



Recycling and Waste Reduction

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INTRODUCTION

This lesson introduces students to the concept of recycling and waste reduction. Students will investigate how materials are recycled, what materials can be recycled and why recycling is so important to protect our environment. Through a hands-on activity students will be able to create their own recycled paper using old newspapers.

LESSON OVERVIEW

Grade Level and Subject: Grades 5-8: Science, Social Studies, Language Arts, and Art

Length: Two class periods (Suggested Class Period #1: article, information and discussion, Class Period #2: paper-making activity and wrap-up discussion)

Objectives:

After completing this lesson students will be able to:

- Identify what basic materials can be recycled.
- Identify some of the environmental benefits of recycling.
- Examine their own personal activities that create waste and impact landfills and resource usage.
- Make personal changes to their waste output so that they can create a positive impact on the environment.
- Conduct a hands-on experiment using old newspapers and office paper to make their own recycled paper.

National Standards Addressed:

This lesson addresses the following National Science Education Standards¹

- **Content Standard:** [NS.5-8.5: Science and Technology](#)
As a result of activities in grades 5-8, all students should develop
 - Abilities of technological design
 - Understanding about science and technology
- **Content Standard:** [NS.5-8.6: Personal and Social Perspectives](#)

¹ Education World (2008) *U.S. National Education Standards*. Retrieved January 22, 2009, from <http://www.education-world.com/standards/national/index.shtml>.

As a result of activities in grades 5-8, all students should develop understanding of

- Personal Health
- Populations, resources, and environments
- Natural hazards
- Risks and benefits
- Science and technology in society
- **Content Standard: [NS.5-8.7: History of Nature and Science:](#)**
As a result of activities in grades 5-8, all students should develop understanding of
 - Science as a human endeavor
 - Nature of science
 - History of science

Materials Needed:

Class Period #1

- **Reproducible #1 - “He’s saving his trash- in his house- for a year”**
- **Reproducible #2 – Article Reflection Questions**
- **Reproducible #3 - Daily Recycling Chart**
- **Reproducible #4 - Municipal Solid Waste**
- **Reproducible #5 – Municipal Solid Waste Reflection Questions**
- **Reproducible #6 - From Used to New**
- **Reproducible #7 – Sample Answers to Questions**

Class Period #2

- Newspaper, scrap paper
- A square of window screen that fits inside a pan
- Pan
- Blender
- Water
- Measuring cup
- Iron or rolling pin
- Towels or scrap pieces of fabric

Assessment:

Students will be assessed through the following activities:

1. Answering short answer reflection questions about article (as homework or in class)
2. Creation of an individual recycling chart, exhibiting the connection between their daily activities and what can be recycled
3. Sharing, comparing and discussing their recycling charts with the class
4. Answering short-essay questions on municipal waste article
5. Creation of their own recycled newspaper through hands-on activity

LESSON BACKGROUND

Relevant Vocabulary:

- **Recycle:** To take old, used materials and make them into something new.
- **“Virgin” Raw Materials:** Materials that have never been processed before.
- **Corrugated Paper:** Cardboard; can be recycled.
- **Municipal Solid Waste:** The amount of garbage that Americans generate

Information:

According to the U.S. Environmental Protection Agency, Americans generated about 251 million tons of trash in 2006. This means the average American generates 4.6 pounds of waste per day, but only recycles 1.5 pounds of it.² This large amount of trash can be decreased by reducing the amount of items one uses, and choosing items that can be recycled over those that cannot. Recycling allows items to be reused for another purpose, instead of just being thrown into a landfill. It is also important because it helps to reduce pollution and green house gasses, along with conserving natural resources and energy. Therefore, by identifying what is recyclable in your home, work, school, and daily life, it is possible to reduce waste and improve environmental conditions.

Resources:

- Recycling Background and Student Action Plans, Earth Day Network, 2009
- How to make your own recycled paper:
 - <http://hubpages.com/hub/How-to-Make-Paper---An-Illustrated-Step-by-Step-Guide>
 - http://erc.openschool.bc.ca/ERC/features/paper_making.pdf
- [David Chameides’s blog, “365 Days of Trash”](http://365daysoftrash.blogspot.com/) (<http://365daysoftrash.blogspot.com/>)
- [US EPA Student Center – Waste and Recycling](http://www.epa.gov/region5/students/waste.htm) (<http://www.epa.gov/region5/students/waste.htm>)
- [Paper Industry Association Council](http://paperrecycles.org/school_recycling/index.html) (http://paperrecycles.org/school_recycling/index.html)
- [Environmental Literacy Council](http://www.enviroliteracy.org/teachers-index.php) (<http://www.enviroliteracy.org/teachers-index.php>)

LESSON STEPS

Warm up: *He’s saving his trash – in his house – for a year!*

1. In class, or as homework the night before, have students read the article in **Reproducible #1: “He’s saving his trash—in his house—for a year”** and

² Environmental Protection Agency (2006). *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2006*. Retrieved 19 June 2008, from <http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/msw06.pdf>

individually answer the reflection questions (**Reproducible #2: Article Reflection Questions**). See **Reproducible #7 – Sample Answers to Questions**.

2. Solicit students to share and discuss answers with the class

Activity One: *Discussing and Estimating Daily Recycling*

1. Discuss the key vocabulary terms and concepts, focusing on recycling as the process of using old items to make new items. Tell your students that when they recycle old notebooks and newspapers, they are used to make new things instead of simply sitting in a landfill. Plus, virgin resources, such as trees, do not need to be used to make new products. Tell your students that paper isn't the only material that can be recycled; plastic, aluminum, steel, and glass can be reused too.
2. As a class, brainstorm different types of recyclable items that they might encounter on a daily basis. Discuss daily activities and the recyclable items involved in each, for example: eating (*plastic cups and dishes, aluminum food and drink containers, cardboard cereal boxes, plastic milk jugs...*), doing school work (*paper, printer ink cartridges, electronics...*), purchasing products from the store (*plastic packaging, cardboard boxes, plastic containers...*), etc.
3. Ask students to individually fill in **Reproducible #3: Daily Recyclable Chart**. Encourage them to come up with one new item in each category.
4. Allow students enough time to fill in their chart. Have them share their answers with each other and discuss.

Activity Two: *Building Knowledge of Recycling*

1. Talk to your students about recycling and waste in more depth. Tell students that in 2007, Americans consumed 96,751 tons of paper, which is a lot of paper!³ Mention that because of the success of the recycling industry, 56.1% of that paper (54.3 million tons) was recycled⁴. However, paper can only be recycled if each of us makes an effort to dispose of it properly in recycling bins. Talk about how great it would be if 100% of all paper could be recycled and we no longer needed to cut down trees!
2. It is important for students to develop an awareness of what they consume and how much waste they produce so that they will incorporate recycling into their daily lives. The average American generates 4.6 pounds of waste per day, but only recycles 1.5 pounds of it.⁵ Use the information from **Reproducible #4: Municipal Solid Waste**, or have students read the article themselves to inform your instruction. Then have students

³ Paper Industry Association Council. (2008). *2007 Recovered Paper Annual Statistics Highlights*. Retrieved 17 June 2008, from <http://stats.paperrecycles.org/>

⁴ Ibid.

⁵ Ibid.

answer the reflection questions (**Reproducible #5: Municipal Solid Waste Reflection Questions**). Solicit students to share and discuss answers with the class.

3. Tell them how many of the materials that you use at school can be reused to make other items. Use the chart in **Reproducible #6: From Used to New**, as a framework to lead your students' discovery of what materials can be recycled and what they turn into. Have students fill in as they follow along. Use examples of how products can be recycled from your school's waste. For extra credit have students bring in examples ahead of time. See if your class can come up with new answers not on this chart.

Activity Three: *Hands-on Activity - Making Paper*

The following experiment demonstrates the simplicity of the recycling process. When students collect old newspapers and classroom papers, they become more aware of the amount of materials in their lives that can be recycled. When they complete this project, they will have tangible proof of the process of how materials are recycled.

1. Students should rip newspapers and old office papers into tiny pieces. Put the ripped pieces of paper in the blender and add warm water to the blender.
2. Mix the paper and water until it becomes well blended, making paper pulp. Add more water or paper to get a thick consistency.
3. Pour 3 cm of water into the pan. Place your screen into the pan and then pour one cup of paper pulp onto the screen.
4. Spread the pulp evenly in the water with your fingers. It should feel mushy.
5. Lift the screen out of the water slowly, allowing the water to drain.
6. Place the pulp-covered screen face down on a piece of cloth or in between newspaper. Lift the screen away, leaving the paper pulp on the cloth or paper. Cover with another cloth and iron with a hot iron, or use a rolling pin to flatten and press out excess moisture.
7. Let the pulp dry for at least 24 hours.
8. Slowly lift the pulp, leaving behind the fabric—this is your sheet of paper!

Wrap Up: *Recycling Discussion*

Ask students to name what types of materials they learned could be recycled, and why it is important to recycle these items. Discuss other ways that they can reduce their waste, both at school and at home (*buy items with less packaging, use items completely before replacing, only buy what you need, etc.*).

Encourage students to recycle, and answer any questions they may have about how to recycle at school and at home. Empower them to take what they've learned home and share how important recycling is with their parents and friends

Extension: *Recycling at Your School*

1. Have your students make recycling posters to hang around school. They should encourage others to recycle, and also explain how and what materials to recycle.
2. Ask your students if they are interested in starting a recycling program at your school. If your school already has a recycling program, ask for suggestions on how they think the program could be improved or expanded. See Earth Day Network's *Recycling* Background and Student Action Plan for more information.

CONCLUSION

After the completion of this lesson, students should be more aware of what they consume, and how some of what they consume can be easily recycled. They will have learned valuable facts about recycling and how to recycle various materials. Through the example of David Chameides, they will learn about real people who are making a significant difference in their waste production and having a positive impact on the environment. By making their own recycled paper, they will also gain a better understanding of the process of recycling, and how it refashions old materials into new.

“He’s saving his trash—in his house—for a year.”

LOS ANGELES, California (AP) -- Without ever lifting a shovel, an archaeologist could dig through Dave Chameides' house and get a pretty good picture of how he has lived for the past eight months.

Dave Chameides shows some of the six months' worth of trash in the basement of his home. Empty soda bottles lead down the staircase. Pizza boxes line the walls. In the cellar are neatly stacked Styrofoam trays, used tea bags and plastic wrap.

Almost every bit of Chameides' garbage has been carefully preserved in a testament to the volume of trash produced by daily living. What's even more surprising is what he doesn't have to show for it. While the average American generates more than 900 pounds of garbage in eight months, Chameides has produced only 30 pounds.

"Whenever I tell people what I'm doing, there's always that look -- the furrowed brow and then the 'I'm sorry? You're doing what?'" said the freelance cameraman for "Nip/Tuck," the FX plastic surgery show that celebrates excess. "I tell people I know this is nuts."

Chameides prefers to think of the yearlong experiment as his contribution to the study of consumerism. The path to becoming a pack rat with a purpose began years ago when he installed compact fluorescent bulbs, bought a Prius hybrid car and began using solar panels.

But as Chameides learned about the staggering amount of trash rapidly filling landfills, he began to ponder keeping his garbage for a year and then broached the subject with his wife.

"He said, 'I'd like to do this experiment. I'd like to keep my trash in the basement for a year,'" recalled his wife Aliza Chameides, who did not object as long as the project didn't affect her.

He set up ground rules: He would only collect his own trash, not that of his wife or two young daughters. Potential health hazards -- toilet paper or fish wrappers -- would be logged on his [blog](#) and then tossed. Food scraps would be composted, and everything else was to be saved, even recyclables because they take energy to haul away and remanufacture.

Edward Repa, director of environmental programs for the National Solid Wastes Management Society, keeps tabs on waste-related news around the country and thought Chameides' experiment was crazy.

"Most people are like if it's under your sink for a week, you don't want it there," Repa said. "I've never heard of anyone wanting to save that stuff."

Chameides isn't the first to attempt such a long-term project. He cited the example of a writer called "[No Impact Man](#)" who is trying to live with his family for a year in New York without making any net impact on the environment.

As the weeks passed, Chameides found ways to reduce his waste. He takes his own cutlery and plates to work. He considers packaging before buying a product and takes a glass container to the fish market to avoid the plastic wrapping. He paid a company to reduce his junk mail and managed to stop phone books from landing on his doorstep.

He's employed an army of worms to chew through the compost in his basement, and the little crawlers have their own blender to puree their meals after his wife discovered him mashing worm chow in the family blender.

"I think Dave thinks trash isn't trash anymore," his wife said.

Explaining his experiment has been awkward at times. When one of his daughters vomited at a friend's house, he was handed a fistful of paper towels. Chameides momentarily considered asking for a cloth towel before deciding to save his daughter the embarrassment.

On a romantic getaway to Mexico, the couple were stopped by airport screeners who appeared baffled by the extra duffel bag of Mexican trash that went through the X-ray machine.

Screeners: Que es esto? (What is this?)

Chameides: Es basura. (It's trash.)

Screeners: Basura? (Trash?)

Chameides: Si, mi basura. (Yes, my trash.)

Most people are supportive once he explains. Chameides' barber agreed to put his hair clippings in a bag, and doctors packed up materials they used to check Chameides' infected ear after a trip to the emergency room.

"If I had totally thought it through, I might not have done it," he admits.

At work, his crusade has inspired changes: Assignments are e-mailed instead of printed on paper, and they come with environmental tips. Writers for the television show no longer use plastic water bottles, and others have adopted composting or installed energy-efficient light bulbs.

"He truly believes in what he's doing," said David Harp, director of photography. "I never feel like I was being preached to with Dave. It's like learn by example."

Now that the half-year mark has passed, Chameides has thought about the day when he will be able to haul his refuse to a landfill. He expects to "feel guilty and remorseful."

His wife is less ambivalent about finally throwing the trash away. "He'd better," she said.

Article Reflection Questions:

1. What has David learned about how much he consumes?

2. In what other ways does David reduce his impact on the environment?

3. What has reading about David made you think about your own life and your impact on the environment?

The Daily Recycling Chart

Time	Activity	Recyclable Material
Wake up/Breakfast	eating cereal, showering, _____ _____ _____	Cereal box, plastic milk gallons, shampoo bottles _____ _____
Classroom time	Homework, tests, art time. _____ _____ _____	Paper, crayons, books, _____ _____ _____
Lunch/dinner time	Drinking, eating, _____ _____ _____ _____	Soda cans, milk cartons, milk or soda jugs, yogurt containers, aluminum cans, _____ _____ _____
_____ (Fill In)	_____ _____ _____ _____	_____ _____ _____ _____
_____ (Fill In)	_____ _____ _____ _____	_____ _____ _____ _____

Municipal Solid Waste (MSW)⁶

(Article adapted from the U.S. EPA Municipal Solid Waste website)

Municipal Solid Waste (MSW)—more commonly known as trash or garbage—consists of everyday items such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries.



In 2006, US residents, businesses, and institutions produced more than 251 million tons of MSW, which is approximately 4.6 pounds of waste per person per day.

Recycling diverts items, such as paper, glass, plastic, and metals, from the waste stream. These materials are sorted, collected, and processed and then manufactured, sold, and bought as new products

Recycling, including composting, diverted 82 million tons of material away from disposal in 2006, up from 15 million tons in 1980, when the recycle rate was just 10% and 90% of MSW was being combusted with energy recovery or disposed of by landfilling.

Typical materials that are recycled include lead batteries, recycled at a rate of 99%, paper and paperboard at 52%, and yard trimmings at 62%. These materials and others may be recycled through curbside programs, drop-off centers, buy-back programs, and deposit systems.

Recycling prevents the emission of many greenhouse gases and water pollutants, saves energy, supplies valuable raw materials to industry, creates jobs, stimulates the development of greener technologies, conserves resources for our children's future, and reduces the need for new landfills and combustors.

Recycling also helps reduce greenhouse gas emissions that affect global climate. In 1996, recycling of solid waste in the United States prevented the release of 33 million tons of carbon into the air—roughly the amount emitted annually by 25 million cars.

Recycling also helps reduce greenhouse gas emissions that affect global climate. In 2006, the national recycling rate of 32.5 percent (82 million tons recycled) prevented the release of approximately 49.7 million metric tons of carbon into the air—roughly the amount emitted annually by 39 million cars, or 1,300 trillion BTUs, saving energy equivalent to 10 billion gallons of gasoline.

⁶“Basic Information: Municipal Solid Waste (MSW).” Retrieved 18, August, 2008.
<http://www.epa.gov/epaoswer/non-hw/muncpl/facts.htm>

Municipal Solid Waste Reflection Questions:

1. How does recycling paper help our environment?

2. What other materials, or products that you use in your daily life, can you recycle?

3. How else can your class, school, and family recycle together?

From Used to New: What products can be recycled and what they turn into

Your Used Products	New, Recycled Products
Office paper	Tissue paper, recycled paperboard, newsprint, ⁷ paper towels, and toilet paper ⁸
Newspapers	Newsprint, tissues, recycled paperboard ⁹ , game boards, egg cartons, gift boxes, animal bedding, insulation, packaging material, ¹⁰ and insulation.
Corrugated Paper	New boxes and paperboard packaging, like cereal and cookie boxes.
Aluminum	Aluminum cans

⁷ Paper Industry Association Council (2008). *2007 Recovered Paper Annual Statistics Highlights*. Retrieved 17 June 2008, from <http://stats.paperrecycles.org/>

⁸ Carnegie Mellon. *Why Recycle Paper?* Retrieved 18 June 2008, from <http://www.cmu.edu/greenpractices/recycling/paper.html>

⁹ Paper Industry Association Council (2008). *2007 Recovered Paper Annual Statistics Highlights*. Retrieved 17 June 2008, from <http://stats.paperrecycles.org/>

¹⁰ Carnegie Mellon. *Why Recycle Paper?* Retrieved 18 June 2008, from <http://www.cmu.edu/greenpractices/recycling/paper.html>

Sample Answers to Reflection Questions:

Article about David Chameides:

1. **What has David learned about how much he consumes?**
 - a. How easy it is to reduce his consumption. How much waste he produces each year.
2. **In what other ways does David reduce his impact on the environment?**
 - a. He uses solar panels in his homes. He chooses products with less packaging. He drives a hybrid car, which uses less gas. He uses compact fluorescent light bulbs, which use less energy. He doesn't print emails unless necessary. He uses cloth rather than paper napkins.
3. **What has reading about David made you think about your own life and your impact on the environment?**
 - a. Answers will vary.

Municipal Solid Waste Article:

1. **How does recycling paper help our environment?**
 - a. Recycling reduces the amount of new, "virgin," materials, such as trees, needed to produce common items, and also reduces the amount of energy used to make materials. It also means that less trash ends up in landfills.
2. **What other materials, or products that you use in your daily life, can you recycle?**
 - a. See Reproducible #4 - **From Used to New**
3. **How else can your class, school, and family recycle together?**
 - a. Through a recycling program in your school, a curbside program in your community, or donating clothes and materials to charities or thrift stores.