is about 2 inches of mushy pulp water in tub.



(Depending on the size of the tub, there may be need to be more than one batch of pulp added. If this is the case, then teams can work together over the same tub.)

5. Have one student at a time carefully dip the frame into the pulp and then lift it slightly out. Keeping the mold level, shift it back and forth over the tub until a layer of pulp—approx. ¼ inch thick—settles evenly over the surface. If there is too much pulp or too little, then put the mold back under the pulp layer and try again.
6. Without tilting the mold, lift it up and hold it over the tub to let the excess water drain out. When the water is gone, a layer of pulp should cover the bottom of the mold. This will be a sheet of paper once it dries.
7. Optional: Add leaves and flower petals. As soon as most of the water has been drained from the pulp in the mold, press flattened leaves or flower petals into the pulp. They do not need to be completely covered with pulp but they should be at least partially covered, or they won't stay on the paper.
8. With a rag or moistened sponge, *gently* sponge off as much moisture as possible from the pulp that's in the mold. With a stack of newspaper laid on a flat surface nearby, carefully and slowly flip the screen upside down so that the paper lands evenly on the newspaper. If it cracks, simply mend with water.
9. Cover the paper with another stack of newspaper and place a sturdy board over it. Have a student stand on the board for two minutes to squeeze out remaining water and to press the paper flat. When this is done, carefully remove the paper and place it between two fresh stacks of newspaper for final blotting. Place a set of heavy books on top of the newspaper and let it dry overnight. When the paper sheets are dry, peel them carefully from the newspaper. Students can cut paper into different geometric shapes before using (circle, triangle, square, etc.)
10. Decorate the paper with pens, rubber stamps, crayons or glitter. Put messages on the paper to raise awareness of saving trees. Here are some ideas:
    - ✓ Create a "100% post-consumer recycled" logo.
    - ✓ Write slogans about re-use, and tree-free paper
    - ✓ Decorate with images of animals that live in forest.

Extensions

- Display educational messages around the school to teach other students the importance of saving trees.
- Research and write reports on papyrus and the way the ancient Egyptians first made tree-free paper.
- Brainstorm ways to reduce paper use and set some classroom goals (like using cloth towels and reusable cups)
- Read and discuss *The Lorax* by Dr. Seuss or *The Great Kapok Tree* by Lynne Cherry.

Paper Makers CA Standards K-5

Kindergarten

Mathematics ♦ **MG.2.l**	Identify and describe common geometric objects (e.g., circle, square, rectangle, cube, sphere, cone)
History/Social Science ♦ **K.1.1**	Follow rules, such as sharing and taking turns, and know the consequences of breaking them.
♦ **K.6.3**	Students understand how people lived in earlier times and how their lives would be different today (e.g., getting water from a well, growing food, making clothing, having fun, forming organizations, living by rules and laws.)
Science ♦ **3c**	The Earth is composed of land, air, and water. As a basis of understanding this concept, student knows how to identify resources from the Earth that are used in everyday life, and that many resources can be conserved.
Language Arts ♦ **R.1.3**	Students understand that printed materials provide information.
♦ **LS.1.1**	Understand and follow one- and two-step oral directions.

Abbreviations
Language Arts: R=Reading; W=Writing; LC= Language Conventions; LS=Listening/Speaking
Math: N=Number Sense; A=Algebra; MG=Measurement/Geometry; S=Statistics/Data Analysis; MR=Mathematical Reasoning

Grade 1

Mathematics ♦ **MG 2.1**	Identify, describe, and compare triangles, rectangles, squares, and circles, including the faces of three-dimensional objects.
Science ♦ **1a**	Students know solids, liquids and gases have different properties.
♦ **1b**	Students know the properties of substances can change when the substances are mixed, cooled or heated.
♦ **2c**	Students know animals eat plants or other animals for food and may also use plants or even other animals for shelter and nesting.

Language Arts **♦ W.1.1**	Select a focus when writing.
♦ W.1.2	Use descriptive words when writing.
♦ W.1.3	Print legibly and space letters, words and sentences appropriately.
♦ LC.1.1	Write and speak in complete, coherent sentences.

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Grade 2

History/Social Science **♦ 2.4.3**	Students understand basic economic concepts and their individual roles in the economy, and demonstrate basic economic reasoning skills, in terms of how limits on resources affect production and consumption.
Science **♦ 3e**	Earth is made of materials that have distinct properties and provide resources for human activities. As the basis for understanding this concept, students know rock, water, plants, and soil provide many resources including food, fuel, and building materials that humans use.
Language Arts **♦ W.1.2**	Create readable documents with legible handwriting.
♦ LS.1.4	Give and follow three- and four-step oral directions.

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Grade 3

Math **♦MG.1.1**	Students choose the appropriate tools and units (metric and U.S.) and estimate and measure the length, liquid volume, and weight/mass of given objects.
History/Social Science **♦ 3.5.1**	Students describe ways in which local producers have used and are using natural resources, human resources, and capital resources to produce goods and services in the past and the present.
♦ 3.5.2	Understand that some goods are made locally, some elsewhere in the United States, and some abroad

Grade 3 (continued)

Science ♦ **PS.1.g**	Students know that when two or more substances are combined, a new substance may be formed with properties that are different from those of the original materials.
♦ **LS. 3.c**	Students know living things cause changes in the environment in which they live; some of these changes are detrimental to the organism or other organisms, and some are beneficial.
♦ **LS. 3.d**	Students know when the environment changes, some plants and animals survive and reproduce; others die or move to new locations.
Language Arts ♦ **W.1.2**	Write legibly in cursive or joined italic, allowing margins and correct spacing between letters in a word and words in a sentence.
♦ **LS.1.1**	Retell, paraphrase, and explain what has been said by a speaker.
♦ **LS.1.3**	Respond to questions with appropriate elaboration.

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Grade 4

Math ♦ **NS.1.1**	Read and write whole numbers in the millions.
Language Arts ♦ **W.1.4**	Write fluidly and legibly in cursive or joined italic.
♦ **LS. 1.1**	Ask thoughtful questions and respond to relevant questions with appropriate elaboration in oral settings.

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Grade 5

Science ♦ **2f**	Students know plants use carbon dioxide (CO 2) and energy from sunlight to build molecules of sugar and release oxygen**.**
Language Arts ♦ **LC.1.4** ♦ **LS.1.1**	Use correct capitalization. Ask questions that seek information not already discussed.

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