

Make Your Own Paper

Grade Level: Primary to Intermediate

Materials:

Used, scrap paper
Bucket of Warm Water
Blender
Small, flat pan or tub of warm water
Wood and screen to make a “deckle” (as described below)
2 Dish Towels
Iron (optional)

Background:

Paper is a simple material. It is essentially a mat held together by a fiber’s roughness and can be made from almost any fibrous materials such as cotton, hemp, flax, wood or recycled paper. And yet, this simple product has a tremendous effect on our lives. Imagine how different your day would be without paper!

The process for making paper was invented in China in the 2nd century A.D., and all paper was made one sheet at a time until 1798. With the Industrial Revolution and the papermaking machine, papermaking became a major industry that provides countless products, from books and newspapers to packaging and not pads. Some modern machines can make a sheet of paper 26 feet (8.8m) wide and nearly 40 miles (64km) long in just one hour! While the technology has changed dramatically over the centuries, the basic steps are simple enough for your students to do in class.

The process begins when trees, grown especially for papermaking, are harvested and transported to a paper mill. At the mill, large machines strip away bark and shred the logs into millions of chips the size of breakfast cereal. The wood chips travel on conveyors to gigantic “pulp cookers” where chemicals and steam are added. The mixture is heated and pressurized, breaking the chips into smaller and smaller pieces and finally forming a dilute water suspension of wood fibers called *pulp*. The pulp then passes through cleaners and screens and sometimes goes through a bleaching process that will give it the whiteness needed for the grade of paper being manufactured. Other chemicals like dyes, pigments, sizings or resins are sometimes added to provide the paper or paperboard (thick paper) for boxes with the appropriate finish.

The pulp is then pumped through pipes to a paper machine where it is sprayed onto a wide, moving wire screen. After the water in the pulp drains through the holes, a damp mat of wood fibers remains: the paper. It is picked up from the end of the moving belt and dried over steam-heated rollers.

Commercial papermaking affects the environment in several ways. The energy needed for papermaking comes primarily from fossil fuels which are nonrenewable. Burning those fuels can put carbon dioxide and other pollutants in the air. However, for public safety, there are state and federal guidelines that control emissions. Most of what you see coming out of the mill’s smokestacks is steam, not pollutants. Many mills recycled the waste paper they produce and use wood waste to generate their own electricity for the process.

The wastewater from the papermaking can cause pollution problems. However, in the United States and Canada, the water discharged from mills is tightly monitored and controlled. Additionally, the pulp-cooking process creates strong odors that can be smelled in the vicinity of the mill. Most mills have odor control systems to lessen this problem although these sometimes fail.

Paper comes from trees, which are a renewable resource. Most of the trees used for paper are planted and harvested on plantations for that purpose. More than half of the fiber used for paper comes from reissue left when lumber and other wood products are made and from paper which has been collected for recycling.

Paper is easily recycled, which helps reduce the amount of land space needed to store the 200 million tons of solid waste Americans generate each year. However, no matter how much paper we recycle, new trees still will be needed for paper products because paper cannot be recycled indefinitely. Each time paper goes through the manufacturing process, the fibers deteriorate. After repeated recycling, the fiber is no longer suitable for papermaking.

Getting Ready:

1. Decide how you will conduct the activity. If you are short on materials or adult supervision, you can demonstrate; but, ideally, you should try to find a way for students to participate. Middle school students might use stations so some students can make paper while others do a different activity. For younger students, you might ask a parent or aide to help at station or have an activity for the rest of the class while you help small groups make paper.
2. The papermaking process is a wet one, so plan to use a workspace that won’t be harmed by moisture. You might want students to wear “wet gear” - an apron or smock, or old clothing.
3. Remove any plastic or staples from the scrap paper and tear it into small pieces (1-inch squares). Soak the paper in hot water in the large container for at least 30 minutes, or if you can, overnight.
4. Buy or build a wooden frame, which you will prepare for papermaking. Tightly staple or tack nylon or wire screening to the frame, making a “deckle”, which is the surface on which you will layer the fibers.

Activity:

1. Introduce the activity by asking students what they think paper is made of and how it is made.
2. Fill the blender halfway with warm water, then add a handful of soaked paper. Blend at medium speed until you no longer see pieces of paper and the pulp has a soupy consistency. You can blend in a piece of construction paper for color, or stir in short pieces of thread, dried flowers or herbs for texture.
3. Pour the mixture into the large basin and then fill the basin with warm water, mixing thoroughly until the ingredients are evenly dispersed.
4. Slide the deckle into the basin. Put some pulp onto the screen and, still holding the deckle underwater, gently move it back and forth to get an even layer of fibers on the screen.
5. Lift the deckle out of the mixture, keeping it flat. Allow it to drip until most of the water has drained off. You should have a uniform layer of pulp mixture on the deckle. Press the pulp gently with your hand to squeeze out excess moisture (rubber glove will help). Soak up any excess water from the bottom of the screen with a sponge.
6. Place a clean dish towel on a flat surface and turn the screen paper-side-down on the cloth. Lift the screen gently, leaving the paper.
7. Quickly cover the paper with another cloth or piece of felt and iron it at a medium dry setting. When the paper is dry, pull the cloth gently from both ends, stretching it to loosen the paper from the cloth. Gently peel off the paper.
8. When you’re finished making the paper, collect the leftover pulp in a strainer and throw it out, or freeze it in a plastic bag for future use. Don’t pour the pulp down the drain!

Discussion Questions:

1. What materials did we use in making paper?
2. What forms of energy did you need to make the paper? (electricity and students’ own energy)
3. What types of waste resulted from making paper (dirty water and leftover pulp)
4. What did we do with the waste products?
5. What were some problems with making paper? (cleaning up the mess)
6. What would it be like in a paper mill, where tons of paper are being made a day? Why do you think recycling paper is important? What about reducing the amount of paper you use?
7. How is the new paper different from the old paper that you recycled?

Notes:

Use white paper instead of newspaper. The ink from the newsprint will be messy and creates a dull gray paper.

Add perfume to the mix to create a scented paper for cards, notes or letters.

Adding dried flowers, thread, glitter or any decorative item makes a great paper for cards or custom applications.