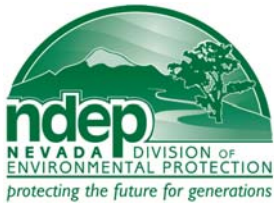


Lesson 15

Pulp Non-Fiction

Industrial Paper Recycling

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Lesson 15	Activity	M3-7
Support Document	Vocabulary	M3-10
Support Document	Student Worksheets	M3-11



Teaching Strategies

Pulp Non-Fiction

Industrial Paper Recycling

Teaching Strategies

Group Discovery

The group work is effective for all levels of learners.

Group Makeup

Groups should be selected by the lead classroom teacher. The groups should be heterogeneous and learners of all levels should be included.

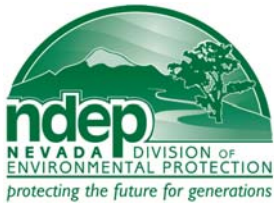
Group Presentations

The group presentation allows learners of all levels to practice public speaking. Each member of the group is required to participate in the presentation. The individuals with difficulty in public should be able to gain confidence with the support of other group members.

Artwork, Postermaking

The poster making is effective for all levels and types of learners. The posters will allow students to write, draw, graphically organize, and otherwise provide a system for information representation.

Tip: The student worksheet can be made as a transparency for group discussion.



Lesson Time:
60 minutes

Vocabulary

Pulp

De-inking

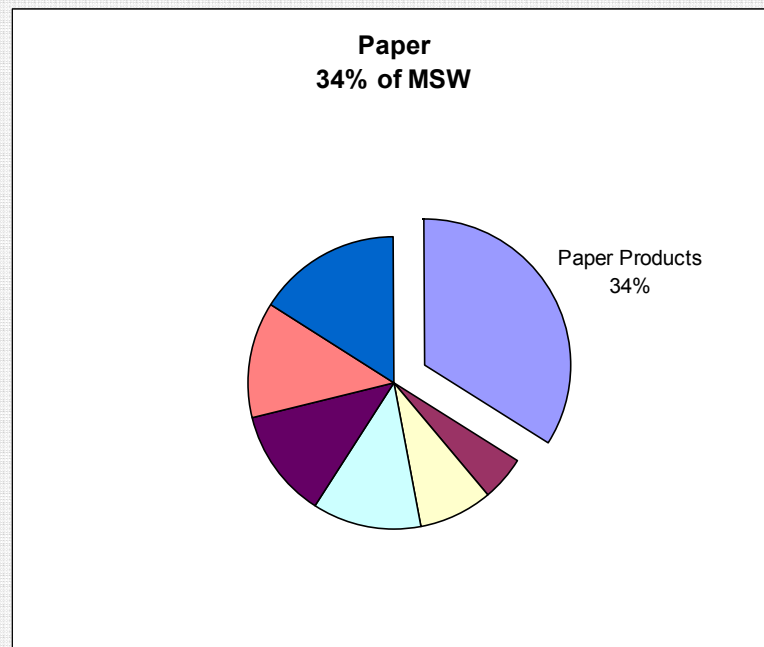
Floatation

Refining

Virgin Fiber

Pulp Non-Fiction

Industrial Paper Recycling



Data from EPA document EPA530-R-06-011 October 2006

Objective

Students will define key vocabulary.

Students will summarize and present the paper recycling process to the class.

Materials Needed

30	Single subject notebooks
6	Dry erase markers
1	White board
7	Fact packets
7	Bags containing colored markers
7	Pieces of paper: 3ft X 3ft

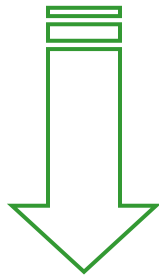
Anticipatory Set

Write the lesson objectives on the white board.
Discuss with the students what the objectives of the lessons are.

Objective: You will define key vocabulary.

Objective: You will summarize and present the paper recycling process to the class.

Distribute handouts (or workbooks).



Introduction:

“Today we are going to learn about how paper is recycled. We have already recycled paper during our papermaking lesson. We are now going to look at how industry recycling is done.”

Modeling / Guided Practice

1. Have the students take out their workbooks (or handouts).
2. Discuss the key vocabulary for the lesson. Have the students write the definitions on their worksheets.
3. Arrange the students into seven pre-selected groups.
4. Arrange the group's desks together into a square table.
5. Have one student from each group come up to the front of the room to get a 3ft X 3ft piece of paper.

Modeling / Guided Practice

6. Have one student from each group come up to the front of the room to get a bag of colored markers.
7. Assign each group to write / draw / map (summarize the information)
The required recycling information is included in the student worksheets.
8. Explain to the students that they will need to convey the most important information from their worksheet to teach the other groups about the steps in the process. Each group's steps are unique.
9. Scaffold for support.

When the students have completed their summary:

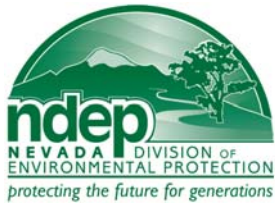
10. Have the first group come to the front of the class.
11. Have them present their poster.
12. Continue this procedure until all of the groups have presented.
13. Be prepared to “fill in” any information to describe the process that the presenters may have omitted.

Closure:

1. Take a few minutes to do a quick review of paper recycling
2. Add any other facts that did not get presented.
3. Check for understanding.

Independent Practice

1. Not applicable.



Support Document

Pulp Non-Fiction

Industrial Paper Recycling

Vocabulary

Pulp: a soft wet mass of fibers derived from wood, used in papermaking.

De-inking: the process of removing ink from the paper pulp.

Floatation: a process in de-inking where air and soap-like chemicals are injected into the pulp. This removes the large particles of ink from the pulp and floats them to the top of the vat.

Refining: the separation of pulp into individual fibers.

Virgin Fiber: new wood fibers.

Objectives: I will define key vocabulary.
I will summarize and present the paper recycling process to the class.

Vocabulary

Pulp:

De-inking:

Flootation:

Refining:

Virgin Fiber:

Group 1

The following material is quoted directly from EarthAnswers_Recycle.pdf. The text was generated by TAPPI and can be found by following the link below:

http://www.tappi.org/paperu/all_about_paper/earth_answers/earthAnswers.htm

Sorting

Successful recycling requires clean recovered paper, so you must keep your paper free from contaminants, such as food, plastic, metal, and other trash, which make paper difficult to recycle. Contaminated paper which cannot be recycled must be composted, burned for energy, or landfilled.

Recycling centers usually ask that you sort your paper by grade, or type of paper. Your local recycling center can tell you how to sort paper for recycling in your community. To locate your nearest dealer, look in the yellow pages of your phone book under "waste paper" or "recycling."

Collection and Transportation

You may take your sorted paper to a local recycling center or recycling bin. Often, a paper stock dealer or recycling center will collect recovered paper from your home or office. Your local dealer can tell you the options available in your community.

At the recycling center, the collected paper is wrapped in tight bales and transported to a paper mill, where it will be recycled into new paper.

Group 2

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http://www.tappi.org/paperu/all_about_paper/earth_answers/earthAnswers.htm

Storage

Paper mill workers unload the recovered paper and put it into warehouses, where it is stored until needed. The various paper grades, such as newspapers and corrugated boxes, are kept separate, because the paper mill uses different grades of recovered paper to make different types of recycled paper products.

When the paper mill is ready to use the paper, forklifts move the paper from the warehouse to large conveyors.

Re-pulping and Screening

The paper moves by conveyor to a big vat called a pulper, which contains water and chemicals. The pulper chops the recovered paper into small pieces. Heating the mixture breaks the paper down more quickly into tiny strands of cellulose (organic plant material) called fibers. Eventually, the old paper turns into a mushy mixture called pulp.

The pulp is forced through screens containing holes and slots of various shapes and sizes. The screens remove small contaminants such as bits of plastic and globs of glue. This process is called screening.

Group 3

The following material is quoted directly from EarthAnswers_Recycle.pdf. The text was generated by TAPPI and can be found by following the link below:

http://www.tappi.org/paperu/all_about_paper/earth_answers/earthAnswers.htm

Cleaning

Mills also clean pulp by spinning it around in large cone-shaped cylinders. Heavy contaminants like staples are thrown to the outside of the cone and fall through the bottom of the cylinder. Lighter contaminants collect in the center of the cone and are removed. This process is called cleaning.

Deinking

Sometimes the pulp must undergo a "pulp laundering" operation called deinking (de-inking) to remove printing ink and "stickies" (sticky materials like glue residue and adhesives). Papermakers often use a combination of two deinking processes. Small particles of ink are rinsed from the pulp with water in a process called washing. Larger particles and stickies are removed with air bubbles in another process called flotation. During flotation deinking, pulp is fed into a large vat called a flotation cell, where air and soap-like chemicals called surfactants are injected into the pulp. The surfactants cause ink and stickies to loosen from the pulp and stick to the air bubbles as they float to the top of the mixture. The inky air bubbles create foam or froth which is removed from the top, leaving the clean pulp behind.

Group 4

The following material is quoted directly from EarthAnswers_Recycle.pdf. The text was generated by TAPPI and can be found by following the link below:

http://www.tappi.org/paperu/all_about_paper/earth_answers/earthAnswers.htm

Refining, Bleaching and Color Stripping

During refining, the pulp is beaten to make the recycled fibers swell, making them ideal for papermaking. If the pulp contains any large bundles of fibers, refining separates them into individual fibers. If the recovered paper is colored, color stripping chemicals remove the dyes from the paper.

Then, if white recycled paper is being made, the pulp may need to be bleached with hydrogen peroxide, chlorine dioxide, or oxygen to make it whiter and brighter. If brown recycled paper is being made, such as that used for industrial paper towels, the pulp does not need to be bleached.

Papermaking

Now the clean pulp is ready to be made into paper. The recycled fiber can be used alone, or blended with new wood fiber (called virgin fiber) to give it extra strength or smoothness.

The pulp is mixed with water and chemicals to make it 99.5% water. This watery pulp mixture enters the headbox, a giant metal box at the beginning of the paper machine, and then is sprayed in a continuous wide jet onto a huge flat wire screen which is moving very quickly through the paper machine.

Group 5

The following material is quoted directly from EarthAnswers_Recycle.pdf. The text was generated by TAPPI and can be found by following the following link:

http://www.tappi.org/paperu/all_about_paper/earth_answers/earthAnswers.htm

Papermaking (cont.)

On the screen, water starts to drain from the pulp, and the recycled fibers quickly begin to bond together to form a watery sheet. The sheet moves rapidly through a series of felt-covered press rollers which squeeze out more water.

The sheet, which now resembles paper, passes through a series of heated metal rollers which dry the paper. If coated paper is being made, a coating mixture can be applied near the end of the process, or in a separate process after the papermaking is completed.

coating gives paper a smooth, glossy surface for printing.

Finally, the finished paper is wound into a giant roll and removed from the paper machine. One roll can be as wide as 30 feet and weigh as much as 20 tons! The roll of paper is cut into smaller rolls, or sometimes into sheets, before being shipped to a converting plant where it will be printed or made into products such as envelopes, paper bags, or boxes.

Group 6

The following material is quoted directly from EarthAnswers_Recycle.pdf. The text was generated by TAPPI and can be found by following the link below:

http://www.tappi.org/paperu/all_about_paper/earth_answers/earthAnswers.htm

Can all of my recovered paper be recycled?

As much as 80% of the content of typical recovered paper can actually be used in the recycling process, but 20% cannot. A lot of what's contained in a bale of recovered "paper" isn't paper! Trash, such as wire, staples, paper clips, and plastic, must be removed during pulping, cleaning, and screening. This trash is usually sent to a landfill, just like your trash at home.

Recovered paper contains some fibers which have become too small to be recycled into paper. Your recovered paper may contain fibers which already have been recycled one [*sic*], twice, or perhaps several times! Wood fibers can only be recycled five to seven times before they become too short and brittle to be made into new paper.

Recovered paper contains many other ingredients which are not paper fibers. Just take a look at a magazine and you'll see what we mean. The printed pages contain lots of ink. If the pages are shiny, that portably [*sic*] means they are coated with clay or other materials. Magazines also contain adhesives which bind the pages together. Ink, coatings, and adhesives must be removed from the paper before recycled paper can be produced.

Group 7

The following material is quoted directly from EarthAnswers_Recycle.pdf. The text was generated by TAPPI and can be found by following the following link:

http://www.tappi.org/paperu/all_about_paper/earth_answers/earthAnswers.htm

What can be made from recovered paper?

Most recovered paper is recycled back into paper and paperboard products. With a few exceptions, recovered paper is generally recycled into a grade similar to, or of lower quality than, the grade of the original product. For example, old corrugated boxes are used to make new recycled corrugated boxes. Recovered printing and writing paper can be used to make new recycled copy paper.

Recovered paper can be used in a variety of other products as well. Recycled pulp can be molded into egg cartons and fruit trays. Recovered paper can be used for fuel, ceiling and wall insulation, paint filler, and roofing. Nearly 100,000 tons of shredded paper is used each year for animal bedding. Even cat litter can be made from recovered paper!