

CHAPTER

2

Products

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Activity Name	A Matching Match	Tracing Trash Back to Its Roots	Putting Products Under the Microscope
Grade Range			
K	✓		
1	✓		
2			
3		✓	
4		✓	
5			✓
6			✓
Subjects Covered			
Math			
Science		✓	✓
Language Arts			✓
Social Studies	✓	✓	✓
Art	✓		
Health			
Skills Used*			
Communication		✓	✓
Reading			
Research			
Computation			
Observation/Classification	✓		✓
Problem Solving		✓	✓
Motor Skills	✓		

*See Glossary of Skills for more details.

Products

How Are Products Made?

Everyone uses a variety of **products** each day—from toothbrushes to notebooks to lunch boxes to video games. Each of these products has an effect on the environment in one way or another. Sometimes merely using (or misusing) a product can affect the health of people and the environment. Some products can affect the environment through the way they are made or disposed of. For example, products made from virgin **natural resources** have different effects on the environment than those made from **recovered resources**. By understanding a product's **life cycle**—the development, use, and disposal of a product—people can make better decisions about what products to buy and how to use them wisely.

A product's life cycle generally includes design; exploration, extraction, and processing of resources (raw materials); manufacturing; distribution and use; and retirement. If a product is made from 100 percent recovered materials, exploration and extraction of virgin materials is not necessary. If a product is recycled, composted, or reused, people do not have to throw it away. By altering the product life cycle in these ways, people can save energy and resources, and therefore, prevent waste and pollution.

The Product Life Cycle

The following sections describe each stage in the product life cycle, as well as the challenges, benefits, and emerging trends associated with each step.

Design

Product design can involve research, testing, and development. This includes development of synthetic materials, such as plastics, which derive from natural sources.

Some products are designed to be used only once (**disposable**), while others are designed to be used many times (**durable**). Engineering and

Key Points

- Product life cycle includes design, extraction of natural resources, manufacture, use, and disposal or recycling. If a product is made with recovered materials, raw materials do not have to be extracted from the Earth. If a product is recycled or reused, its life cycle begins anew and has less effect on the environment.
- The extraction of raw materials and the manufacture and disposal of a product can create pollution and waste and can require a great deal of energy resources.
- Durable products can be used many times, while disposable products are usually used only once.
- Product manufacturers are beginning to make more products that have environmentally preferable attributes.

material choices can determine whether a product is durable, disposable, or **recyclable**.

Over the last few decades, as people's lives have become more complicated and technology has advanced, many consumers have come to desire the convenience of disposable items over the durability of reusable ones. Also, it is sometimes easier to replace items rather than fix them. Thus, more and more items end up as trash in **landfills** or **incinerators**.

Products are often conceived and designed with a focus simply on how they will be used and with less concern about the other stages in their life cycle. In the past decade, however, consumers have begun to demand more **environmentally preferable products**—products that have fewer negative effects on human health and the environment when compared to

traditional products. Manufacturers have responded by offering products that are made from recycled-content materials, low in toxicity, and highly energy-efficient. Other products have been designed to conserve water, minimize air pollution or, through a combination of factors, have fewer negative impacts on the environment.

Exploration, Extraction, and Processing

Manufacturers must obtain the materials needed to make their products. If a manufacturer uses **recovered materials**, the company can obtain them from recycling processors or other similar sources. **Virgin resources**, however, must be mined (for metals and minerals) or harvested (for wood and other biobased materials) from the Earth. Once they are extracted, they must be processed for use in manufacturing.

The extraction of raw materials generates waste and pollution and requires a great deal of energy. In many cases, the natural resources used in manufacturing are **nonrenewable**. This means that, eventually, the natural resource will be depleted. As more and more communities offer recycling programs and people use them,



Product Facts

- Most glass bottles and jars contain at least 30 percent recycled glass.
- Making 2,000 pounds of paper from trees requires 3,700 pounds of wood, 200 pounds of lime, 360 pounds of salt cake, 76 pounds of soda ash, 24,000 gallons of water, and 28 million BTUs of energy.
- It requires 95 percent less energy to make an aluminum can from recycled material than from the natural resource raw material, bauxite ore.
- For every 100 pounds of products made, over 3,000 pounds of waste is generated.

(Sources: Glass Packing Institute; Can Manufacturers Institute; Weyerhaeuser Company.)

manufacturers may be able to use increased recovered materials instead of virgin materials to make products.

Manufacturing

Whether a product is made from virgin or recovered materials, often the factories that manufacture the product are specially designed to use a consistent form of material. If a product is made in a plant designed to process virgin materials, changing to recycled feedstock might not be easy. Changing the kinds of materials used in manufacturing, such as using recycled paper instead of virgin paper, can require changes in technology and equipment and can slow down the pace of production. In the past decade, however, many manufacturing plants have begun retooling and learning to use recovered materials rather than virgin materials, and thus, the variety of recycled-content products has been growing. (See the Teacher Fact Sheet titled *Recycling* on page 73 for more information.)

Manufacturing products generates pollution and usually requires a great deal of energy resources. Using recovered materials can often save energy and reduce pollution. The manufacturing process also generates waste, but at some manufacturing plants, this waste can be reused.

Distribution and Use

People rely on various products to live in a modern society. Most people purchase and use some type of manufactured product every day because it is easier and more convenient than making the same items from scratch (for example, going to a store and buying a box or bag of rice is much simpler, and more practical, than trying to grow rice in a paddy in the backyard).

After products are manufactured, many must be packaged for transportation and distribution. Often, products are transported long distances across the nation or even internationally before people can purchase and use those items. Products often require packaging to

protect them from spoilage, damage, contamination, and tampering during transportation, storage, and sale. Sometimes packaging is necessary to inform consumers about product benefits, proper use, and other information. While some products might appear to have excessive packaging, in many cases the packaging serves several purposes, without which the products might not be available as widely or as frequently.

Packaging—when it is discarded—can create a great deal of waste. In communities where common packaging materials are not recyclable, these items must be thrown away, wasting precious resources and potential recovered materials.

Product Retirement

After use, many items or packaging are disposed of in landfills or incinerators. Others are recovered for recycling. If products are disposed of in landfills or incinerators, they can no longer provide any benefit. Emissions to air and water from these disposal methods can affect human health and the environment.

Think Globally, Buy Locally

One way consumers can help eliminate the need for excessive packaging is to buy products locally. This concept, known as bioregionalism, works on the idea that if consumers buy products made within their own communities, packaging that would otherwise be needed to protect the products during transportation and storage could be eliminated.

If products are recycled, composted, or reused, they continue to serve a purpose, either as a raw material or for the same use they were originally intended. Extending a product's life is a way to save natural resources, prevent waste, reduce pollution, and conserve energy.

The more people recycle and buy recycled products, the more incentive manufacturers will have to make products with recovered content.

Additional Information Resources:

Visit the following Web sites for more information on designing and purchasing products with the environment in mind:

- U.S. Environmental Protection Agency (EPA): <www.epa.gov>
- U.S. EPA Office of Solid Waste extended product responsibility site: <www.epa.gov/epaoswer/non-hw/reduce/epr/index.htm>
- U.S. EPA Office of Pollution Prevention and Toxics, Design for the Environment Program: <www.epa.gov/dfe>
- U.S. EPA Office of Pollution Prevention and Toxics, Environmentally Preferable Purchasing: <www.epa.gov/opptintr/epp>

To order the following additional documents on municipal solid waste and product life cycle, call EPA toll-free at 800 424-9346 (TDD 800 553-7672) or look on the EPA Web site <www.epa.gov/epaoswer/osw/publicat.htm>.

- *WasteWise Update—Extended Product Responsibility* (EPA530-N-98-007)
- *Puzzled About Recycling's Value? Look Beyond the Bin* (EPA530-K-97-008)
- *A Collection of Solid Waste Resources—CD-ROM*

A Matching Match



Objective

To teach students that many products come from natural resources such as animals and plants.



Activity Description

Students will draw a line from a product to its natural source and then color the pictures.



Materials Needed

- Copies of the *Matching Match* worksheet for each student
- Crayons



Subjects Covered

Natural resources
Products



Duration

1 hour



Skills Used

Observation/classification
Motor skills



Activity

Step 1: Discuss with students that everything we use is made from a natural resource, such as a plant or other resource that comes from the Earth. Some products also come from animals. Provide examples by talking about what students are wearing or items in the classroom and the sources of those items.

Step 2: Either individually or in groups, have the students use the *Matching Match* worksheets to match the different products with their natural resource.

Step 3: Encourage the students to color the pictures.



Assessment

1. Ask the students to name other items that are made from the same natural resources that are listed on the worksheet.
2. Ask students to list other plants and animals that products are made from.



Enrichment

1. Pick a product that is made in your local community, such as paper, ice cream, or wool sweaters, and take the students on a field trip to see how it is made. Ideally, students would see how a raw material is converted into a product.



social
science



art

Student Handout

Matching Match

Name: _____



leather jacket



bread

newspaper



milk



cotton t-shirt



wool hat



wool sweater



cotton plant



tree



sheep



cow



wheat

Tracing Trash Back to Its Roots



science



social studies



Objective

To teach students to identify the various natural resources used to produce common items that become waste.



Key Vocabulary Words

Natural resources
Renewable resources
Nonrenewable resources



Activity Description

Students will play “Trash Bingo” as a method to identify what natural resources are used to make common products.



Duration

1 hour



Materials Needed

- Copies of bingo card for each student (make copies and then cut sheets so half the students get one version of the bingo card and half get a different version).



Skills Used

Communication
Problem solving



Activity

Step 1: Review and explain the vocabulary words above. Explain that most products are made from natural resources. (Refer to the Teacher Fact Sheets titled *Natural Resources* on page 5 and *Products* on page 25 for background information.)

Step 2: List five categories of natural resources on the blackboard: animals, fossil fuels, metals, plants/trees, and sand. Discuss with students some examples of products that are made from these natural resources. Brainstorm a list of things that are made from natural resources (mostly everything!) and make another list on the blackboard. Make sure there are at least five products for each natural resource category. Encourage students to think of food and beverage items and con-

Common Products

Aluminum can	Grocery bag
Aluminum lawn chair	Hamburger
Apple core	Leather jacket
Bicycle tire	Linen pants
Bologna sandwich	Milk container
Book	Mirror
Bread	Nylon pantyhose
Cereal box	Sandwich bag
Cotton shirt	Soda bottle
Egg shells	Window
Glass bottle of juice	Wool hat



Journal Activity

Ask students to write about what natural resources mean to them. Ask them to pick a natural resource and describe why it is special or important to them.

Or

Have students write about their favorite toy or game. Have them write a history of where it came from, starting from when it was a natural resource.

tainers, household product containers, and household items (furniture, books, appliances). See suggestions in box if the list is deficient.

Step 3: Explain the rules for bingo, and hand out bingo cards.

Step 4: Select words from the students' product list (or the list of suggestions) and call out words one at a time. Instruct students to find the category or categories that each item belongs in on their bingo sheet and write the name of the product. There may be more than one natural resource for each product (for example, a pair of tennis shoes might fill three categories: plant, fossil fuel, and metal).

Step 5: The first student to fill the card wins. Use the T-R-A-S-H letters as free spaces. Be sure to check the student's bingo sheet to see if all answers are correct!

Step 6: After the bingo game, have each student circle the items that are made from renewable resources.



Assessment

1. What are natural resources?
2. What's the difference between renewable and nonrenewable natural resources?



Enrichment

1. Additional questions include asking students what happens if we keep using more and more natural resources? How can we stop using so many natural resources? How can we use more renewable resources and less nonrenewable resources?
2. Play show and tell. Have students bring in one of their favorite "things" and tell the class where it came from, including the resources used in producing it and how it came to be in their house. Have them describe what they will do with it when it is broken, old, used up, or no longer needed.
3. Conduct a scavenger hunt. Make a list of common items found inside or outside of the classroom that are derived from animals, plants, metals/minerals, fossil fuels, or sand. Have students find 15 of 30 items and identify which category they belong in. Give the students 15 minutes to look for the items, then call them together and discuss their answers.

Name: _____

Trash Bingo

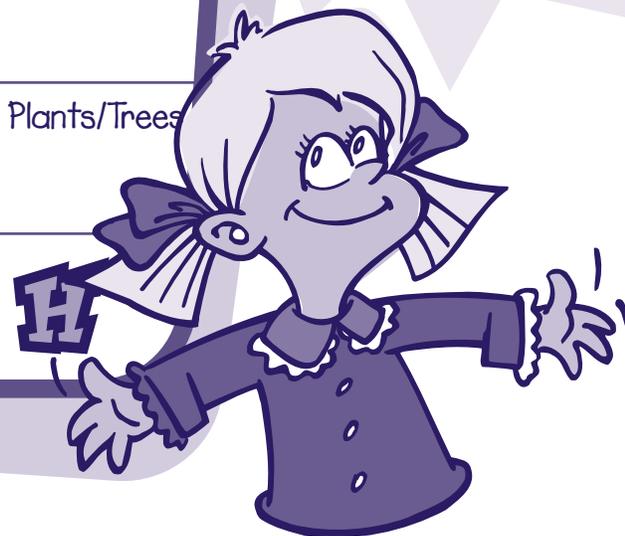


Animals	Fossil Fuels	Metals	S	Sand
Plants/Trees	Metals	Metals	Sand	Fossil Fuels
Fossil Fuels	R	A	Plants/Trees	Sand
T	Animals	Sand	Plants/Trees	H
Plants/Trees	Fossil Fuels	Fossil Fuels	Metals	Metals



Trash Bingo

T	Animals	Metals	Fossil Fuels	Fossil Fuels
Sand	Plants/Trees	A	Metals	Sand
Animals	Metals	Metals	Fossil Fuels	Plants/Trees
Plants/Trees	Sand	Sand	S	Plants/Trees
Fossil Fuels	R	Plants/Trees	Fossil Fuels	H



Name: _____

Putting Products Under the Microscope



Objective

To have students evaluate a product to determine its resource use and overall impacts on the environment.



Activity Description

Students select a product manufactured in their community and discuss the raw materials and resources required to make the product.



Materials Needed

- Copies of *Product Inspector* worksheet for students.



Key Vocabulary Words

Products
Manufacturing process
Raw materials
Resources
Ecosystems



Duration

30 minutes



Skills Used

Communication
Observation/classification
Problem solving



Activity

Step 1: Explain that everyone uses a variety of products every day. Note that there is a manufacturing process involved in creating a new product and that any new product requires raw materials. (Refer to the Teacher Fact Sheets titled *Natural Resources* on page 5 and *Products* on page 25 for background information.)

Step 2: Have students select a product that is made in their community or state. Products might include bicycles, batteries, pens, milk, shoes, ships, plastic toys, glass bottles, or paper.

Step 3: Ask the students to draw a picture of the product. Then ask them to label all of the product's different parts and write both the

raw materials used to make each part as well as the original resources used to make the raw material on the *Product Inspector* worksheet. If a student draws a car, for example, he or she would label the dashboard and note that plastic is derived from petroleum.

Step 4: Discuss whether there are more raw materials required to make the product than expected. Ask where the raw materials come from—your town, state, country, or another nation. Discuss what happens to the environment when the raw materials are extracted from the Earth or harvested. Does this process produce pollutants or harm land or ecosystems? Discuss ecosystems in your geographical area that might be affected by the removal of raw materials. How might people living in the area be affected?



science



language
arts



social
studies



Journal Activity

Ask the students to name some products they could give up for a day, a month, or longer. Ask them to describe how giving up these items would affect other people and the environment.

Step 5: Ask students to describe what happens to the product after they use it. Can it be used up or will it wear out? Can the product or its parts be reused or recycled in some way? How? Will the product or its parts decompose if buried in a landfill? What effects does disposing of this product have on the environment? Who pays for disposing of the product? Who is responsible for disposing of it?



Assessment

1. Ask students how products are created.
2. Ask students how this process impacts the environment.
3. Have students explain what happens to products after we are finished with them.
4. Ask students if they think we really need all of the products we use. Why or why not?



Enrichment

1. Contact or visit the manufacturer with your class to learn more about the process and materials used to make the product.
2. Ask students to name the different products they use during the course of a day (e.g., toothbrush, shoes). Make a list of these items on the blackboard. Then, ask students to categorize the product as essential to survival, necessary for living in today's society, or a luxury. Ask students if they are surprised how few products we really need and how many products are a luxury. Explain to students that all products create waste and that they should keep this in mind when they buy products.
3. Check books, articles, and magazines, or write to agencies or organizations to learn about the types of natural resources (e.g., wood, oil) that the United States obtains from other countries. Research whether these are renewable or nonrenewable resources. Describe what might happen if we begin to use up these resources. What can we do to conserve these resources?

