

Make Every Day Green

LESSON TWO

Recycling Paper

Grade Levels: 3-5

Sunshine State Standards

- **Body of Knowledge: The Nature of Science**
 - Big Idea 1: The Practice of Science
- **Body of Knowledge: Life Science**
 - Big Idea 17: Interdependence
- **Body of Knowledge: Earth & Space Science**
 - Big Idea 6: Earth Structures

Key Concepts

- Learn the process of making recycled paper.
- Understand that recycling can save energy, money, and natural resources.
- Recognize that reusing old materials to make new ones keeps valuable resources from being wasted.

Vocabulary

- **natural cycle:** A series of events in nature that repeats over and over, usually involving a complete process of growth or action.
- **renewable:** A naturally occurring raw material, or form of energy, that will be replenished through natural ecological cycles.
- **nonrenewable:** A resource that cannot be replaced in the environment because it forms at a rate far slower than its consumption.
- **raw materials:** Unprocessed natural substances, such as wood, used in the manufacture of products.
- **lignin:** A complex chemical compound and an important part of plant cell walls.
- **pulp:** A mixture of fibrous materials ground up and moistened to be used in making paper.

Background

Paper mills use a lot of energy and natural resources to produce paper. Trees that are cut down can be replanted, but it takes 16 to 30 trees to make one ton of paper. Each person in the United States uses approximately 600 pounds of paper a year, so at the current population, that is about 60 million tons of paper! Paper is the number one material that gets thrown away. For every 100 pounds of trash, 35 pounds is made up of paper products. Through recycling, people can save energy, natural resources, and money.

To produce one ton of paper, it takes about 16,320 kilowatt hours (KWH) of electricity, where recycled paper only requires 5,919 KWH, a savings of 64%! Since paper contains the same fibers as the original plants, these fibers can be re-used to make new paper. The process of making paper weakens the fibers, so a small amount of fresh wood pulp is added to the recycled pulp. Different grades of paper are recycled into different types of new products. Old newspapers are made into newsprint, egg cartons, or paperboard. Old corrugated boxes are made into new corrugated boxes or paperboard. High-grade white office paper can be made into almost any new paper product: stationery, newsprint, or paper for magazines and books.



Time

15 prep;
45 minutes class time.
Paper dries overnight.

Materials

- 2 buckets
- Blender (a hand or egg beater can be substituted)
- Used classroom paper, ripped into 1 inch pieces
- 5"x7" wooden frame
- Screening material large enough to cover frame
- Small nails, tacks or staples to attach screening to frame
- Basin at least 8" deep, wide enough to fit frame
- Pieces of felt 9"x12" (at least one per student)
- Warm water
- Old newspapers
- Wooden Spoon for stirring
- Smocks (optional, this can get messy)
- Sponge
- Several magnifying glasses



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Introduction

Introduce the concept of natural cycles and recycling.

- Use a banana for this example. Ask, "What would happen if I threw the banana peel on the ground?" Explain that organic material decomposes, and is part of a natural cycle. Nature has a way of recycling things. Raw materials, left unrefined, are worn down and returned to the earth. Some examples of natural cycles: erosion in the rock cycle or the flow of water in the water cycle.
- Use an old newspaper, a soda can, and a plastic bottle as an example. Ask students to guess how the items are made.
 - These new items are no longer raw materials, and it took a lot of energy to produce them. If we just threw them away, that would be wasteful. This is where recycling comes in.
- Identify with your students the three arrows of the recycling symbol.
 - Reduce, Reuse, and Recycle
 - Find the recycling symbols on some of the products you saved from the trash. Explain that the three arrows of the symbol represent each stage.
- The recycle stage is when the recyclable material is broken back down and reshaped into usable products.
- Explain that the class is going to explore the process on how paper is recycled, and we are going to recycle paper collected from the classroom to remake into new and usable materials.

Procedures

Day Before:

1. Show the students that the scraps of paper are being placed into the first bucket and covered with warm water. (Use twice as much paper shredded as you want to make into new paper).
2. Wrap the screen around the wooden frame and tack or staple it down.

Day of Lesson:

3. Take a handful of the wet shredded paper from the bucket and put into the blender. Cover with warm water and blend until the paper is broken down into pulp. Pour the pulp into the basin and repeat until all of the paper is processed.

4. Lay newspapers in an area that can be undisturbed for a day and place felt on them. You may want to mark these with the students' names so they will know which paper is theirs. Before the students begin to make their individual pieces of paper, you can briefly have them touch the pulp with their hands and you can explain that the paper contains little fibers that fit together to form a mat that becomes paper.
5. Have the students take turns dipping the frame into the basin and lifting it up horizontally. The students should gently shake the frame from side to side and hold it for a minute to drain off the excess water. It is also helpful to try to absorb some of the water by applying the sponge to the other side. Wring out the sponge after each use.
6. Let the paper dry overnight, and it's ready to use.

Special Notes: A tablespoon of liquid starch can be added to the basin of pulp so students can decorate the finished product without having the ink run. **Be sure that when you are done with the pulp you do not pour it down the sink or it will clog the drain.**



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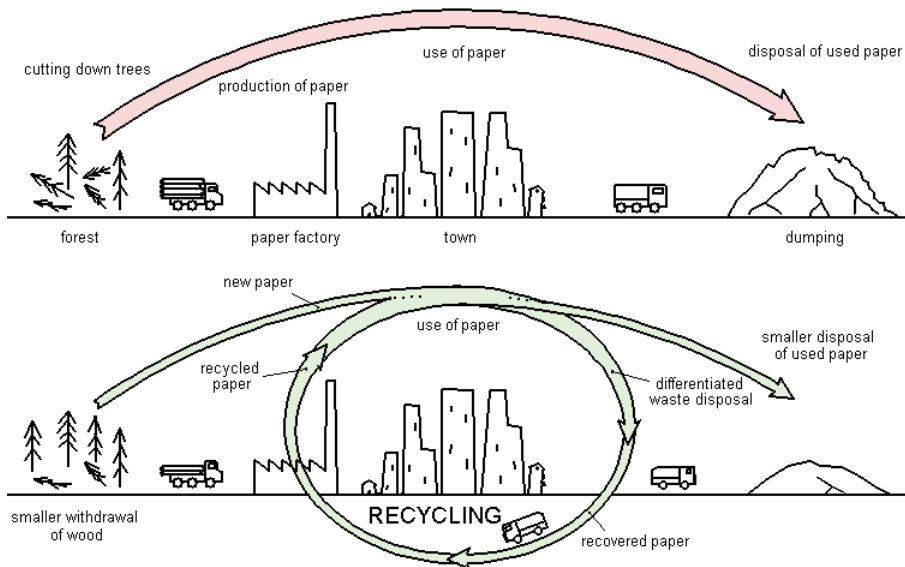
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Reflection/Response

Questions for students response

- Where are recycling bins in the school located?
- Ask students to describe how papermaking is done.
- Ask students to make a poster that encourages people to recycle paper.
- What are the benefits of recycling paper rather than throwing it away?
 - Write the students responses on the board and add the following:
There is less pollution created when we recycle paper, and we are conserving space in landfills.
- Have older students draw a step-by-step diagram of how the paper is made.



Extension

- Use the information on tipping fees in Broward County to estimate how much money has been saved by recycling in Broward County Schools.

1 ton = 2000 pounds

The total collected from Broward County Schools Recycling Program for fiscal year 2008 was 2,115 tons of recyclables. That equals \$204,858.90 saved!

1992-1993	-----	494 tons
1993-1994	-----	1,125 tons
1994-1995	-----	1,204 tons
1997-1998	-----	1,282 tons
1995-1996	-----	1,500 tons
1996-1997	-----	1,550 tons
1998-1999	-----	1,888 tons
2002-2003	-----	2,071 tons
2001-2002	-----	2,252 tons
1999-2000	-----	2,260 tons
2000-2001	-----	2,265 tons
2003-2004	-----	2,296 tons
2005	-----	2,516 tons
2006	-----	2,728 tons
2007	-----	2,353 tons
2008	-----	2,115 tons

- Rates:

\$96.86/ton – Waste that can be burned in a waste-to-energy plant

- Have a contest with another class to see who can recycle the most paper.

