

# Papermaking

## Objectives

Students will be able to:

- ➔ name the benefits of paper recycling;
- ➔ summarize the paper recycling process; and
- ➔ make a sheet of recycled paper.

## Method

Students will recycle used paper to make new paper.

## Materials

- several papermaking screens (see procedure to make)
- used paper (white and colored)
- kitchen blender
- sponges
- paper or cloth towels
- board for pressing or rolling pin
- pitcher or cups
- water
- aprons (optional)
- clear shallow plastic dish pan

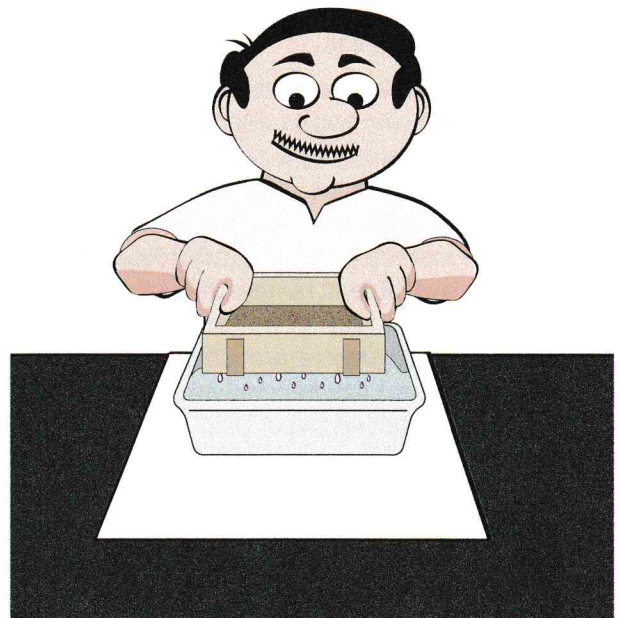
## Vocabulary

- |           |            |
|-----------|------------|
| • recycle | • couching |
| • mold    | • pulp     |
| • deckle  | • slurry   |

## Background

Recycling is a way to extend the useful life of a valuable resource. Recycle means to use used materials again by saving them from the trash and reprocessing them. Reprocessing used materials involves breaking them down and then reforming them into a new product.

Paper recycling is the process of recovering used paper and remaking it into new paper products. Paper recycling is not a new idea—in the 19th century, people used old cloths and rags to make new paper. Papermaking is the process of making paper.



Many different types of paper can be recycled into new products. Notebook paper, for example, can become printing or writing paper, newspaper, or packaging.

Newspaper is usually made into new newsprint, tissue, or paperboard. Cardboard is recycled into new cardboard or paperboard packaging. Magazines, catalogs and telephone directories are made into paperboard, tissue and writing paper. Every ton of paper recycled saves more than 3.3 cubic yards of landfill space. That is about the same size as a small refrigerator. According to the EPA, in 2009 62.1 percent of the paper used in the U.S. was recovered for recycling. And by weight, more paper is recovered for recycling than glass, metals and plastics combined.

In the papermaking process, the following vocabulary is used:

- **Couching:** A method of transferring a sheet of wet paper from the mold onto a drying surface.
- **Deckle:** An uncovered frame which fits on the mold and shapes the paper.
- **Deckle edge:** When pulp slips under the deckle, it forms a soft edge and is called a deckle edge.
- **Mold:** A frame used when making paper which holds a stretched screen.

- Pulp: Fibrous material prepared from wood or recovered paper used to make paper products.
- Slurry: The product produced when pulp and water are mixed together during the paper making process that is used to make paper.

## Pre-Activity Procedure

### 1. Preparing the Screen:

**Wood Screen Option:** A mold and deckle are usually made with two wooden picture frames with one as a mold with a screen stapled to it or secured inside and the second wooden frame as the deckle. The screen may be hardware cloth, nylon window screen or craft/embroidery screen. Screen is available at hardware or craft store. Place screen on back of wooden picture frame and secure with staples around the entire edge. Cut away the excess material and you have a mold that will screen paper pulp. The size of the frame depends on the size of paper you would like to make. You may want to vary size depending on both age of students and uses of finished paper (for example: will the paper be used to write on, use for art, or display). You may want to have 3 or 4 molds and deckles so an assembly line process may be used to make several pieces of paper at each time.

**Plastic embroidery/craft hoop Option:** Two plastic embroidery/craft hoops may be used. One hoop will be used as a mold with the screen secured inside by pressing screen into the outer frame with your fingers and then place the inner frame into position. Screen should be pulled tight in the hoop. Cut away the excess material and you have a mold that will screen paper pulp. The second hoop without screen acts as a deckle.

### 2. Gather the Following:

**Sponges:** Sponges are natural for water removal. Use a sponge small enough to fit in your hand, one that is good for soaking up water.

**Towels/Paper Towels:** Large towel or paper towels. Towels (couch sheets) get wet from being used and maybe dried and reused.

**Board for Pressing:** This will be used to press down on a wet sheet of recycled paper between layers of towels. Use a rolling pin or 1" x 4" board cut into 6" lengths works well.

Set up a paper recycling station equipped with the above materials. Be sure to place newspaper or a sheet of plastic on table. This process can be messy.

## Procedure

Introduce paper recycling to the students. Discuss the papermaking process outlined in the Background section. Discuss the use of wood and recovered paper in making paper. The raw material used to make paper in the U.S. comes from a combination of wood from trees grown to make paper, recovered paper and the wood residuals (such as wood chips) left behind from lumber manufacturing. For this activity new paper will be made from recovered paper only.

### How to Make Pulp:

1. Fill the kitchen blender with water until 3/4 full.
2. Cut or tear scrap papers into small pieces and place paper into blender.
3. Place lid on blender. Start with medium speed. Run the blender in a series of short bursts. This process is turning paper back into pulp. Run blender until the mixture has the consistency of thin oatmeal.
4. Pour blender contents into the plastic container. Add more water until the container is 1/2 full.

### Making a Paper Sheet:

1. Gently stir the pulp in the container with your hand.
2. Place the deckle against the screen side of the mold. Hold the two parts together.
3. Dip the mold/deckle vertically into the edge of tub with the top edge tipped slightly towards you. As you lower the mold/deckle, tip the top edge away from you in a scooping motion. Lift the fully immersed mold/deckle straight up out of the tub, keeping it horizontal.
4. The pulp will even out and the fibers will bond together while the water is draining out.
5. Carefully lift the deckle off the mold. If you don't like the sheet, turn the mold over, hold it on the surface of the water to release the pulp so that you can try again.
6. If you are pleased with the sheet, place a couch sheet (a dry piece of paper or towel) on it and turn the mold over onto a firm hard waterproof surface. Remove excess water by pressing a sponge on the back of the mold.
7. Lift mold and starting slowly at one corner of mold, peel off the new paper from screen, leaving the new sheet on 1-2 towels.
8. If new paper is still very wet place 1-2 more paper towels on top of the new sheet. Take a flat piece of wood or rolling pin and press down hard on top of the dry towels.

9. Remove the top wet towels. Replace with dry ones. Repeat pressing. Repeat replacement of wet towels with dry ones, and pressing, until little water is removed with dry towels. Do not throw wet towels away. Lay them out to dry. Re-use them in future papermaking.
10. Place newly made paper on a sheet of paper and instruct students to write their names on sheet of paper beside their recycled papers.
11. Let the paper dry overnight. Optional methods to drying paper:
  - Place paper in sun
  - Place paper on an ironing board with a dishtowel or fabric over them and iron. (Ironing dried paper will flatten it out.)
  - Set them in front of a fan.
  - Use a hairdryer.
12. Summary discussion: Remind students that recyclable paper may include writing paper, paperboard boxes, corrugated boxes, magazines, newspapers and other materials. Share information on the process of recycling and how an existing item may be turned into a new item. Explain that the used item may be made into new items that are the same or different than the used item. For example, old newspapers can be made into new newsprint or paperboard.

## Assessment

- Have students describe the process of recycling paper.
- Display students dried paper products
- Ask students to discuss the importance of recycling

## Technology Connections

- American Forest & Paper Association (<http://www.afandpa.org>)
- [paperrecycles.org](http://www.paperrecycles.org) (<http://www.paperrecycles.org>)
- Before or after the activity, show students the video “Making Paper” at [www.paperrecycles.org](http://www.paperrecycles.org) to give a real-world overview of the recycling process.
- Design a presentation to pictorially explain the process.
- Video the process of making paper and include the paper recycling collection at the school/site.

## Enrichment

For additional sheets of recycled paper:

- Dry flowers, leaves or parts of plants by placing them between two pieces of paper towels and microwave for 30 seconds at a time. Check every 30 seconds until the plants are almost crisp. Or collect items and lay in sunlight for a day to dry. Add the dried plants to your sheets as soon as you have lifted the mold from the pulpy water. Arrange the flowers and leaves in an artistic manner. A toothpick helps to position them.
- Add flower seeds to paper after it is molded to make “plantable” seed cards or seasonal ornaments.
- Combine threads, ribbon lengths, in a single new sheet. Add the threads to the pulp when it is in containers just before pouring.
- Try glitter; add it either in the blender and/or in the containers just before pouring.
- Collect examples of recycled paper products. Some possibilities are: food boxes such as cereal boxes, paper napkins, kraft grocery bags, copier paper, greeting cards, stationery and carry-out trays from fast-food restaurants. Make a display.