

An Invitation to Recycling



GRADES
K-4

Begin with recycling, continue with creativity and end with a celebration. Makes for a good collaborative lesson between Science and Art teachers.



PREPARE

Time Required: 2 class period (90 minutes) without extensions

- Gather materials (see activity pages).
- One week prior to this activity, have students keep track of all the paper the class uses by saving all paper recycling bins and having students make sure they discard paper products appropriately as part of the data collection process.
- You might label several different bins or boxes during this time period to mark the different categories such as: white paper; colored paper; newspaper; cardboard; other.
- You might also have students collect and bring in materials like bits of thread, petals from silk flowers, glitter or anything else that is tiny and resistant to water.
- Make copies of Activity Pages (optional depending on abilities)



MOTIVATE

Have students keep track of the amount of paper they use as a class in a week. Have students come up with reasons they may be keeping track of this. Optional: read a story like *The Lorax*, by Dr. Seuss (or any other piece of literature or story about saving the environment). Ask students to reflect and consider if the story describes anything that could really happen in our lives. Discuss why humans cut down trees and what trees are used for.



TEACH

- Have students calculate how much paper they use in a week. This can be done in terms of # of sheets of paper, or mass, for example. To save paper, consider projecting this information onto a screen once tabulated. For younger children, this may be sufficient. Have older students create a table, graph or chart to illustrate their paper use for the week.
- Older students may also be able to figure out much paper the class uses in a month, and a year. Guide them through these calculations as needed if applicable.
- For more advanced students, you might also have them calculate how many trees the amount of paper the class uses translates to. Although, note that this measurement is harder to determine because every tree is a different size, and different methods of making paper require different amounts of pulp. Moreover, different kinds of trees produce different amounts of paper as well (hardwoods vs. softwoods). However, conserveatree.org offers a few good insights as to how this conversion can be done. One of the easier calculations is that 1 tree, 40 feet tall and 6-8 diameters

across, produces approximately 17 reams of office paper (500 sheets). Students calculate how much the class will use in a year, and “translate” that to trees. Depending on grade and ability, you may do this with students as a class, or let them do their own calculations.

- When introducing the term cellulose, you might also discuss how most animals, including humans, can’t digest cellulose. Animals that can digest cellulose include cows, horses, sheep, and goats because they have a special kind of bacteria that live inside their stomachs to help break it down. Because cellulose is so strong, it can be re-used several times to make new paper after the old paper has been used.
- Lead students through the process of making paper!
- The [ScrapMap of recovered paper](#) shows how newspapers are converted into cardboard boxes and can be projected onto a screen for the class to review and consider.
- At one station you will need a frame and deckle. These are simple to make, and useful. You can use old picture frames or cut the frame yourself.
- Staple window screening or nylon mesh to the smaller frame, so that the paper/water mixture can be spread thinly across it and dried.
- There is no set pattern for the paper that students produce. Irregular mats of paper can be cut into any shape students prefer when they dry, and can be as simple or elaborate as students prefer.
- Don’t forget to emphasize the science! The same resilience that makes the cellulose in the recycled paper suitable for recycling is what makes it so valuable for commercial and industrial uses in industry.



REFLECT/ASSESS

Students should be able to:

- Describe where paper comes from and the relationship between trees and paper (cause and effect: to make paper, we must cut down trees).
- Explain what cellulose is and why it is ideal for paper-making.
- Identify ways students can reuse paper, above and beyond recycling.



EXTEND

Have students plan a celebration of recycling through an open-house event. Students can then use the paper they make to prepare invitations to the event. This event could include:

- Artwork students created from re-purposed paper, plastic, and other materials
- Presentations and/or posters as to the benefits of recycling and repurposing
- Photos of items in the school area that are made from recycled products
- Participation by special guests like the school custodian or the municipality’s sanitation supervisor
- Quick art activities/stations using recycled products
- Games or challenges using recycled products or re-purposed items (see suggestions for [The “Recycle Games”](#))



JOURNAL QUESTION

Have students draw a picture of what the earth would be like if there were no trees.



WEBLINKS

Interactive ScrapMap for recovered paper
Conversions of Trees to Paper
The Recycle Games

http://www.jason.org/interactive/isri/scrap_map/
<http://conservatree.org/learn/EnviroIssues/TreeStats.shtml>
http://www.educationworld.com/a_lesson/03/lp308-02.shtml

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Background

Paper recycling is one of the real success stories of the industry. Paper and other forms of fiber comprise one of the most widely recycled materials in the world. Since 1990 Americans have recycled more than a billion tons of paper. The materials are used for new packaging and paper. More than 75 percent of paper mills rely on recovered fiber to make some of their products. In 2011, the US recycled about 325 pounds of paper for every person in the country-- nearly two-thirds of what we use. This not only saves trees, but energy.

The essential component of paper is cellulose. It is a polysaccharide that is indigestible to humans and most other animals (although termites have protists in their guts and many breeds of cattle have bacteria in their rumen that make it possible for them to use it as food.)

The properties of cellulose make it both resilient (giving plants strength) and exceptionally useful for recycling. It is the essential molecule that gives wood and paper products their strength. When cellulose fibers are soaked in water hydrogen bonding occurs among the hydroxyl (OH-) groups on the surface of the fibers causing them to cling together. Once these bonds are formed, removal of the water (drying) causes these bonds to strengthen even more, resulting in a strong sheet or mesh of fibers that we call paper. That's the process that students will recreate in the paper-making activity in this unit.

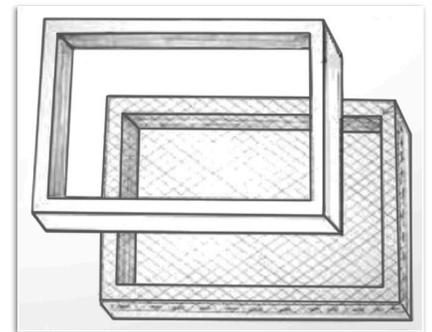


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Do you know where paper comes from? If you said trees, you are right! Paper is made from a chemical called cellulose (sel-you-lohs). Cellulose is found inside plants and trees. Cellulose is strong stuff! In this activity, you will find out how much paper your class uses in a week. You will then think about ways to reuse and recycle the paper you use for schoolwork to help the environment.

Materials:

- Sponges
- Paper towels
- Scraps of paper (collected, cut and soaked for at least four hours)
- Blender
- Water
- Bits of colored thread and/or tiny leaves and petals from old silk/cloth flowers
- Large dish pan
- Liquid starch (or starch packing pellets dissolved in water)
- Two pieces of flat plywood or laminate that fit inside the dishpan
- A deckle (a wooden frame used in manual paper making) and a frame with a piece of nylon or mesh stapled to it for paper making
- Colored paper and newsprint



Part 1: Collect Data

1. Find out how much paper your class uses in one week by counting or weighing the paper your class has collected. Show the information in terms of # of sheets, weight or mass.
2. Optional: Can you figure out how many trees your class would use in a year if 1 tree makes 500 sheets of office paper?

Part 2: Make Paper

1. Cut some of the used paper your class has used into the tiniest bits possible.
2. Add some of the extra items you collected like bits of colored thread, tiny petals from artificial flowers, a bit of construction paper or glitter.
3. Fill a blender approximately half-way full with the paper bits. Fill blender with warm water. Let soak for a few minutes.
4. Blend until you can't see any paper any more.
5. In a separate bowl or pitcher, put 1-2 teaspoons of liquid starch (tablespoons of corn starch works too), or two or three starch "peanuts" that come in packaging along with two cups of warm water, and let the starch dissolve completely.
6. Put your paper mixture into a pan. Add the warm water/starch mixture. Mix it thoroughly.

7. Your teacher will provide your group with a frame that has a very fine mesh—nylon or screen. Insert that frame into the pan. Gently put that frame into the pan and allow a thin layer of your paper fibers (pulp) settle on the screen.
8. Lift the screen gently. Press the pulp to get some of the water out. You may need a sponge to clean the extra water as you do this.
9. Flip your frame onto a layer of newspaper. Jiggle it a bit, to release the paper from the frame. Let it dry for a day, and then peel it off carefully.
10. Put on safety glasses, and cut the new paper into a rectangular shape.
11. Use your new paper to make a new drawing, story, or invitation (see extension class project)

Reflect and Apply

1. Where does paper come from?
2. What is cellulose and why is it so important?
3. List some other ways you can reuse paper.

Extension:

With your class, plan an event that shows the importance of recycling. You might use photos of recycled products, graphs of what we can save by recycling, or projects made from reused paper to show unexpected treasures. Create invitations out of the paper you made! Make your celebration fun by challenging those who attend to commit to recycling.



JOURNAL QUESTION

Draw a picture of what the earth would be like if there were no trees!