

# Activities with Paper

## How to Make Paper

Art, Science, ELA

K-5

1-2 Lessons





## Overview

Students will learn how to make recycled paper using mostly everyday materials. They will use techniques for recycling paper that have been used for centuries in Europe and North America. Finally, they will use their handmade paper to record a favorite poem or write a letter to someone special.

## Objectives

Students will learn that

- products are created by following steps in a process
- paper has been made in different cultures for centuries
- you can make recycled paper at home
- everyday materials don't just appear; they are made by human effort and ingenuity
- paper can be made by hand (it doesn't necessarily require machines)

## MATERIALS

- Shredded paper
- Plastic basin
- Water
- Towels
- Sponges
- Blender
- Mesh frame
- Deckle
- Dried flowers
- Feathers

## Activities

Split your group into five teams. Each team will be in charge of one part of the process. Name the five teams: TEAM BLEND, TEAM POUR, TEAM STRAIN, TEAM PRESS, and TEAM SEPARATE.

Explain that paper has been made by hand for centuries. Today we will use some techniques for making paper that have been popular in Europe since the Middle Ages.

Step	Materials this team will need
<b>TEAM BLEND</b> <ol style="list-style-type: none"><li>1. Shred paper. If your school has a paper shredder, use it.</li><li>2. Put shredded paper in a plastic container.</li><li>3. Add warm water until the shredded paper is saturated. Let it sit for ten minutes.</li><li>4. Put the soggy paper mixture into a blender. (Be sure to include the water.)</li><li>5. Blend until it turns into a thick, soupy consistency. Now, it is pulp!</li></ol>	<ul style="list-style-type: none"><li>• Shredded paper</li><li>• Shallow bucket (rectangular in shape)</li><li>• Blender</li><li>• Water</li></ul>



Step	Materials this team will need
<p><b>TEAM POUR</b></p> <ol style="list-style-type: none"> <li>1. Fill a shallow, plastic basin until it is half full with water.</li> <li>2. Pour the pulp into the basin. This mixture is called slurry. If you want to add some dried flowers, feathers or other decorations, now is the time to do it.</li> <li>3. Stir the slurry with your hand so that it becomes smooth.</li> <li>4. Take the mesh frame and put the deckle on top of the mesh. With the mesh side facing up, dip it into the basin.</li> <li>5. Rock the frame and deckle backwards and forwards in the mixture about 5 times. This should cover the entire mesh frame evenly with pulp.</li> </ol>	<ul style="list-style-type: none"> <li>• Shallow rectangular bucket with water in it</li> <li>• A thin cloth</li> <li>• Sponges</li> <li>• A mesh frame or “deckle”</li> <li>• A blender full of pulp</li> <li>• Dried flowers, feathers , other decorative items</li> </ul>
<p><b>TEAM STRAIN</b></p> <ol style="list-style-type: none"> <li>1. Lift the frame out of the mixture. Hold it over the bucket for ten seconds so that the excess water can drain through the mesh.</li> <li>2. Remove the deckle.</li> <li>3. Place a thin cloth on a flat surface.</li> <li>4. Quickly flip the mesh frame face down on the thin cloth.</li> </ol>	<ul style="list-style-type: none"> <li>• Thin cloth</li> </ul>
<p><b>TEAM PRESS</b></p> <ol style="list-style-type: none"> <li>1. Take a DRY sponge and press it over the mesh so that it can absorb the excess water. Do not rub as this will break the paper.</li> <li>2. Squeeze your sponge back into the basin of slurry. Then, go back and press it against the mesh again. Do this several times. Take your time with this step. If you rush, you may break your paper.</li> </ol>	<ul style="list-style-type: none"> <li>• Dry sponge</li> <li>• As you dry, the fibers begin to bind together.</li> </ul>
<p><b>TEAM SEPARATE</b></p> <ol style="list-style-type: none"> <li>1. The paper should now be sticking to the thin cloth. Slowly and carefully lift the mold off the thin cloth. If the paper is still sticking to the mesh as you lift the mold, give it more time to dry. When you lift the mold, the paper should remain on the thin cloth.</li> <li>2. Allow the paper to dry, still on the thin cloth. Place it in the sun or by a window for a few hours.</li> </ol>	<ul style="list-style-type: none"> <li>• A warm or sunny spot</li> </ul>



### Next Steps

Follow these steps until enough pieces of paper have been produced so that each student has one. Rotate the teams so that students can learn how to complete each stage in the process.

Have your students write a favorite poem on their paper or a letter to someone special.

With all craft activities, practice makes perfect. Students gain confidence as they get better and better at making paper. We strongly recommend giving students repeated opportunities to practice their new paper-making skill and enjoy the resulting creations. Since it's unrealistic to make paper over and over again in your own classroom, we recommend sharing this activity with other teachers who may find the activity useful for their own discipline-based instruction. For example, the Science teacher may find this activity useful for learning about fibers and recycling; the Art teacher may find this activity useful for creating paper-based crafts. If your school has an after-school, you can share these instructions (and the materials for this activity) with the after-school and encourage them to continue this activity in their program.

### Involve the Science Teacher and the Art Teacher

Ask your science teacher to repeat this activity in his/her classroom, if possible, and explain the scientific processes happening in each stage of the papermaking process.

Ask your art teacher to repeat this activity in his/her classroom and emphasize paper decoration techniques and color mixing.

### Involve the School's Behavioral Therapist

Ask your school's behavioral counselor to participate in the activity. Papermaking (and other paper-based crafts) has been proven to soothe anxiety and help develop executive function. It has a calming effect similar to meditation. It is an ideal activity for students with behavioral problems and/or students living in high-stress situations.

### Foster Home-to-School Connections

Papermaking is an easy, safe activity that children can do at home. Aside from the cost of the deckle (which runs about \$15), the materials and tools needed are found in every kitchen and are extremely cheap. We encourage you to share these directions with families and use this activity as a TV alternative!



This information is reprinted from the Cranberry Corner column of Hand Papermaking Newsletter #50 (April, 2000). To order Hand Papermaking bi-annual magazine and quarterly newsletter, visit <http://www.handpapermaking.ws>.

## Papermaking History

**THE INVENTION OF PAPER.** The invention of paper and the recording of this discovery have been attributed to Ts'ai Lun, a courtier in the court of Ho Ti, emperor of China in 105 A.D., although there is recent evidence that papermaking actually preceded this date. The process of making handmade paper was kept a secret and it was only in the year 751 that the Arabs learned about it from Chinese prisoners taken in Samarkand. Papermaking reached Baghdad in 793, Morocco in about 1100, Spain in 1150, France in 1189, Germany in about 1320, England in 1494, and Pennsylvania in the year 1690.<sup>1</sup>

**PAPER RAW MATERIALS AND PREPARATION.** There are a number of variations of the papermaking fibre pulping process which evolved in different countries. However, essentially the pulp fibres from which paper is made are obtained primarily from the stems and inner bark (or the flower in the case of cotton) of certain plants which are made from cellulosic fibres. (Cellulose is a naturally occurring long chain polymer). The bonding material that holds these fibres together in the plant is called lignin, which is a complex natural organic polymer.

In order to separate the cellulose fibres from the lignin, the early papermakers retted (fermented) the plant stalks, a process which could be accelerated by the addition of milk. Depending on the plant, this process could take several weeks or even months.<sup>2</sup>

Much later the use of chemicals such as soda ash and caustic soda were used to cook the plant stalks thus dissolving out the lignin which was washed away. These early processes evolved into modern day pulping processes which process wood chips. Today, however, the cooking chemicals used are recycled and the fibrous and liquid wastes are treated, recovered, and recycled and/or burned for fuel.

Around 1838, Charles Fenerty, a Nova Scotian, is credited with producing the world's first useable paper from woodpulp made by a grinding process. Independently in Germany in 1844, F. G. Keller produced enough groundwood pulp to make paper when combined with 40% of the much stronger rag pulp.<sup>3</sup> Thus began the use of mechanical pulps to make much cheaper, but much less permanent papers.

**OTHER FIBRE SOURCES.** Other sources of fibres for the early papermakers were cotton and silk (also cellulose) rags which were gathered from households by the "rag men" and sold to the papermills. Even hemp rope, old fishing nets, and old sails were used. This was an early example of recycling!

**BEATING THE FIBRES.** In order to make strong paper with uniform "formation," the cellulose fibres and rags, etc., had to be beaten or macerated. Originally this was done by hand using a large mortar and pestle-like apparatus. Later this was replaced by water wheel-driven mechanized stamping machines. (And much later by motor-driven beaters and refiners.) This process disintegrated the textile rags and broke open the cellulose fibres thus exposing many "fibrils" or very fine fibre particles which intertwine and hold together during the wet forming of paper.

*References: <sup>1</sup>Paper in the Making, G. Caruthers, The Garden City Press, Toronto, 1947. <sup>2</sup>Japanese Papermaking, T. Barrett, Weatherhill, New York, 1984. <sup>3</sup>Making Paper, B. Rudin, Rudins, Vallingby, Sweden, 1990.*

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