Mission Statement

The mission of Project Waste is to build a foundation of student knowledge about pollution prevention, conservation of natural resources through reduction, reuse and recycling and proper disposal of waste. This knowledge will enable students to advocate for environmental responsibility and to make informed, healthful decisions that will foster lifelong, positive, and environmentally sound behaviors.

Introduction

This curriculum and teachers guide for Project WASTE is divided into five sections: I Identification, II Waste Management, III Prevention, IV Outcome, and V Advocacy. Each section contains a series of suggested and supplemental activities that have been formatted in the same manner for ease of student and teacher use.

Within each activity, the main concept(s) addressed are listed first, followed by the activity objective (what is to be accomplished during the activity) and a materials list. In addition, the principal standards addressed by the activity are listed. The science and English standards are taken from “New Standards” published by the National Center on Education and the Economy. Other standards have been obtained from national curriculum and professional groups.

Teacher notes are included; suggestions and comments that may assist the teacher before, during or after the activity to maximize activity success.

Included in each activity are knowledge and performance outcomes. These statements inform the teacher and the student about learning expectations. Knowledge outcomes detail what students should know after completion of the activity and performance outcomes detail what students should be able to do during and after the activity.

Assessments for individual sections are located at the end of the teacher guide before the resource pages. Assessments are accompanied by 4-point holistic rubrics that may be reconfigured into the analytical style as the teacher requires.

Many informative resource pages are located at the rear of the guide covering topics such as waste, landfills, recycling and plastics.

To facilitate understanding and increase ease of use, an activity template is located on the next page. All activities follow this basic format.
# Activity Template

<table>
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<tr>
<th>Activity Title</th>
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<tr>
<td>Grade Level</td>
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<td>Main Concept(s)</td>
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<td>Activity Objective</td>
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<td>What is the purpose of the activity?</td>
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<td>Materials</td>
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<td>Keywords</td>
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<td>Background - As necessary</td>
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## Knowledge and Performance Outcome

What should the student know after they have completed the activity and what should they be able to do?

<table>
<thead>
<tr>
<th>Teacher Procedure*</th>
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<td>Student Procedure*</td>
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*Teacher and Student Procedure may be included separately or as one procedure

<table>
<thead>
<tr>
<th>Student Worksheet</th>
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<th>Follow-Up</th>
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Curriculum Outline
(Wanting Answers to State’s Troubled Environment)

Inquiry Question:
How can you be and how can you help others to be environmentally responsible?

Phase I: Knowledge

Step 1 Identification
Outcome: Identification of waste
Suggested Time Frame: Two weeks
Inquiry Question: What is WASTE and where does it come from:
Suggested and Supplemental Activities: See Curriculum Contents

Step 2 Waste Management
Outcome: Explanation of waste management
Suggested Time Frame: Two weeks
Inquiry Question: What is a landfill and how does it work?
Suggested and Supplemental Activities: See Curriculum Contents

Phase II: Exploration and Investigation

Step 3 Prevention
Outcome: Prevention through reduction, reuse and recycling (3 R's)
Suggested Time Frame: Two and one-half to three weeks
Inquiry Questions: What are the three R's? How do they help the environment?
Suggested and Supplemental Activities: See Curriculum Contents

Step 4 Waste Practices and Tracking
Outcome: Tracking and application of waste practices
Suggested Time Frame: Two weeks
Inquiry Question: What can you do to be an environmentally responsible person?
Suggested and Supplemental Activities: See Curriculum Contents

Phase III: Monitoring

Step 5 Advocacy
Outcome: Learning about ways to influence the behavior of others
Suggested Time Frame: Two weeks
Inquiry Question: What could you do to persuade others to be environmentally responsible?
Suggested and Supplemental Activities: See Curriculum Contents
**Step 1 Identification**

**Suggested Activities**
1. “The Trash Story”
2. “What’s The Source?”
3. “Where From, Where To?”
4. “Mix and Match Waste Game”
5. “Will We Ever Run Out?”
6. “Trash- A Big Problem”

**Supplementary Activities**
A. “What Is This Bike Made Of?”
B. “The Throwaway Tree” Skit

**Assessments**
1. Parts I, II, III, Answer Sheet and Rubrics
2. Alternative Assessment and Rubric

**Step 2 Waste Management**

**Suggested Activities**
1. “Life At A Landfill”
2. “Create A Landfill”
3. “Drowning In Oil”

**Supplementary Activities**
A. “Plastic ‘Cloze’” A Waste Reading
B. “Does Biodegradable Plastic Really Degrade?”

**Assessments**
1. Parts I and II and Rubrics

**Step 3 Prevention**

**Suggested Activities**
1. “Throwaway Society”
2. “Paper, Paper, Everywhere”
3. “Smart Shopper In-Class Field Trip” (Kit Activity)
4. “Smart Shopper-Part 2” (Kit Activity)
5. “Smart Shopper-Part 3” (Kit Activity)
6. “Recycle Cycle” (Kit Activity)
7. “All Wrapped Up”
8. “Consumers/Conservers”

**Supplementary Activities**
A. “Wise Use of Paper”
B. “Making Recycled Paper” (Kit Activity)
C. “Recycle Bicycle”
D. “Solid Waste/Recycling”
E. “Best Ever Compost”
F. “Mini-Composts”

**Assessments**
1. Parts I and II and Rubrics

**Step 4 Outcome: Tracking and Application**

**Suggested Activities**
1. “Investigating Waste”
2. “Household Toxic Chemicals”
3. “Is Cleaning Hazardous to Your Health?”

**Step 5 Advocacy**

**Suggested Activities**
1. “Changing Behaviors”
2. “The Lorax”
3. “Letter Writing Campaign”

**Supplementary Activities**
A. “Design A Poster”
B. “Public Service Announcement”
C. “The Garbage Diet” A Skit
D. “Environmental Health Presentation”

**Resource Material**
1. Source Reduction
2. Recycling
3. Composting
4. Landfills
5. Incineration/Waste to Energy
6. Paper
7. Plastics
8. Steel
9. Aluminum
10. Glass
11. Household Hazardous Waste
12. Environmental Labeling Claims
13. Glossary of Solid Waste Terms
15. Schematic of RI Resource Recovery Corp.
17. Major References
Identification

Suggested Activities
1. The Trash Story
2. What’s The Source?
3. Where From, Where To?

Supplementary Activities
A. What Is This Bike Made Of?
B. The Throwaway Tree Skit
C. Mix and Match Waste Game
D. Will We Ever Run Out?
E. Trash- A Big Problem

Assessments
a. Parts I, II, III, Answer Sheet and Rubrics
b. Alternative Assessment and Rubric
Main Concepts:
1) Humans have always produced trash. 2) Human behaviors have lead to the current garbage crisis.

Standards:
MS S3d: The student produces evidence that demonstrates understanding of natural resource management. MS S4c health: Such as nutrition, exercise and disease; effects of drugs and toxic substances; personal and environmental safety; and resources and environmental stress. MS S4d impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.

History-Chronological Thinking: The student uses chronology as a basis for organizing historical thoughts.

Activity Objective:
Students will learn how garbage has been disposed of throughout history and will understand the factors that have lead to the current garbage crisis.

Materials:

Keywords:
trash, prehistoric, reduce, reuse, recycle, packaging, plastic, Middle Ages, Renaissance, plague, typhoid, cholera, Industrial Revolution, open-air dump, landfill, “throwaway society”, toxins, poisons, leach, leachate, groundwater, incineration, smokestack, industrialized country.

Knowledge and Performance Outcomes:
Knowledge: Students will understand that trash generation, although a natural outgrowth of civilization, has reached epidemic and disastrous proportions. The student will be familiar with waste disposal methods that have changed over thousands of years and that today; the most common method of trash disposal is in the landfill. They will also know that there are alternative methods of trash disposal such as reuse, recycling and incineration. Students will know that garbage disposal is an immediate problem that requires individual choices and personal responsibility. Students will become familiar with the keywords.

Performance: Students will be able to successfully complete the “Trash Story” worksheet and will be able to use the vocabulary words appropriately.

Teacher Notes:
Students may become familiar with the keywords before or after reading the “Trash Story” handout. The student worksheet should be completed after a discussion of any points of the handout that students do not understand. The student worksheet may be used as an assessment or as a class activity.

Students can be advised to take some notes about important points in the handout to enhance note-taking skills.

Teacher Procedure:
1) Distribute the handout and student worksheet.
2) Review keywords as necessary.
3) Instruct students to read the handout silently or read aloud to them, having them follow along. Students should be advised to read first, then re-examine the handout to take notes if notes will be required.
4) Engage students in a class discussion about important points, questions raised by students or to make a clarification.
5) Instruct students to fill out the worksheet. If the worksheet is to be used as an evaluation, inform students of the fact that it will be graded.
Trash, whatever we don’t want and throw out, has been around as long as man. Prehistoric man threw out some parts of animal skins, spoiled food and unusable bones. But prehistoric man recycled or reused almost everything he consumed, so members of his culture threw out very little.

As man began to live in large groups and to construct permanent dwellings, he produced more trash. When people began to trade and farm the land, they created settlements and villages with homes containing tools, furniture, dishes and clothing. Although many items were reused and recycled from generation to generation, trash production created a need for trash disposal. As people began to keep animals for food and transportation, they created animal shelters, barns and fences. Construction created trash.

But compared to today, trash production was still minimal, consisting mostly of food waste that decomposed into the soil. In early towns, there were no plans for trash disposal and unwanted items, including food, were thrown into the streets. Food waste in the streets attracted animals, many of which carried diseases like the plague.

Trash was also thrown into streams, lakes, rivers and the ocean. Because most towns were located on or near waterways for transportation, rivers became choked with trash. In the United States, at the turn of this century, Lake Erie became filled with grease and bones from slaughterhouses in Chicago. Sometimes the water caught fire! Today, some city garbage is hauled out to sea where plastic packaging kills and cripples wildlife and garbage destroys marine life.

It is believed that Athens, Greece, was the first city to collect garbage around 700 B.C. Although this must have created a much cleaner and attractive city, other communities did not follow Athens’ example. Even though Rome was a city of learning and culture at about the same time, the population of over 1 million continued to throw trash into the streets. Garbage could be brought to collection areas outside the city, but only the wealthy made use of these early “dumps”.

Dumping waste into the street continued and increased as man passed through the Middle Ages and into the Renaissance era. Outbreaks of plague, typhoid and cholera killed millions, spread by human waste discarded into the streets each day.

Around the time of the Industrial Revolution, trash collection and street cleaning became common. Although this reduced some types of trash in the streets, more trash was produced than ever before because factories began to produce goods that were eventually thrown away. Factories also produced air pollution (soot) from coal fires. Smoke and odors also polluted the air as trash burning became common.
Open-air dumps became the disposal sites of the Industrial Revolution. Although such dumps have been replaced by landfills in most U.S. areas, open-air dumps are still common in many areas of the world and in some areas of the U.S. Open-air dumps attract animals and contribute to many environmental problems. United States residents have become part of a “throwaway society”, thanks to the development of aluminum and steel cans, plastics, and many types of packaging. Each year in the United States, we throw away huge quantities of metals, plastics and paper products. Today, much of this material is reused and/or recycled, thanks to new awareness about the problems of trash disposal. Materials that are not recycled may enter landfills or can be burned to produce electricity.

A landfill is a site where trash is buried under soil. Roman roads may actually have been the first “landfills” where trash was compacted and a road was created higher than the surrounding ground. The potential hazards of landfill were first recognized when people became aware of the poisons and toxins that were buried in the landfills. They realized that these chemicals could reach into underground water. These “leachates” were carried through the soil of the landfill by rainwater where they could then enter groundwater. Toxic leachates could include items such as paints, motor oils, heavy metals from printed materials and from batteries.

Today, landfills are regulated, lined and engineered to prevent leachates from entering soil and water.

Incinerating waste began in the 1970’s but is not as common as landfill trash disposal. This is due to the fact that incineration plants are expensive to build and run. These plants have complex smokestacks that prevent ash and pollutants from entering the air and contributing to air pollution. They also consume large quantities of oil or natural gas because the fires used to burn the trash must be VERY hot. This heat reduces the toxic waste gases from burned plastics and other hazardous materials.

Today, Americans are more aware than ever of the need to reduce trash generation. Living in the United States, each individual produces TWICE as much trash per day as individuals in other industrialized countries. Even though we may be aware of the problem, we continue to create huge amounts of trash, 70% of which ends up in landfills or is incinerated. We are running out of landfill space as old ones close because they are full or create pollution. New space for landfills is limited and trash burning creates some air pollution. What is the solution?

Obviously, we must reduce our trash production. We can all REDUCE, REUSE AND RECYCLE the materials we no longer want or need.

1) We can make thoughtful choices when we choose to purchase goods that contribute less waste to the environment. 2) We can find new uses for items that we would normally throw away. 3) We can separate our waste into wood, metals, paper, glass and plastic so that it can be recycled.

We can ALL help to reduce the “garbage crisis”.
The Trash Story

You are to pick the phrase that best answers the questions or finishes the statement. Circle the correct letter.

1) The greatest contributor to the trash crisis has been:
   a) construction of buildings and towns
   b) dumping waste into rivers
   c) the Industrial Revolution
   d) farming

2) Most of today’s waste comes from:
   a) food waste
   b) household packaging
   c) batteries
   d) clothing

3) The most common waste disposal method used today is:
   a) incineration
   b) open-air dumping
   c) disposal in waterways
   d) the landfill

4) Many landfills have been closed because:
   a) no one wants to live near them
   b) toxins and poisons get into groundwater
   c) they produce pollution
   d) the land is needed to build on

5) The first city to collect garbage was probably:
   a) Rome
   b) New York
   c) London
   d) Athens

6) A disease linked to waste disposal is:
   a) plague
   b) the cold
   c) food poisoning
   d) flu

7) The first landfills were probably created under:
   a) buildings
   b) fields
   c) Roman roads
   d) barns

8) Toxins and poisons found in landfills may include:
   a) newspapers
   b) food waste
   c) construction materials
   d) paints

9) Incinerating waste is not popular today because:
   a) the smokestacks are ugly
   b) the plants burn coal
   c) it costs a lot to build and operate the incineration plants
   d) incineration plants last only ten years

10) To prevent more trash disposal problems, we should:
    a) send waste to the moon
    b) reduce, reuse and recycle
    c) dump trash in the ocean
    d) burn more trash
What's The Source?

Grades 5-8

Main Concept:
Natural resources are used to create items we use every day. Resources are classified as renewable or non-renewable. Non-renewable resources must be conserved.

Standards:
MS S3d The student produces evidence that demonstrates understanding of natural resource management and MS S4c health, such as nutrition, exercise and disease; effects of drugs and toxic substances; personal and environmental safety; and resources and environmental stress and MS S4d impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.

Activity Objective:
Students will be able to identify common items as coming from renewable or non-renewable resources. Students will learn the importance of saving both renewable and non-renewable resources.

Materials:
Worksheet entitled, “What’s the Source?” and the following items:
1. Motor oil (new) 11. Piece of plywood
2. Sand 12. Glass bottle
3. Tree branch 13. Paper
5. Iron bar 15. Stainless steel spoon
6. Picture of sheep 16. Soda can
7. Cotton ball 17. 2L soda bottle
8. Plastic wrap 18. Polar fleece vest, jacket or glove
9. Wool hat, scarf or sweater jacket or glove 19. Cotton sock
10. Plastic wrap

Keywords:
renewable, non-renewable, resources, essential, luxury, bauxite, and petroleum

Knowledge and Performance Outcomes:
Knowledge: Students will understand the concepts of renewable and non-renewable resources and will understand the concepts of lifestyle essentials and luxury items. Students will apply the concepts to decide if objects in their environments come from renewable or non-renewable resources.

Performance: Students will consider items shown in class and in their homes and will identify them as essential to life, essential to their lifestyle or luxury items. They will identify items that they could do without to save resources.

Teacher Notes:
The teacher should review the keywords with students before they begin the activity. Students will not know the word bauxite and will not know that it is an aluminum ore. A review of the aluminum-making process and emphasis on its rather expensive nature would be very helpful.

Students will probably not be aware of some of the processes used to make wool and cotton yarn and polar fleece fabric. These should be discussed as well. A discussion of reuse, reduction and recycling as well as lifestyle changes is a natural outgrowth of this activity.

Teacher Procedure:
1. Show students the motor oil, sand, tree branch, bauxite sample, iron bar, picture of sheep, cotton ball. Identify these as resources.
2. Show students the remaining items, one at a time. Have students link each of the items to the resources shown first.
3. Point to items in the classroom. Ask students to try to identify the resource(s) used to create each item.
4. Hold a class discussion to define renewable and non-renewable resources. Have students write their own definitions on the worksheet. Give students the dictionary definitions of both.
5. Have students list ten items in the classroom and at home that have not already been discussed in class. Students should list the source and categorize it as renewable or non-renewable.
6. Using the student generated lists, have students classify the items as essential to life, essential to lifestyle or luxury items. They should then make a list of items that they could do without to save resources.
## What’s The Source?

1. Identify the resource shown by your teacher as renewable or non-renewable.
   
   a. __________________________
   
   b. __________________________
   
   c. __________________________
   
   d. __________________________
   
   e. __________________________
   
   f. __________________________
   
   g. __________________________

2. Identify the household item with its resource. Place an R for renewable resource and an N for non-renewable resource in the space provided.

<table>
<thead>
<tr>
<th>Source</th>
<th>R or N</th>
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<tbody>
<tr>
<td>Plastic Wrap</td>
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<td>Plywood</td>
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<td>Glass bottle</td>
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<td>Soda Can</td>
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<td>Soda Bottle</td>
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<td>Fleece clothing</td>
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<td>Wool clothing</td>
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<td>Cotton sock</td>
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3. Identify items in the classroom not already discussed and identify resource and whether it’s renewable (R) or non-renewable (N).

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<tr>
<th>Item</th>
<th>Resource</th>
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3. YOUR DEFINITIONS:
Renewable Resource

Non-renewable Resource

DICTIONARY DEFINITIONS:
Renewable Resource

Non-renewable Resource

HOW CLOSE WERE YOUR DEFINITIONS? Explain.

4. Pick ten classroom/home items. List the ten items. Circle those that you could live without to save resources. Identify the item's source, decide if the source is renewable or non-renewable and identify the item as essential to LIFE, essential to LIFESTYLE or a LUXURY item.

<table>
<thead>
<tr>
<th>Item</th>
<th>Resource</th>
<th>R or N</th>
<th>LIFE, LIFESTYLE OR LUXURY ITEM</th>
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Where From, Where To?

Grades 5-8

Main Concept:
Everything that is made, used and thrown away comes from and returns to the earth.

Standards:
Science MS S2d The student produces evidence that demonstrates understanding of populations and ecosystems, such as the role of producers, consumers, decomposers in the food web; and the effects of resources and energy transfer on population, ES S2c The student produces evidence that demonstrates understanding of organisms and environments, such as the interdependence of animals and plants in an ecosystem, populations and their effects on the environment.

Activity Objective:
Students will trace common household objects from their source to the consumer and back to the earth or to a “new” raw material.

Materials:
One common household object (made of one material) per student

Keywords:
cycle, resource, reuse, recycle, transportation, energy, environmental impact, metal, plastic, glass, wood, paper, oil, landfill, natural resource

Pre-activity:
Students are to walk through their neighborhoods on trash pick-up day and are to examine the volume of trash thrown away. They are to 1) consider where the trash came from 2) think about the relationship between trash volume and waste of natural resources 3) think about the impacts of reusing and recycling to save natural resources, reduce trash volume and pollution associated with manufacturing, transporting and disposing of trash.

Background:
Because students will bring in a variety of materials, teachers should provided students with appropriate pages or summaries from resources at the back of this curriculum guide that describe 1) source reduction 2) recycling 3) composting 4) sanitary landfills 5) incineration/waste-to-energy 6) paper 7) plastics 8) steel 9) aluminum 10) glass 11) household hazardous waste as applicable.

Students should also be provided with a list of definitions (located at the back of the curriculum guide) either before the pre-activity or once the activity has begun.

Knowledge and Performance Outcomes:
Knowledge: Students will understand and be able to use the keywords properly.

Performance: Students will be able to 1) describe their common household object to other students 2) correctly identify the natural resources used to create their household object 3) correctly describe the steps taken to make the object and deliver it to the consumer 4) correctly describe the steps necessary to recycle the object into another object or into a “new” raw material 5) illustrate the complete cycle of the household object from raw material to object delivered to the consumer and recycling of the object into a “new” raw material.

Students will be able to 1) discuss how many times an object can be reused 2) decide if a household object is easily recyclable 3) ascertain the environmental impacts of producing and transporting the household object.

Students will be able to complete two worksheets entitled “From Where, Where To?” and “What’s In A Paper Cup?” that trace the cycle of an object made from one material.

Students will be able to compare the common household objects for ease of recycling.
Teacher Procedure:

1. Teachers are to ask each student to bring a common household object made from only one material (e.g. rubber eraser, glass jar, piece of paper, plastic bag) to class. Each student will identify the natural resources used and the steps taken to make the object and deliver it to the consumer. Students will then trace all of the steps needed to recycle the product back into another object. Students will then illustrate the cycle of the object.

2. Students will discuss the different steps required to produce the things that are used in our society each day. Teachers should ask questions to get students thinking such as, “How many times is the object easily reusable?”, “Is the object easily recyclable?”, “What are the environmental impacts of producing and transporting the object?”.

3. Teachers should direct students to complete the “Where From, Where To?” worksheet where they will trace the cycle of any object made from one material. They are to make note of the number of steps or phases that are found in the cycle of their object.

4. Teachers should direct students to complete the “What’s In A Paper Cup?” worksheet where they will trace the cycle of a paper cup or other commonly used, inexpensive object made from several different resources. They are to decide if a paper cup is easily recyclable and are to discuss the factors that make multi-material items difficult to recycle.

5. Teachers are to have students role-play the cycles of different objects (e.g. one recycled vs. one landfilled; Styrofoam (polystyrene) vs. paper, etc.) and are to have students compare the cycle of a disposable paper/plastic cup to a reusable ceramic or plastic mug. Students should be directed to explain how they are different.
Where From, Where To?

1. You are to bring a common household object (as described by your teacher) to class.

2. You are to name the natural resources used and the steps taken to make the object and deliver it to the consumer.

3. You are to describe all of the steps needed to recycle the object into another object or into a “new” raw material.

4. You are to illustrate the cycle of the object as described by your teacher.

5. You are to decide if the object is easily reusable/recyclable.

6. You are to discuss the environmental impacts of producing and transporting the object to the consumer.

7. You are to complete the “From Where, Where To?” worksheet and are to decide how many steps or phases there are in the complete cycle of your object.

8. You are to complete the “What's In A Paper Cup?” worksheet and are to trace the cycle of a paper cup or other object. You are to decide if the object is easily recyclable.

9. You are to describe what makes multi-material items difficult to recycle.
Where From, Where To?

Lifecycle Example:
- tree
- logger cuts
- trucker hauls
- processed in mill
- furniture factory
- buys wood
- trucker hauls
- factory processes into candlesticks
- trucker hauls
- wholesaler buys
- trucker hauls
- retail store buys
- transports
- customer buys & uses
- transports
- thrift store
- transports
- discarded in trash
- trucked to landfill
- buried in soil

Lifecycle of a Tree

Choose a product and describe its Lifecycle.
What’s In A Paper Cup?

When we make too much trash, we don’t use natural resources efficiently. By using less stuff, or reusing things again, we become better at getting the same value from fewer resources. The result will save materials, energy and money—and reduce pollution associated with manufacturing, transporting, and disposing of that stuff.

Think about a paper cup. Quick and easy to use, even quicker and easier to throw away. But here’s the behind-the-scenes look at the life of a paper cup:

Look at the many stages in the life of a paper cup. How many steps are there? Compare this with a disposable plastic cup. Then, compare it with a cup that is reused many times.
Main Concept:
Many of the objects that we use are composed of multiple parts that consume many raw materials; many that are not renewable.

Standards:
Science MS S3d The student produces evidence that demonstrates understanding of natural resource management and MS S4d the impact of technology, such as constraints and trade-offs; feedback; benefits and risks; problems and solutions.

Activity Objective:
Students will identify the natural resources used to produce an object and will understand that many of the listed resources are nonrenewable.

Materials:
Paper, pencil, bicycle or picture of a bicycle

Keywords:
natural resource, renewable resource, nonrenewable resource, raw material

Teacher Notes:
Students will need to understand the concepts of resources and raw materials and must be able to distinguish between renewable and nonrenewable resources. They should be exposed to the concepts in a pre-activity discussion when the students are led through an example activity that involves another object that students know well. Students must be made aware of the fact that EVERYTHING comes from resources present on earth. Examples for the pre-activity could include: pencils, cars, softballs, houses, etc.

Teachers should assign students to small groups to complete this activity as a cooperative effort will include more raw materials and will create discussion within the groups about renewable and nonrenewable resources.

Knowledge and Performance Outcomes:
Knowledge: After the activity, students will know about the raw materials used to produce the object they have chosen. They will know how raw materials relate to the finished product and will be able to decide if the resources needed to produce the object are renewable or not.

Performance: Students will be able to successfully complete the “What Is This Bike Made Of?” worksheet indicating the object, what parts make up the object, raw materials used to make the object and will indicate if the production materials are obtained from renewable or nonrenewable resources.

Teacher Procedure:
1. After discussion or pre-activity, pass out the student worksheets.
2. Instruct students to list the object they have chosen in the space provided.
3. Instruct students to list the raw materials needed for the production of their object and to indicate if the resource is renewable or non-renewable, both in the spaces provided.
## What Is This Made Of? Record

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Item being examined (e.g., bike)

<table>
<thead>
<tr>
<th>Parts that make up the object</th>
<th>Raw materials needed</th>
<th>Renewable in 100 years?</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g., wheels</td>
<td>aluminum - bauxite</td>
<td>no</td>
</tr>
</tbody>
</table>

Adapted from Recycling: Mining Resources from Trash, Cornell Waste Management Institute.
The Throwaway Tree Skit

Grades 5-8

Main Concept:
Trash that is thrown away remains in the environment and builds up in volume over time.

Standards:
Science MS S4d: The student produces evidence that demonstrates understanding of the impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions and MS S4c health, such as nutrition and exercise; effect of drugs and toxic substances; personal and environmental stress and MS S5e identifies problems; proposes and implements solutions; and evaluates the accuracy, design and outcomes of investigations.

English MS E5a: The student responds to non-fiction, fiction, poetry and drama using interpretive, critical and evaluative processes, that is, the student analyzes the reasons for a character's actions, taking into account the situation and basic motivation of the character, makes inferences and draws conclusions about fictional and non-fictional contexts, events, character settings and themes.

Activity Objective:
Students will consider the tremendous volume of trash generated by human activity and will think about responsible ways to dispose of it.

Materials:
Actors, scripts, audience and props as listed below.
- Monkey- monkey mask, banana peel
- Cave Dweller- artificial fur wrap, leather or animal skin piece
- Roman- Roman style helmet, bag of trash
- Briton- stack of trash
- Settler- pilgrim hat
- Colonist- coonskin hat, leather bridle, harness or leather strips (belts without buckles)
- Industrialist- train engineer's cloth or leather cap, top hat (as mill owner), two machine-made sweaters, one hand-knit sweater
- Scientist- lab coat
- Industrialist- nylon stockings, plastic bag, plastic container
- Scientist- perma-press shirt or pants
- Industrialist- plastic bag-type instant meal or instant soup in a disposable container
- Scientist- broken small appliance
- Industrialist- model car
- Native American- headband, headdress or beaded moccasins
- Industrialist- old blanket, cola bottle

Keywords:
muck, mire, “gardy-loo”, industrialist, yore, synthetics, rayon, nylon, acrylics, plastics, washboard, car model names that include "Skylark", "Nova", "Cougar", "Dart", refuse, spyglass, slew
Teacher Notes:
Students may volunteer or can be chosen for roles. To maximize the number of students able to participate, several students should play the industrialist and scientist roles. Other responsibilities can include prop masters, dialogue coaches, program designers, announcers, etc. The skit should be performed for an in-house or outside audience and may have simple background props such as artificial bushes, trees, and campfire, chamber pot, quilt, fence, etc., as are appropriate.

Some vocabulary included in the skit will be understood by the audience in context. But actors and participants should learn the meaning of the keywords listed before learning the text and beginning production. Some of the car models mentioned are no longer in production and students may not know of them.

After the performance, student participants (and possibly the audience) should critique the methods of trash disposal indicated in the skit. Pros and cons of composting, incineration, landfilling, reduction, reuse and recycling should be discussed in detail. Students must understand that no one option takes care of the trash problem. Students must also understand that individual regions and communities may have different solutions for the trash problem based upon space constraints, existing air pollution problems, population density, etc. Students should be directed toward REUSE, REDUCTION and RECYCLING as viable options for all consumers.

The most important conclusion to be reached by students in the discussion is that there is no “AWAY” for trash; it is produced, it accumulates and must be removed to some other place. As we continue to generate trash, we deplete natural resources and pollute our environment.

Possible additional discussion questions include:
1. Where do hazardous items (motor oil, batteries, toxic chemicals) go when thrown out or collected by the community? This could also be a possible research project.
2. What has been learned about our past disposal practices (air, soil and water pollution) from throwing trash out, burning it, burying it?
3. Why is the problem so severe now?
After viewing the skit, participants and the audience may complete the student worksheet dealing with waste disposal content from the skit.
Please answer the following questions after viewing the skit.

1.) How did cave dwellers get rid of their trash?

2.) Living in the city, how did Romans dispose of trash?

   Do you think that all Romans disposed of trash as they should have? Explain.

3.) What did housewives throw out of their windows?

   Explain what kinds of problems this practice can create.

4.) When do you think that trash disposal became a major problem?

   During the time you mentioned, what happened to create this major problem?

5.) What is meant by “synthetics”?

   What do synthetics replace?

6.) Why do you think that we buy new items so often?

7.) What happens to resources when we keep buying new items and then throw the items away?
The Throwaway Tree
A Script

Person 1
This is the tale of the Throwaway Tree,
Of humans and their garbage throughout history:
Now they’re very nice people, just like you and me,
Who all have a problem, as you will soon see —
What shall they do with their garbage and trash?

All
Why, throw it!, Or bury it! Or burn it to ash!

Person 2 - 90,000 B.C. (Monkey)
I represent people when we lived in a tree.
I get rid of garbage so easily!
It’s a snap! It’s no problem — to me or to him.
We just let go, plop! Down through the limbs.

Person 3 - 50,000 B.C. (Cave dweller)
I am a cave dweller who lives on the ground.
What do I do with old stuff all around?
Why, burn it, like meat; burn it up in the fire;
Or bury it like bones, in the muck and the mire.

All
Yes, throw it, or bury it, or burn it to ash!
That’s how we always get rid of our trash!

Person 1 - 200 B.C. (Roman)
I am a Roman who lives in the town.
Our laws won’t allow me to just throw it down.
I have to drag it away for a mile
And then I can dump it, forget it, and smile!

Person 2 - 1200 A.D. (Briton)
I am a Briton, wary and quick;
Down on our street it can get pretty thick.
When housewives up there want to pitch out their goo,
They just heave it out there and yell: “Gardy-loo!”

(person 1 stands on chair and yells)
It will stay there and stay there until the next rain,
Or until our fair London should burn down again.
Oh, what do we do with our garbage and trash:
We throw it, or bury it, or burn it to ash!

**Person 3 - 1630 (Settler)**

I am the settler. I came without much
But everything else I must make with my hands.
So I don't throw out much — I use all I can.
Cloth scraps become quilts; I reuse my bent nails
It will be a long time 'fore the next trade ship sails.

**Person 1 - 1700 (Colonist)**

I am a colonist; now life's not so tough.
We have trade between cities that brings lots of stuff
And some things are made by our townfolks today,
I could buy a new harness, throw this old one away,
We have pigs and hogs running loose in our street,
If I toss it out there, they'll eat it up neat!
Or I might bury it right over there.
Or I might burn it: nobody would care.
You see; New World is the same as the Old!
We trashmakers come from the time-honored mold.

All

What are we still doing with garbage and trash?
You guessed it! Throw it away, or bury it, or burn it to ash!

**Person 2 - 1890 (Industrialist)**

I'm the industrialist person new on the scene,
I mass-produce goods with my trusty machine.
This sweater, handmade, took a week in days of yore,
But now in one hour, I can make forty-four.
I make things so cheaply, you can now afford two,
and throw out twice as much trash as you need to do.

**Person 3 - 1950 (Scientist)**

I am the scientist person in the new post-war age.
We've learned a few tricks while the shortage raged
When we couldn't get natural stuff to process.
We invented synthetics to replace the rest.

**Person 2 (Industrialist)**

Rayons and nylons, acrylics and plastics.
For furniture and clothing and even elastics;
Forget your old wooled silk and cotton;
Real wooden toys and washboards are forgotten.
**Step 1  Identification**

The Throwaway Tree Skit

**Person 1 (Scientist)**

Our new stuff will last ‘til forever, you see  
Even when it’s worn out to you and me  
Permanent pressed, pre-sized and pre-shrunk  
When dingy and old, it’s still permanent “junk”  

(Person 1 yells “Junk”)

**Person 2 (Industrialist)**

We make instant menus that come in a PACK.  
You just boil the food in its own plastic sack  
Or our TV dinner in its tinfoil tray it’s quick;  
you don’t wash it; just throw it away!

**Person 3 (Scientist)**

We make lots of TVs and clothes dryers, too.  
Don’t ask for trade-in; you’re kidding, aren’t you?

**Person 2 (Industrialist)**

Our new cars all change with each model year,  
Don’t try to repair them, the cost’s too dear,  
Besides, we don’t bother to make last year’s parts  
For Skylarks, or Novas, or Cougars, or Darts.

**Person 3 (Scientist)**

It’s the New Thing, The NEW that America craves.  
So out, out with old stuff, away to its graves.

**Person 2 (Manufacturer)**

So what if there’re more of us buying goods?  
So what if they won’t rot away as they should?

**Person 1 (Native American)**

Now wait just a minute! You cannot fail.  
To include me in your historic trash tale.  
We lived simply, on prairies, in woods,  
We made no high trash piles, nor mass produced goods.  
Let me be your critic, show you where you stand;  
And tell you how you’re defiling our land.  
Your new-fangled goods will not rot away.  
When you throw them all down they remain where they lay  
Then you say you will bury them deep in the ground:  
All your modern trash will make quite a mound!  
So then you would burn it,  
And fill up our air with smoke and gases!  
Oh, all of your answers have faults everywhere:  
You’ll either ruin the water, the land, or the air.  
What’s more, your resources—your lumber, your ore—  
Get smaller each year than the year before,  
And what’s more—this old earth’s not making any more.
Person 2 (Industrialist)
You're right. Our resources are shrinking away
While our garbage problem grows bigger each day.
We're always converting resources to refuse.
Instead of recycling them for reuse!

Person 3 (Scientist)
(Pick up old blanket and wrap around shoulders)
Oh stop it! Don't drop it! We'll think of a way
To make food for cows that's much better than hay.
Don't burn it, return it—we'll make something new,
A vase for your mother, a spyglass for you.
(Person puts flowers in bottle for vase, flower out,
bottle held up to eye for spyglass)
Don't bury it, carry it—back to the mill.
We'll make a new blanket to ward off the chill.

Person 2 (Industrialist)
It's time we progress past the Disposal age
And make recycling part of the popular rage!
We'll have to give up old solutions for trash
And use new technology so the earth does not crash.

It will take a whole slew of solutions
to solve this problem and reduce pollution.
So...

All
Reduce, reuse, and recycle the trash. Send little
to landfills, or lose lots of cash!

~THE END~
DISCUSSION

The skit shows the children that people have historically gotten rid of solid waste successfully by throwing it out, burying it, or burning it, but none of these methods solve modern urban garbage problems. The discussion should attempt to reinforce this concept. One way this can be done is to discuss the characters in the skit: how they disposed of their garbage and why their methods of doing so were either satisfactory or unsatisfactory.

Monkey: Threw garbage down. No problem developed because no large concentration of monkeys existed and the garbage disintegrated.

Cave Dweller: Found uses for most things that might have been considered garbage. What little was left was burned in the fire or left where it fell.

Roman: Threw it. Tossing out garbage began to be a problem because of the many people who lived in cities, but it was easily solved by taking the garbage out of the city.

Briton: Threw it. A problem grew because more and more people moved to the cities, thus producing more trash than they could get rid of in the city.

Settler: Had very little garbage, mostly decomposable.

Colonist: Threw it, burned, buried it. Greater trade resulted when people did not use goods until they wore out, but then more things to be discarded began to accumulate.

Industrialist: With a greater concentration of people in the cities than ever before and more buying because machine-made goods were cheaper, much more was thrown out.

Scientist: The big change to synthetics plus the use of enormous amount of natural resources are causing tremendous trash problems.

Our solid waste disposal options include reducing, reusing, recycling, composting, incinerating, and landfilling. None of these options can stand alone. We must look at individual regions or communities and decide what are the best solutions for each. Any place we live, we can reduce, reuse, recycle, and compost. It is important to do these things to conserve our natural resources and become a wise user. Incineration may be important in areas where there is a severe space problem or where other options don’t exist. It has a place in some solid waste plans because it produces energy and reduces the volume of garbage. Landfilling will always be needed but maybe not in every community. We continue to produce items that are not or cannot be disposed of in other ways.

Look at your own community’s waste or your classroom waste to see what disposal options you can take advantage of. Discuss the idea that we can’t “throw away” our trash; there is simply no such place as “away.” Care is always required to prevent our trash from having bad effects on our lives. We are literally running out of some natural resources so that any form of disposal of certain goods is self-defeating.

Questions to discuss:

Where do hazardous items such as batteries and toxic chemicals go?
What have we learned from our past disposal practices
Why is it such a problem now?

Adapted from Let’s Recycle! Lesson Plans for Grades K-6 and 7-12., U.S. Environmental Protection Agency.
Main Concept:
There are many options for dealing with solid waste.

Standards:
English/Language Arts MS E1c The student reads and comprehends informational material to develop understanding and expertise and produces written work that relates new information to prior knowledge and experience and makes connections to related topics or information.

Activity Objective:
Students will learn some of the vocabulary associated with solid waste.

Materials:
Handout entitled “Mix and Match Waste Game.”

Keywords:
leachate, conservation, compost pile, decomposition, polluted, toxic waste, waste-wise, solid waste, incinerator, environment, natural resources, recycling, reuse, sanitary landfill

Background:
Teachers may wish to provide students with a list of definitions (located at the back of the curriculum guide) either before or during the activity.

Knowledge and Performance Outcomes:
Knowledge: Students will understand and relate keywords to concepts.
Performance: Students will be able to define key terms, associate them with related concepts and use them properly.

Teacher Procedure:
Teachers are to instruct students to complete the “Mix and Match Waste Game” activity sheet.
Mix And Match Waste Game

Name
Date

Try to match the words on the left column to the descriptions in the right column.

1. Compost pile
2. Conservation
3. Decomposition
4. Environment
5. Leachate
6. Natural resources
7. Polluted
8. Recycling
9. Reuse
10. Sanitary landfill
11. Toxic waste
12. Waste wise
13. Solid waste
14. Incinerator

A. When natural materials break down and become soil.
B. Dirty.
C. A place to put vegetable peels, leaves, and grass clippings where they will decompose to humus.
D. Chemicals and some industrial and household wastes that are harmful to all living things.
E. Wise use of our natural resources to avoid waste.
F. The dirty water that collects after rain runs through a landfill.
G. Things we depend on in our environment that are supplied by nature, such as air, water, soil, and wildlife.
H. A place where garbage is properly buried to protect water and the surrounding environment.
I. The world around us.
J. Collecting and using materials to make new products.
K. Using items more than one time, i.e. peanut butter jars to hold buttons or nails.
L. Using our heads about conserving, recycling, and any problems we might have dealing with solid waste.
M. Everything we throw away, i.e., glass, metal, plastic, and kitchen scraps.
N. A place where waste is burned and energy can be produced.

Adapted from Recycling: Mining Resources From Trash, Cornell Waste Management Institute.
Will We Ever Run Out?

Grades 5-8

Main Concept:
Natural resources are the source of everything humans use and consume.

Standards:
Science MS s3d The student produces evidence that demonstrates understanding of natural resource management and ES s3c: The student produces evidence that demonstrates understanding of properties of earth materials such as water and gases and the properties of rocks and soils such as texture, color, and the ability to retain water.

Social Studies: Economics- Content Standard 1 Students will understand that productive resources are limited. Therefore, people cannot have all of the goods and services they want; as a result, they must choose some things and give up others.

Activity Objective:
Students will recognize that resources are renewable or non-renewable, identifying the types of sources used to create common items.

Materials:
Handout entitled “Will We Ever Run Out?”

Keywords:
renewable, non-renewable, limited, unlimited, resource, fossil fuels, minerals

Background:
Students will need to understand the definitions of minerals and fossil fuels, how they are created and that they are non-renewable resources.

Knowledge and Performance Outcomes:
Knowledge: Students will understand and use the keywords properly.

Performance: Students will be able to: 1) identify resources used to create common items 2) decide if a resource is renewable or non-renewable 3) list additional common household items, identify the source of the item and decide if the resources used to create the items are renewable or non-renewable.

Teacher Procedure:
1. Distribute the student worksheet “Will We Ever Run Out?” and discuss the text, defining renewable and non-renewable resources.
2. Give students time to complete the written activity.
3. Challenge students to list and identify additional items made from both renewable and non-renewable resources. Lists may contain five, ten or larger numbers of items that students can add to the back of the activity sheet.
Some **resources** come from plants and animals which grow and reproduce. These can slowly be replaced if we use resources wisely and plan ahead for the future. If we cut down a tree to make lumber, paper or cardboard, we could plant a new tree. Since more trees can be grown, trees are called a **renewable** resource. Crops, animals and other things which can be replaced are renewable.

But there are some resources which cannot be replaced. A **limited** amount is found on the earth. When it is gone, there will be no more. These resources are **non-renewable**. We can’t grow or make new copper or other precious metals. When the last oil well runs dry, there will be no more oil for heat, for cars or for use in all the plastic products which are now part of our lives. Minerals, fossil fuels, water and air are all non-renewable.

**IDENTIFY THE RESOURCE WHICH IS USED TO MAKE EACH ITEM. THINK ABOUT WHETHER THAT RESOURCE CAN GROW SO THAT WE WILL HAVE MORE. MARK AN ‘R’ NEXT TO THOSE ITEMS, BECAUSE THE SOURCE IS RENEWABLE. MARK AN ‘NR’ NEXT TO THE ITEMS WHICH ARE MADE FROM SOURCES THAT CAN’T BE REPLACED. THEY ARE NON-RENEWABLE.**

<table>
<thead>
<tr>
<th>Item</th>
<th>Resource Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>cardboard box</td>
<td>wooden desk</td>
</tr>
<tr>
<td>aluminum pan</td>
<td>tire</td>
</tr>
<tr>
<td>steel bucket</td>
<td>cotton shirt</td>
</tr>
<tr>
<td>drinking glass</td>
<td>diamond ring</td>
</tr>
<tr>
<td>copper pipe</td>
<td>polyester shirt</td>
</tr>
<tr>
<td>hamburger</td>
<td>plastic toys</td>
</tr>
<tr>
<td>book</td>
<td></td>
</tr>
<tr>
<td>corn on the cob</td>
<td></td>
</tr>
<tr>
<td>leather jacket</td>
<td></td>
</tr>
<tr>
<td>wool sweater</td>
<td></td>
</tr>
</tbody>
</table>
“Will We Ever Run Out?

Some resources come from plants and animals which grow and reproduce. These can slowly be replaced if we use resources wisely and plan ahead for the future. If we cut down a tree to make lumber, paper or cardboard, we could plant a new tree. Since more trees can be grown, trees are called a renewable resource. Crops, animals and other things which can be replaced are renewable.

But there are some resources which cannot be replaced. A limited amount is found on the earth. When it is gone, there will be no more. These resources are non-renewable. We can’t grow or make new copper or other precious metals. When the last oil well runs dry, there will be no more oil for heat, for cars or for use in all the plastic products which are now part of our lives. Minerals, fossil fuels, water and air are all non-renewable.

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<thead>
<tr>
<th>Item</th>
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<tr>
<td>cardboard box</td>
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<tr>
<td>aluminum pan</td>
<td>bauxite—NR</td>
</tr>
<tr>
<td>steel bucket</td>
<td>iron—NR</td>
</tr>
<tr>
<td>drinking glass</td>
<td>sand/silica—NR</td>
</tr>
<tr>
<td>copper pipe</td>
<td>copper—NR</td>
</tr>
<tr>
<td>hamburger</td>
<td>animal—R</td>
</tr>
<tr>
<td>book</td>
<td>tree—R</td>
</tr>
<tr>
<td>corn on the cob</td>
<td>plant—R</td>
</tr>
<tr>
<td>leather jacket</td>
<td>animal—R</td>
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<tr>
<td>wool sweater</td>
<td>sheep—R</td>
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<td>tree—R</td>
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<td>tire</td>
<td>rubber tree—R</td>
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<tr>
<td>cotton shirt</td>
<td>plant—R</td>
</tr>
<tr>
<td>diamond ring</td>
<td>diamond, gold—NR</td>
</tr>
<tr>
<td>polyester shirt</td>
<td>oil—NR</td>
</tr>
<tr>
<td>plastic toys</td>
<td>oil—NR</td>
</tr>
</tbody>
</table>

Adapted with permission from Oscar’s Options Ocean State Cleanup and Recycling, Department of Environmental Management, Providence, RI 02908
Trash - A Big Problem

Grades 5-8

Main Concept:
Solid waste generation and elimination are major problems in the United States.

Standards:
Science MS S2d: The student produces evidence that demonstrates understanding of populations and ecosystems, such as the role of producers, consumers and decomposers in the food web; and the effects of resources and energy transfer on populations.

Social Studies: Geography, Standard 15: Students will understand how physical systems affect human systems.

Economics, Standard 1: Students will understand that productive resources are limited. Therefore, people cannot have all the goods and services they want; as a result, they must choose some things and give up others.

Activity Objective:
Students will be encouraged to think about particular components of the solid waste stream and about the volume of solid waste generated in the United States.

Materials: Handout entitled, “What Do You Know About Trash?” and handout solution pages

Keywords:
solid waste, incinerator, junkyard, packaging, trash, tipping fee, dump, recycle landfill, municipal, edible, garbage, obsolescence, micronutrients, compost, calories, malnutrition, TV tubes, protein, affluent, microcircuits

Teacher Notes:
Students will need to understand the first eleven keywords in order to complete the “What Do You Know About Trash?” worksheet successfully. Other words in the list may need to be defined as the solution pages are discussed.

Knowledge and Performance Outcomes:
Knowledge- After a class discussion using the solution pages to correct the student handouts, students will have a better understanding of the sheer volume of trash generated by Americans each year. Students will understand how Rhode Island disposes of its trash and the cost of its elimination.

Performance- After class discussion, students will be better able to make informed and thoughtful decisions about choices in packaging and will hopefully be motivated to reduce trash generation in their own homes.

Teacher Procedure:
1. The teacher should distribute the handouts to students and are to instruct them to complete the worksheets.

2. Solution sheets may be distributed to students or answers can be read to students. Students should correct their worksheets.

Follow-Up: Teachers can assist students to create a Class Trash Book- each student can be assigned a letter of the alphabet to create a page in the book. Each page should contain lists and illustrations of waste items beginning with that letter.

Students can create a bulletin board of posters displaying collages in the form of trashcans. Instruct them to include pictures representing each category of solid waste using the following figures for a family trash can: 13% yard waste, 9% plastic, 24% food waste, 5.5% metal, 4% glass, 35% paper, and 9.5% Miscellaneous or other rubbish.
What do You Know About Trash?

Name

Date

1.) The average family of four creates about _____ pounds of trash each week.
   ____ 20  ____ 500
   ____ 100  ____ 1000

2.) In the past 50 years, the amount of waste discarded per person in the U.S. has______.
   ____ stayed the same
   ____ doubled
   ____ decreased
   ____ increased 10 times

3.) Each day, Americans throw away ______ million pounds of edible food.
   ____ 1  ____ 400
   ____ 100  ____ 900

4.) We send ______ cars to the junkyard each day.
   ____ 250  ____ 10,000
   ____ 1000  ____ 20,000

5.) How many years does the average American own a car?
   ____ 1  ____ 5
   ____ 3  ____ 10

6.) How many TV’s are thrown out each year?
   ____ 100,000
   ____ 1 million
   ____ 5.2 million
   ____ 7.6 million

7.) What percentage of packaging (boxes, bags, and wrappers) is thrown out right away?
   ____ 90%  ____ 50%
   ____ 75%  ____ 10%

8.) How much paper do Americans use each year?
   ____ 1 million lbs.
   ____ 1 million tons
   ____ 5 million tons
   ____ 50 million tons

9.) How does Rhode Island get rid of most of its solid waste?
   ____ incinerator  ____ recycling
   ____ landfill  ____ dump

10.) What is the “tipping fee” (cost per ton) to deposit municipal (residential) solid waste at Rhode Island’s Central Landfill? (2004).
    ____ $18  ____ $32
    ____ $24  ____ $96

11.) Approximately how much municipal (residential) solid waste does Rhode Island produce a year that is disposed of in the Central Landfill?
    ____ 100,000 tons
    ____ 250,000 tons
    ____ 470,000 tons
    ____ 1.1 million tons
What do You Know About Trash?

1.) The average family of four creates about 100 pounds of trash each week.

*If a family of four creates 100 pounds of waste weekly, how much would that amount to in a year? (100 x 52 = 5200 pounds) Help your class to envision almost 3 tons of waste by comparing it to: 6 horses (950 lbs. each), 3 cows (1800 lbs. each), or 4 pilot whales (1500 lbs. each).

2.) In the past 50 years, the amount of waste discarded per person in the U.S. has doubled.

*What reasons can you think of to explain this increase in waste?
- increased packaging
- increase in items designed for one use only
- increased industry
- higher personal income resulting in greater purchasing power

Discuss with students the fact that Americans generate more solid waste per person than do people in any other country. We throw away 3kg. per person daily. Yet Australians discard 0.8kg./person each day, and people in India throw away 0.2 kg. per person per day! Students should contemplate the causes: different buying habits, different ways of life, the fact that both Australia and India are much less developed than the United States.

3.) Each day, Americans throw away 400 million pounds of edible food.

*Mention waste in the school cafeteria and the food discarded at home. What else could be done with this food?
- it could be composted or used as animal fodder
- smaller portions could be served initially to cut down on waste
- usable surplus could be donated to foodbanks or organizations which feed the needy.

The United Nations estimates that 460 million people do not receive an adequate amount of the right kinds of food. The diet of these people is frequently lacking in:
- calories (fewer than 2200 calories per person each day is the norm throughout China, India, and much of Africa. We consume more than 3300 calories per person per day in the U.S.)
- protein (less than 60 grams per day in the above places compared to more than 90 grams each day in the U.S.)
- needed micronutrients.

Malnutrition exists not because we don’t produce enough food, but rather because of unequal distribution of what is grown. The most affluent third of the world’s population eats well over half the food produced.

4.) We send 20,000 cars to the junkyard each day.

*What could be done with the cars once they are not wanted anymore?
- We could reuse the metal, batteries, tires, and other parts for auto repair and body work.
- We can recycle the tires, batteries, and plastic interior shell.

Twenty thousand cars placed end to end, would result in a line over 50 miles long, the full length of the state of Rhode Island. In the course of a year, Americans discard over seven million cars—enough to stretch 17,500 miles (two-thirds of the distance around the earth at the equator)!

5.) How many years does the average American own a car? 5

*Why do you think we trade cars in so frequently? (to keep up profits, manufacturers try to convince drivers to purchase new automobiles by changing the styles, updating options, and planning obsolescence. Only certain models are expected to “last” past the 100,000 mile mark.
6.) **How many TVs are thrown out each year?**

**7.6 million**

*If a television set will last 10 to 15 years, why do you think so many are thrown away? (product variety, improvement over time—from tubes to printed circuits, from black and white to color, a variety of sizes from micro to widescreen, and a variety of colors) Again, the manufacturers convince us that a new (or another) TV is needed in our lives, even if the old one continues to function perfectly well.

7) **What percentage of packaging (boxes, bags, and wrappers) is thrown out right away?**

**90%**

*Can you think of ways to reduce this percentage to reduce our litter and solid waste problem and save natural resources as well? (Use reusable packaging—cloth shopping bags, straw baskets; boycott certain items which carry excess packaging and alert manufacturers to your dis-satisfaction.) Fast food packaging is one of the largest litter items, and most of it (polystyrene and plastic lids) will not decompose in the elements. Therefore, although packaging is in use for a very few minutes, it will persist in our landfills for literally thousands of years. Discuss with students how this practice might be changed.

8.) **How much paper do Americans use each year?**

**82 million tons**

*What are ten things we use paper for on a daily basis? Can you think of ways to reduce the amount of paper we use? (schoolwork, newspaper, cereal boxes, paper bags, stationery, magazines, tissues, napkins, paper towels, etc.) Assist students in finding ways to change their behaviors and lessen consumption by substituting materials which can be used repeatedly whenever possible.) Explain to students that it takes 10,000 trees to print the Sunday New York Times each week—and that most of the papers are discarded the next day!

9.) **How does Rhode Island get rid of most of its solid waste?** (landfill)

*Ask students if they know the meaning of the other terms—they are discussed at length in the resource guide.

10.) **What is the “tipping fee” (cost per ton) to deposit municipal solid waste at Rhode Island’s Central Landfill? (2004).**

**$32**

*Do students feel that this is too much, too little or just right? The rate for commercial trash is $50-$65 per ton. What are some reasons that municipalities pay less to dispose of their trash?

11.) **How much municipal solid waste does Rhode Island produce in a year?**

**470,000 tons**

*Have students do the conversion from tons to pounds (470,000 x 2,000). Get them thinking about what could be done with this garbage when the Central Landfill is filled up, which will most likely happen in their lifetime. Remember to tell them that transporting garbage over long distances is very expensive, and that no other state sends all of its garbage out of state.
Part I

Multiple Choice: Circle the correct answer.

1.) An example of a natural resource is
   a. plastic
   b. water
   c. paper
   d. leather

2.) The kind of garbage we make more of than any other is
   a. metal
   b. glass
   c. paper
   d. plastic

3.) An example of a renewable resource is
   a. gold
   b. oil
   c. trees
   d. tin

4.) Anything that people no longer use or want is called
   a. broken
   b. old
   c. trash
   d. a resource

5.) An example of a non-renewable resource is
   a. oil
   b. apple tree
   c. sheep
   d. plant

6.) One reason millions of years ago people did not have a garbage problem is
   a. there were no trees.
   b. there were no plastic bottles.
   c. there were fewer people.
   d. there were no cities.

7.) The part of the world that produces the most waste is
   a. Europe
   b. United States
   c. China
   d. Australia

8.) The amount of edible food Americans throw away each year is
   a. 1 million pounds
   b. 100 million pounds
   c. 400 million pounds
   d. 900 million pounds

9.) The amount of trash the average family throws away each week is
   a. 20 pounds
   b. 100 pounds
   c. 500 pounds
   d. 1000 pounds

10) A place to put vegetable peels, leaves and grass clippings where they will decompose is
    a. solid waste
    b. compost pile
    c. natural resources
    d. pollution

Part II

(On the back of this paper)

a.) Draw and label a renewable resource and a product that comes from that renewable resource.

b.) Draw and label a non-renewable resource and a product that comes from that non-renewable resource.
Part III

A). During our study in Step 1 of Project Waste, we role played the life-cycle of different objects (e.g. one recycled and one landfilled; Styrofoam (polystyrene) vs. paper, etc.). Explain the life-cycle of a disposable paper cup and a reusable glass cup.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

B.) Which one is more beneficial to the environment and why?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Part I

Multiple Choice: Correct answer is in bold.

1.) An example of a natural resource is
   a. plastic   b. water   c. paper   d. leather

2.) The kind of garbage we make more of than any other is
   a. metal   b. glass   c. paper   d. plastic

3.) An example of a renewable resource is
   a. gold   b. oil   c. trees   d. tin

4.) Anything that people no longer use or want is called
   a. broken   b. old   c. trash   d. a resource

5.) An example of a non-renewable resource is
   a. oil   b. apple tree   c. sheep   d. plant

6.) One reason millions of years ago people did not have a garbage problem is
   a. There were no trees.   b. There were no plastic bottles.   c. There were fewer people.   d. There were no cities.

7.) The part of the world that produces the most waste is
   a. Europe   b. United States   c. China   d. Australia

8.) The amount of edible food Americans throw away each year is
   a. 1 million pounds   b. 100 million pounds   c. 400 million pounds   d. 900 million pounds

9.) The amount of trash the average family throws away each week is
   a. 20 pounds   b. 100 pounds   c. 500 pounds   d. 1000 pounds

10) A place to put vegetable peels, leaves and grass clippings where they will decompose is
   a. solid waste   b. compost pile   c. natural resources   d. pollution

Part II

a.) Draw and label a renewable resource and a product that comes from that renewable resource.

b.) Draw and label a non-renewable resource and a product that comes from that non-renewable resource.

Any reasonable answer should be accepted.
Part III A

During our study in step 1 of Project Waste we role played the life-cycle of different objects (e.g. one recycled and one landfilled; Styrofoam (polystyrene) vs. paper, etc.). Explain the life-cycle of a disposable paper cup and a reusable glass cup.

**Paper Cup Cycle**

4- **ABOVE STANDARD**
Student successfully includes all steps in the cycle of a paper cup:
1.) A tree is found and cut down.
2.) The tree is transported to a paper mill.
3.) The wood is processed into paper.
4.) The paper is transported to a cup-making facility.
5.) The cups are transported to a retail store.
6.) The cups are purchased by the consumer and used.
7.) The cup is thrown away.
Student uses whole sentences
Student uses correct grammar, punctuation and spelling.

3- **AT STANDARD**
Student successfully includes most (6 of 7) steps in the cycle of a paper cup.
Student uses whole sentences.
Student uses correct grammar, punctuation and spelling with minor errors.

2- **BELOW STANDARD**
Student includes some (4-5) steps in the cycle of a paper cup.
Student uses some sentence fragments.
Student experiences difficulty with grammar, punctuation and spelling.

1- **SERIOUSLY BELOW STANDARD**
Student includes a few (2-3) steps in the cycle of a paper cup.
Student uses sentence fragments.
Student experiences difficulty with grammar, punctuation and spelling.

**Glass Cup Cycle**

4- **ABOVE STANDARD**
Student successfully includes all steps in the cycle of a glass cup:
1.) A supply of sand is found.
2.) The sand is transported to a glass factory.
3.) The sand is heated and molded into glass cups.
4.) The cups are transported to a retail store.
5.) The cups are purchased by the consumer and are used.
6.) The cup is washed and reused.
Student uses whole sentences.
Student uses correct grammar, punctuation and spelling.

3- **AT STANDARD**
Student successfully includes most (5 of 6) of the steps in the cycle of a glass cup.
Student uses whole sentences.
Student uses correct grammar, punctuation and spelling with minor errors.

2- **BELOW STANDARD**
Student includes some (3 of 4) of the steps in the cycle of a glass cup.
Student uses some sentence fragments.
Student experiences difficulty with grammar, punctuation and spelling.

1- **SERIOUSLY BELOW STANDARD**
Student includes a few (1 to 2) of the steps in the cycle of a plastic cup.
Student uses sentence fragments.
Student experiences difficulty with grammar, punctuation and spelling.
Part III B

In attempting to answer the question, "Which is more beneficial (paper cup or glass cup) to the environment and why?" the student:

4- ABOVE STANDARD
   Correctly answers that the glass cup is more beneficial.
   Mentions that the cup is reusable.
   Mentions that the glass cup does not create instant trash.
   Mentions that fewer steps are required to process the glass cup into the final product.
   Mentions that the glass cup is a more efficient use of resources (requires less energy, creates less waste).
   Responds in whole sentences.
   Uses correct grammar, punctuation and spelling.

3- AT STANDARD
   Correctly answers that the glass cup is more beneficial.
   Mentions that the glass cup is reusable.
   Mentions that the glass cup does not create instant trash.
   Mentions either that the glass cup requires fewer steps to produce or is a more efficient use of resources.
   Responds in whole sentences.
   Uses correct grammar, punctuation and spelling.

2- BELOW STANDARD
   Correctly answers that the glass cup is more beneficial.
   Mentions that the glass cup is reusable.
   Mentions that the glass cup does not create instant trash.
   Responds in sentence fragments and/or has major problems with grammar, punctuation and spelling.

1- SERIOUSLY BELOW STANDARD
   Correctly answers that the glass cup is more beneficial.
   Includes no supporting statements to explain why the glass cup is more beneficial.
1.) Explain what is meant by a natural resource.

2.) Why is PLASTIC not considered a natural resource?

3.) What are some differences between renewable and non-renewable resources?

4.) Trash became a problem when people changed the way they lived. What changes contributed to a build-up of trash?

5.) Why does paper contribute the greatest volume to trash today?

6.) Why do you think Americans produce more trash than any other Industrialized country?

7.) Describe some benefits of recycling vegetable peels, leaves and grass clippings in a compost pile.
Assessment 2: Answer Key

4- ABOVE STANDARD
Student explains that a natural resource is obtained from the earth or from living things and has not been processed into another substance.
Student explains that plastic is a manufactured product not directly obtained from the earth or from living things.
Student explains that renewable resources are replenished over time (such as trees) while non-renewable resources are not.
Student explains that people began to live in cities AND increased in numbers.
Student explains that people use paper in many ways each day and cites some examples such as packaging, newspapers, computer and school paper, paper products such as napkins, cups, etc.
Student explains that Americans are the greatest consumers of all types of packaged goods and the least likely to conserve, reuse and recycle.
Student explains that composting decreases trash volume, creates new soil, provides living environments for many species, creates natural fertilizer.
Student uses whole sentences with correct spelling, grammar and punctuation.

2- BELOW STANDARD
Student attempts to answer some questions.
For the seven questions, three or four of the responses are correct and complete.
Student responds in sentence fragments or one word answers to the remaining questions.
Complete student responses have major grammatical errors.

1- SERIOUSLY BELOW STANDARD
Student attempts to answer a few of the questions.
For the seven questions, one or two of the responses are correct and complete.
Student responds in sentence fragments or one word answers to a few of the remaining questions or leaves them blank.
Complete student responses have major grammatical errors.

3- AT STANDARD
Student attempts to answer all questions.
For the seven questions, five of the responses are correct and complete.
Student responses may include a few sentence fragments or minor problems with grammar, punctuation and spelling.
Suggested Activities
1. Life At A Landfill
2. Create A Landfill (Kit Activity)

Supplementary Activities
A. Plastic Cloze — A Waste Reading
B. Does Biodegradable Plastic Really Degrade?
C. Drowning In Oil

Assessments
a. Parts I and II and Rubrics
Main Concept:
Most solid waste is disposed of in landfills, but landfills are filling up and it is very difficult to find new places to put them, especially in the Northeast.

Standards:
Science MS S3d The student produces evidence that demonstrates understanding of natural resource management and MS S4d the impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.

Reading MS E1c The student reads and comprehends informational materials to develop understanding and expertise and produces written or oral work that: 1) restates or summarizes information 2) relates new information to prior knowledge and experience 3) extends ideas and 4) makes connections to related topics or information.

Activity Objective:
Students will read about a sanitary landfill and learn how it is made, operates and what steps are taken within and around the landfill to protect the environment. If students visit a landfill as part of the activity, they will have a more complete understanding of the VOLUME of trash disposed of each day and of the magnitude of the trash disposal problem.

Materials:
“Biggest Little Landfill” handout and sample outline (one per student). If students have made a field trip to the landfill, a “Visit To A Landfill” worksheet (or similar questions made up by the students) is needed.

Keywords:
landfill, trash, municipal, scalehouse, working face, compactor, capped, dump, decompose, methane, groundwater, surface water, demolition, debris, non-hazardous, sewage sludge, EPA, bacteria, leachate

Background:
As the hazards of open dumping become more apparent, landfill designs and regulations have changed to better protect the environment – particularly the air and groundwater near the landfill. New Federal regulations requiring all operating solid waste landfills to be “lined” with “leachate collection” systems went into effect in October 1992. However, states were given the authority to decide whether or not to enforce the regulations. The new area accepting trash at the Central Landfill in Johnston, RI is lined with a leachate collection system. (See “Landfills” section at the rear of the curriculum guide for additional information).

Teacher Notes:
Students will need to be familiar with the vocabulary keywords either before or during their reading of “The Biggest Little Landfill” handout. Through previous activities, students should already be familiar with the words municipal and trash.

Students should be given copies of the handouts “The Sanitary Landfill”, “Johnston Landfill”, “Typical Leachate Collection System” before they read the “Biggest Little Landfill” handout or visiting the landfill.

Pre-Activity:
It is advisable to have a pre-activity discussion of groundwater, surface water and leachate for complete student understanding of the landfill structure and environmental concerns.
Knowledge and Performance Outcomes:

Knowledge: Students will understand the structure of a landfill and how it works to break down trash. Students will be familiar with and be able to use the keywords successfully.

Performance: Students will be able to demonstrate that they understand the structure of a landfill and how it operates. They will be able to complete the outline given by the teacher using pertinent information located in the reading. Students will be able to extend ideas by making several suggestions for future landfill use. They will be able to discuss how changing personal and municipal habits can extend the “life” of a landfill. After a visit to the Central Landfill, students will be able to successfully complete the “Landfills” handout.

Teacher Procedure:

1.) Distribute handouts to students. Have students read “The Biggest Little Landfill” independently or as a class.

2.) Instruct students to identify important information found in the reading.

3.) Instruct students to complete the outline using important information found in the reading OR offer the outline as a guide that students can use to construct their own outlines.

4.) Visit the Central Landfill in Johnston, RI. Call the Education Coordinator at 942-1430 ext. 124 IN ADVANCE to arrange a tour and lecture about what happens at the landfill.
The Central Landfill in Johnston, Rhode Island is one of the largest landfills in New England, located on 1,100 acres. Presently, only a fraction of that space (186 acres) is used for trash disposal. Ninety-eight percent of Rhode Island’s waste comes to the Central Landfill. Thirty-eight out of thirty-nine cities and towns bring their trash to the Central Landfill. Nearly four thousand tons of trash are brought there six days a week. Since it was purchased by the State in 1980, over 20 million tons of trash have been buried here. Some is municipal waste from homes and some is from businesses. Construction and demolition debris, nonhazardous liquid waste and sewage sludge are accepted. Each day enough trash comes in to fill a 200 by 200 foot space 15 to 20 feet high. That's about 40 classrooms full of garbage.

Every day, between 600 and 800 garbage trucks drive up to the scalehouse to weigh in. After the truck’s weight is entered into the computer, it drives up to the working face of the landfill. There, each truck dumps its load of garbage. Inspectors on the working face tell the trucks where to dump, and check loads for any unacceptable waste. Once all the trash has been dumped from the truck, the bulldozer and compactors go to work. The landfill has seven compactors. A crew works to see that at least three of them are running each day. The compactors weigh 90,000 pounds and have huge spiked wheels and rectangular rakes or blades. Each one costs $350,000 and they last about 5-7 years. Their drivers spend 10 hours each day moving up and down the mountain of trash. Their job is to compact the trash, so it takes up as little space as possible in the landfill.

The garbage truck returns to the scalehouse where it is weighed once more. The difference in weight equals the amount of trash brought in. Trucks that make regular trips to the landfill have a special yellow sticker with a number on it. The number has been entered into the scalehouse computer, along with the weight of that truck. Communities pay for each ton of garbage dumped. A higher fee is charged for commercial waste or waste from construction sites.

In other corners of the landfill, rocks are broken up and soil (or “cover material”) is stockpiled. The rocks are used to build the roads running through the site. Every day 2,000 cubic yards of cover material is needed to cover the working face. In spite of the soil cover, on windy days plastic bags litters the open spaces. Birds and seagulls circle the area or perch on the face in search of food. Burying the garbage keeps animals from getting into the garbage and keeps the smell from getting too strong.

There are safeguards practiced at the landfill. Sixty-four wells monitor groundwater. Surface water is checked at five locations. Four times a year, tests are run to see if chemicals are getting into the soil. At one time, (before the state owned it) hazardous waste was dumped in part of the landfill. This area, which is being capped was closed in 1982, and is monitored by the EPA and the landfill staff. Studies have been done on the groundwater around the landfill. Some nearby homes were switched from wells to the Johnston town water supply.
The landfill site was first used as a rock quarry and a dump. It was run as a private landfill from 1955 to 1980. In 1980 it was sold to the RI Resource Recovery Corporation. The first 121 acres of the landfill were closed in April, 1993. It had reached the maximum height of 575 feet above mean sea level. Currently there are 44 acres remaining that are licensed and accepting trash. It is estimated that there are approximately 12-15 years of capacity remaining at the Central Landfill, but this will depend on how much can be separated from the trash for recycling.

It is impossible to see, but things are happening inside the landfill. Bacteria inside the layers of trash and soil break down or decompose the organic waste. This creates methane and other gases. Methane, like natural gas, can be used to heat and generate electricity. The Central Landfill is one of only 123 landfills in the country that collects methane to generate electricity. The methane gas to energy plant at the Central Landfill is the largest in the Northeast. It makes enough power to supply 31,000 Rhode Island homes annually. Methane can only be removed from the part of the landfill that is closed and no longer accepting trash.

When the entire landfill closes, recreation areas such as parks or ski slopes could be built on the site. Homes or buildings cannot be built on the site because the landfill is not solid. No new landfills are expected to be sited in Rhode Island. No one wants to live near them, and land is very expensive. Everyone wants to get rid of their trash, but not in their neighborhood. It is impossible to make trash disappear. Things we can do to extend the life of the landfill are not to create trash in the first place and recycle or compost whatever we can. However, there will always be some garbage that will have to be disposed of somewhere.

Adapted with permission from Oscar's Options Ocean State Cleanup and Recycling, Department of Environmental Management, Providence, RI 02908
The Sanitary Landfill
The above figure depicts the Central Landfill and its facilities in relation to the surrounding roadways, namely Central Avenue to the north and Shun Pike to the south. The new access ramps to Route 295 off of Scituate Avenue/Shun Pike are also shown to the east. In addition, the shaded landfill area is identified by its phased construction (Phases I-V). Phases IV and V are presently the only active cells.
Visit To A Landfill

Name

Date

1.) Can you tell it is a landfill from the road, and what can you see happening from the road?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2.) Does the site stand out from the rest of the landscape?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

3.) Are there any houses nearby?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

4.) What is being done to the refuse?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

5.) How many tons of trash is disposed of at the landfill each day? Each year?

________________________________________________________________________
________________________________________________________________________

6.) How many vehicles do you see working there? Coming and going?

________________________________________________________________________
________________________________________________________________________

7.) What kinds of vehicles?

________________________________________________________________________
________________________________________________________________________

8.) What are they used for? How many workers are there?

________________________________________________________________________
________________________________________________________________________

9.) Where does the methane gas go? Where does the leachate go?

________________________________________________________________________
________________________________________________________________________

10.) Is there a charge to bring trash to the landfill? How much is it and for whom?

________________________________________________________________________
________________________________________________________________________

11.) How many more years does the landfill have left? What happens after that?

________________________________________________________________________
________________________________________________________________________
Create A Landfill

Grades 5-8

Main Concept:
Almost three-fourths of the trash in the United States ends up in landfills. Because unlined landfills allow toxic and poisonous leachates to enter the water table, they are a source of pollution and pose health risks. Newer landfills (sanitary landfills) are required to have liners that prevent leachates from entering water supplies.

Standards:
MS S 5e: The student demonstrates scientific inquiry and problem-solving by thoughtful questioning and reasoning strategies, common sense and conceptual understanding from Science Standards 1-4 and uses appropriate methods to investigate the natural world and identifies problems; proposes and implements solutions; and evaluates the accuracy, design and outcomes of investigations and MS S5f works individually and in teams to collect and share information and ideas. MS A1b: The student troubleshoots problems in the operation of a system in need of repair or devises and tests ways of improving the effectiveness of a system in operation and devises strategies for putting the system back in operation or improving its performance.

English/Language Arts: MS E2d: The student produces a narrative procedure that engages the reader by establishing a context, provides a guide to action for a relatively complicated procedure in order to anticipate the reader’s needs; creates expectations through predictable structures (headings); and provides transitions between steps, includes relevant information, excludes extraneous information, anticipates problems, mistakes and misunderstandings that might arise for the reader, provides a sense of closure for the reader.

Activity Objective:
After observing a demonstration using an unlined landfill model, student groups will brainstorm ideas for a lined landfill model, will create it and will write a narrative procedure for its construction (narrative optional).

Materials:
Part A — Teacher Demonstration
Picture of an unlined landfill (available in the Curriculum Guide), picture of an unlined landfill model (in this activity)
2L soda bottle
Scissors
6-8 oz. Clean sand mixed with colored, powdered paint, dry Jell-O® powder, Tintex® or Rit® dye. Note- These powders may discolor hands and clothing. Teacher and students should avoid touching wet powders or crystals. Tintex® and Rit® dyes stain DEEPLY.
Paper towel, paper napkins or coffee filters
Small can or bottle of water
6-8 oz. plastic cup (to collect leachate)

Part B – For Each Group
Picture of lined landfill (available in the Curriculum Guide)
Picture of lined landfill model (in the activity)
Scissors
2L soda bottles cut in half with small hole in the neck portion (off to the side) to insert straw to collect leachate
Clay
Plastic bags (large enough to completely line top portion of the soda bottle)
Colored sand (as prepared in Part A)
4-6 inch sections of plastic straws
Small can or bottle of water
6-8 oz. plastic cup

Keywords:
lined landfill, unlined landfill, landfill, leachate, toxic, poisonous
Knowledge and Performance Outcomes:

Knowledge: Students will understand the differences in construction between a lined and unlined landfill. Students will understand the keywords.

Performance: In small groups, students will be able to use a variety of materials to construct a lined landfill model that prevents leachate from leaving the neck portion of a plastic soda bottle. Students will be able to write a narrative procedure that instructs the reader to recreate the successful, “lined landfill” design.

Teacher Notes:

Students should be told about the differences between a lined (sanitary) and unlined landfill and should know the keywords before the activity.

The teacher should create the unlined landfill model during a demonstration, demonstrate it and then should initiate a classroom discussion as indicated in the teacher procedure.

Then the students should be broken into small groups of three to four students to create their own group version of a lined landfill model using the materials listed. Instruct students that their models should prevent leachate (colored water) from leaving the bottleneck. This can also be done as a teacher demonstration.

Student groups that create successful lined landfill models should write a narrative procedure that details construction steps. Other groups or the teacher should critique these procedures. Sand, soda bottle parts, straws, etc., can be dried and then reused many times. Plastic cups have been chosen because they are reusable.

Teacher Procedure:

Part A - Demonstration
1.) Pass out pictures of unlined landfill and unlined landfill model (or show on overhead).
2.) Cut a 2L soda bottle in half using scissors. Cut off the bottom of the lower section.
3.) Place the top (neck portion) of the bottle upside down inside the bottom half.
4.) Place several napkins, a paper towel or coffee filter (that has been folded into a cone shape) in the bottle-neck as shown in the picture (represents the landfill).
5.) Use the plastic cup to put the sand mixture into the paper cone in the bottleneck (represents soil, containing waste and toxins, in the landfill).
6.) Place the plastic cup under the bottleneck to collect leachate (represents leachate entering the groundwater).
7.) Slowly pour water from the can or bottle over the sand mixture (represents rain or snow).

Teacher Discussion
Initiate a discussion about the unlined landfill model and what was observed. Students should be asked to identify the model parts that correspond to rainwater/snow, soil, toxic substances and wastes, leachate and groundwater.

Part B — Groups
1.) Continue the discussion by asking students to brainstorm ideas about how the leachate (containing toxins) could be prevented from entering groundwater. Students should develop the idea that the soda bottle top must be lined with some material to prevent leachate from entering groundwater (two liners, plastic and clay, are required in sanitary landfills today).
2.) With students, discuss the fact that the leachate must be collected and removed to a water treatment center. It must be collected from the soil of the landfill or it will pool at the bottom soil layers and will eventually rise to the top soil layers, creating new hazards.
3.) Pass out pictures of lined landfill and lined landfill model (or show on overhead). Break students into small groups.

4.) Instruct students to cut the soda bottle in half as demonstrated. Instruct students to use scissor points to create a small hole 1-3 inches below the bottleneck. Tell them that they will insert their straw pieces into the landfill model through this hole. Instruct groups to vary the position of the hole from group to group.

5.) Instruct students to use their materials to create a lined landfill model after they have discussed possibilities within their groups. Instruct them that to be successful, leachate (colored water) should not leave the bottle through the neck.

6.) Tell students that they are to test their models by pouring a cup of water over the sand mixture as previously demonstrated.

7.) Instruct students to complete the student worksheet both during and after model construction.

8.) If no water leaves the neck of the bottle, they have been successful and are to write a narrative procedure that explains the construction of the model step by step.

9.) Critique the narrative procedures written by successful groups.

10.) As an extension, data could be collected about the position of the hole for the straw and the amount of leachate collected. The class could construct a data table and graph.
Create A Landfill Models

Unlined Landfill

Lined Landfill
Unlined Landfill Diagram

- Soil
- Waste
- Soil
- Soil, Gravel, Stone
- Gravel, Stone
- Groundwater
- Rock

LEACHATE
Create A Landfill

1.) What happened to the colored water in the unlined landfill model?

2.) What happened to the colored water in the lined landfill model?

3.) What parts of the models correspond to:
   a. rainwater/snow
   b. landfill soil
   c. toxins/waste
   d. groundwater with leachate
   e. leachate to be treated

4.) What are some of the benefits of a lined landfill?

5.) Why does the leachate have to be collected in a lined landfill?

6.) Why does the leachate have to be treated at a water treatment facility rather than just discarded?

7.) As your teacher directs, create a procedure (a list of steps) that explains how to construct a lined landfill model. Complete this step if your model was successful in keeping leachate from leaving the neck of the bottle.
Main Concept:
Plastic has unique properties that make it different than other materials.

Standards:
MS S4d: The student produces evidence that demonstrates understanding of the impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions and Reading MS Ec. The student reads and comprehends informational materials to develop understanding and expertise and produces written or oral work that: restates or summarizes information.

Activity Objective:
Students will learn about plastics by reading the passage and choosing the appropriate word to insert in the blank space.

Materials:
Handout entitled “Plastic Cloze”, pencil or pen

Keywords:
petroleum, transparent, chemicals, and pliable, airtight, glass fiber, asbestos, fillers, polyethylene, vinyl, urethane, transparent, decompose

Background:
Students will need to be familiar with all of the keywords and other words listed as possible choices on the handout. Since some students have larger vocabularies than others, it will be helpful to provide a dictionary or thesaurus to students if vocabulary has not been part of previous activities. Students may not know how plastics are made or what they are made from. They may also be unaware of the fact that while some plastics are recyclable, many are difficult or impossible to recycle and/or do not decompose naturally. They might not know that only a few types of plastics are collected for recycling and that plastics are energy-intensive to manufacture.

As a result, teachers should engage in a pre-activity discussion with students using information from the reference section of the curriculum guide marked “Plastics”.

Pre-Activity:
Teachers should determine the amount of prior knowledge that students have about plastics and if necessary, should provide information about plastics; their characteristics, manufacture and disposal as suggested in the background section above.

Knowledge and Performance Outcomes:
Knowledge: Students will know more about the nature of plastics from an in-class reading and activity.

Performance: Students will successfully choose the appropriate word to be used in the blanks in the paragraphs in the plastics reading assignment.

Teacher Procedure:
1.) Pass out copies of the handout “Plastic Cloze” to students.

2.) Instruct them to choose the appropriate word to complete the sentence from the four possibilities given.

3.) After students have finished completing the handout, give students the correct answers, have them correct their handouts, and correct any misconceptions they may have.
Plastic Cloze — A Waste Reading

Name Date

Read and circle the best word that completes the idea in the story.

Plastic is a man-made 1 that originally comes from 2. It can be 3 into almost any shape and is very pliable. It can be made harder than steel, or as soft as cotton. Often it can be used 4 glass, wood, or metal. If it used in 5 form, it can be made into paints and adhesives. Pressed hard, it is used for furniture, in cars, helmets, and is 6 enough to resist 7 and wear. Mixed with other substances such as wood, glass fiber, and asbestos, it is used as fillers to 8 or reinforce the product better.

Soft plastic is very 9 and can be made into toys, soda bottles, or even spongy cushions. Plastic is made into polyethylene, vinyls, and urethanes. This is particularly 10 in latex paints.

Plastic can be made to be as 11 and clear as glass. This kind of plastic is sometimes used for food and medicine 12. Even contact lenses are made with plastic. Plastic can be treated with other 13 to resist heat and has been used for rocket nose cones and laboratory containers.

Unfortunately, plastic doesn’t 14 because it doesn’t decay and break down naturally. As a result of this, if plastic is not recycled it adds to our 15.

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<td>a. containers</td>
<td>b. colors</td>
<td>c. salesmen</td>
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Plastic Cloze A Waste Reading

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Unfortunately, plastic doesn’t 14 because it doesn’t decay and break down naturally. As a result of this, if plastic is not recycled it adds to our 15.

Circle the Best Answer

1) a. ideas  
   b. containers  
   c. material  
   d. glues

2) a. coal  
   b. gasoline  
   c. petroleum  
   d. iron

3) a. molded  
   b. rippled  
   c. cut  
   d. stacked

4) a. instead of  
   b. along with  
   c. for making  
   d. for weakening

5) a. gaseous  
   b. airtight  
   c. dry  
   d. liquid

6) a. tough  
   b. light  
   c. soft  
   d. dark

7) a. scratches  
   b. bites  
   c. slips  
   d. air

8) a. hold  
   b. push  
   c. save  
   d. weaken

9) a. sticky  
   b. flexible  
   c. sweet  
   d. soft

10) a. lucky  
    b. unnecessary  
    c. useful  
    d. costly

11) a. breakable  
    b. heavy  
    c. flexible  
    d. transparent

12) a. containers  
    b. colors  
    c. salesmen  
    d. doctors

13) a. chemicals  
    b. colors  
    c. fuels  
    d. poisons

14) a. decompose  
    b. bury  
    c. purchase  
    d. design

15) a. waste  
    b. transportation  
    c. cities  
    d. budget
Main Concept:
Expendable goods are biodegradable or non-biodegradable. Plastics that are known as biodegradable actually decompose at a variety of rates.

Standards:
Science MS S3d: The student produces evidence that demonstrates understanding of natural resource management and MS S4d of the impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.

Activity Objective:
Students will determine if plastic degrades and if so, how fast the degradation is for various types of plastics.

Materials:
various plastic samples (biodegradable and non-biodegradable, as many as possible to include a 6-pack carrier), photodegradable cornstarch, scrap wood, nails, board, student observation worksheet

Keywords:
photo-degradation, biodegradable, non-biodegradable, cornstarch, plastic

Teacher Notes:
Students need to understand the differences between biodegradable and non-biodegradable materials before the activity begins. They also need to understand that some biodegradable materials are broken down by microorganisms (cornstarch) or fungi, while others are broken down by the action of ultraviolet or visible light (during photo-degradation).

Knowledge and Performance Outcomes:
Knowledge: Students will understand the meanings of the keywords and will understand the difference between biodegradable and non-biodegradable plastic. They will understand that some substances can be broken down by photo-degradation.

Performance: Students will successfully expose their samples to the elements and will examine those samples on a regular basis while keeping records of their observations.

Teacher/Student Procedure:
Note-start the experiment early in the school year.
1.) Collect several brands and thicknesses of plastic. Cut two pieces from each type of plastic. Every piece should be approximately the same size. Cut two pieces of cornstarch in the same manner.
2.) Locate a safe place outside the school that is relatively undisturbed.
3.) Take two pieces of scrap wood and attach one sample of each type of plastic and cornstarch to each board. Use a piece of non-degradable plastic as a control (it will not change over time while exposed to light or soil).
4.) Place one set of samples outside where they will be exposed to the sun. The other set should be buried, at least partially, in soil so that microorganisms will have a chance to carry out biodegradation.
5.) Watch the samples for several months during fall/winter (Sept. – Feb.).
6.) Check the samples once per month and record any observed changes in the color, texture or other characteristic of the plastic. Record observations on the observation worksheet.

Follow-Up:
Students should be lead in a discussion about 1) conditions necessary for plastic degradation 2) about degradation in a landfill 3) about degradation along a highway 4) about degradation in an ocean and 5) about the hazards inherent in plastics exposure to wildlife found in landfills, around highways and in oceans.
# Does Degradable Plastic Really Degrade?

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*Note: in Northern climates, you may not be able to observe samples year-round.
Drowning In Oil

Grades 5-8

Main Concept:
It is important to understand the properties of motor oil and how its disposal can affect the environment.

Standards: MS S3d The student produces evidence that demonstrates understanding of natural resource management and MS S4c health, such as nutrition, exercise and disease; effects of drugs and toxic substances; personal and environmental safety; and resources and environmental stress and MS S4d the impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.

Activity Objective:
Students will understand how motor oil reacts with water, soil, sand, rocks and plants and will deduce its properties from observations.

Materials:
Motor oil in 35mm film canisters
(Caution-Motor oil is potentially harmful if improperly handled)
plastic spoons
small plastic bags
jars of water with lids
toothpicks or straws
ceramic bowls containing soil
“Drowning in Oil” handout
small plants in pots
feathers
plastic containers holding a thin layer
of sand and small stones

Keywords:
motor oil, properties, persistent, dissolvable, non-renewable, recyclable

Background:
Students should understand that motor oil comes from petroleum (a non-renewable resource) and that its recovery will save petroleum resources. They need to know that to keep a car in good running order, oil must be used to lubricate hot moving parts and that it must be changed on a regular basis. While some motor oil is disposed of properly and is recycled, much is dumped into storm drains, onto soil in vacant lots and into trashcans. They need to know that when improperly disposed of, oil persists in the environment and can have negative health effects. Students need to be aware that, because Americans depend so heavily on cars for transportation, huge quantities of used motor oil end up polluting the environment; more than in any other motorized country.

Knowledge and Performance Outcomes:
Knowledge: Students will understand the properties of motor oil, how it reacts with water, soil, sand and plants and will be aware of problems associated with its disposal. They will understand why motor oil is used in car engines and methods currently used for its disposal.

Performance: Students will carry out five experiments involving motor oil while in pairs or small groups. They will be able to keep accurate records of observations and will successfully complete a series of follow-up questions. Students will successfully conduct a small amount of research by questioning employees at a local gas station or recycling center. Students will be able to actively participate in a class discussion about suggestions to increase motor oil recycling.

Teacher Procedure:
1.) Teachers should assemble necessary materials.
2.) Plastic shoeboxes should be filled with a thin layer of sand and pebbles, ceramic bowls should be filled with soil about halfway to the top edge.
3.) Students should be broken into pairs or small groups
4.) Students should be advised not to get motor oil on skin or clothing and should be advised to notify teachers about any oil spills.
5.) Students must be asked to save the plastic spoon from one experiment to the next and store it in a small baggy.
Student Procedure:

**Experiment 1**
Using a disposable plastic spoon (saved in a baggy for other experiments), the students are to add a teaspoonful of motor oil to the jar containing the water. They should cap the jars and close tightly, shake the jars with the caps tightly closed. They are to observe the jar contents, record observations and set the jars aside for the following day. They are to observe the jars and record observations on the following day, but without shaking the jars again. They should answer the following questions.

1.) Do oil and water dissolve into one another? Explain.
2.) Does time cause oil to dissolve in the water? Explain.

**Experiment 2**
Students are to obtain a ceramic bowl containing soil. Using the same disposable spoon saved in the baggy, students should carefully dribble two tablespoons of oil over the soil surface. They should observe and record their observations. The next day they should find an area of soil that contains oil and carefully lift it up using a straw or toothpick and are to examine it. They should record their observations. They should answer the following question.

1.) What happens to the areas that contain oil?

**Experiment 3**
Students are to obtain a small plant or seedling in a pot. Using the same disposable spoon saved in the baggy, students should add a tablespoon of motor oil to the topsoil around the plant or seedling. Plants should then be lightly watered as needed over the course of a week. Each time plants are watered, another tablespoon of motor oil should be added to the soil. Students should examine the seedling each day of the seven-day experiment and record observations. Students should answer the following question.

1.) What has happened to the seedling as it has been exposed to motor oil?

**Experiment 4**
Students are to obtain a few feathers (if large) or a handful (if small). Students should carefully dip the feather into a clean jar of water and observe the behavior of the water on the feather and record their observations. They should then dip the ends of several feathers, one at a time, into the motor oil container. They should observe and record their observations. Then they should dip oily feathers into the clean water, observe and record their observations. Students should answer the following questions.

1.) In a normal feather, does water cause the feather to absorb water and get wet?
2.) In a feather exposed to oil, what happens to the individual parts of the feather?
3.) Does the oil on the feather wash off after being rinsed in clean water? Will it ever?

**Experiment 5**
Students are to obtain a prepared plastic shoebox containing a thin layer of sand and pebbles. Using the same disposable plastic spoon saved in the baggy, students should carefully dribble two tablespoons of motor oil over the sand and pebbles. They should then attempt to rinse the oil off several times with clean water in their jars. Students should observe and record their observations. Students should answer the following question.

1.) Does the oil stick to the sand and rocks after rinsing? Will it ever rinse off?

Follow-Up:
Student observations should be posted by small groups or as a class for experiments 1-5. Students should be lead in a discussion about the PERSISTENCE of motor oil in the environment and about its harmful effects on birds (feathers), plants and environments. Students can discuss the potential effects of a major off-shore spill on beaches, birds, plants, fish and other ocean life.

Follow-Up Questions:
Students may need additional assistance as they try to answer and discuss follow-up questions about recycling used oil. It may be helpful to segue the discussion into a strategy/campaign to change attitudes and practices dealing with used motor oil.
Part I
On a separate piece of paper draw and label the cross section of a modern sanitary landfill.

Part II
Answer the questions below:
1.) Why have sanitary landfills replaced open dumps?
   2.) Why do sanitary landfills layer with soil?
   3.) What are some of the environmental safeguards practiced at a sanitary landfill?
   4.) What is a byproduct produced by a sanitary landfill and how is it used?
Assessment 1 Answer Key

Part I Rubric

In drawing and labeling a cross section of a modern sanitary landfill, the student:

4- **ABOVE STANDARD**
   - Includes the appropriate layers in order from top to bottom
     1.) top soil layer
     2.) clay liner
     3.) plastic liner
     4.) at least two layers of waste with soil/sand below
     5.) waste with gravel below
     6.) plastic liner below gravel
     7.) clay liner below plastic liner
     8.) plastic liner below clay liner
     9.) clay base below plastic liner
    10.) soil at the bottom
    11.) groundwater below soil
   - Includes a gas recovery pipe/system in gravel layer.
   - Includes a leachate recovery system in gravel layer.
   - Creates layers that are easy to see.
   - Makes good use of paper space.
   - Neatly and correctly labels each layer.
   - Includes a title/label at the top of the page.

3- **AT STANDARD**
   - Draws a cross section of the sanitary landfill and includes all of the layers indicated in 4, above standard, but includes only one layer of waste with the soil/sand below OR
   - Drawing is missing one layer, the gas recovery system or the leachate recovery system.
   - Created layers are easy to see.
   - Makes good use of paper space.
   - Neatly and correctly labels each layer.
   - Includes title/label at the top of the page.

2- **BELOW STANDARD**
   - Draws a cross section of the sanitary landfill and includes most (7-8) of the layers indicated in 4, above standard.
   - Drawing is missing gas recovery system or leachate recovery system.
   - Created layers are easy to see.
   - Does not make the best use of paper space.
   - Neatly labels layers that are present.
   - Includes a title/label at the top of the page.

1- **SERIOUSLY BELOW STANDARD**
   - Draws a cross section of the sanitary landfill and includes some of the layers indicated in 4, above standard.
   - Incorrectly or illegibly labels the layers present.
   - Drawing is missing gas recovery and leachate recovery systems.
   - Makes poor use of space.
   - Does not include title/label at the top of the page.
Part II Rubric

4- ABOVE STANDARD
Student response to the four questions indicates complete understanding and answers include:
Sanitary landfills have replaced open dumps because they reduce odors, do not attract animals, and prevent run-off from entering surface and groundwater.
Sanitary landfills layer with cover material to reduce odors from trash, prevent exposure to health hazards, prevent animals from entering trash and prevent rain and snow from entering trash.
Environmental safeguards used at the sanitary landfill include:
1.) Cover material
2.) Use of a baseliner
3.) Leachate collection system
4.) Methane gas collection
5.) Air, soil and water collection
A by-product produced by the sanitary landfill is methane gas, used to produce electricity.
Whole sentences
Correct grammar, punctuation and spelling.

2- BELOW STANDARD
Student response to the four questions indicates some understanding and answers include:
Some of the points for questions # 1-3 but answers are incomplete.
Student correctly answers that methane gas is a byproduct of the sanitary landfill and is used to produce electricity.
Sentence fragments
Difficulty with grammar, punctuation and spelling.

1- SERIOUSLY BELOW STANDARD
Student response to the four questions indicates little understanding and answers include:
Few of the points in questions # 1-3.
One or more questions unanswered.
No response to question 4 or answer is completely incorrect.
Sentence fragments, single words are used.

3- AT STANDARD
Student responds to the four questions and indicates good understanding and answers include:
The majority of the points for questions # 1-3.
Student correctly answers that a byproduct of the sanitary landfill is methane gas and that methane is used to produce electricity.
Whole sentences
Correct grammar, punctuation and spelling.
Suggested Activities

1. Throwaway Society
2. Paper, Paper, Everywhere
3. Smart Shopper In-Class Field Trip (Kit Activity)
4. Smart Shopper-Part 2 (Kit Activity)
5. Smart Shopper-Part 3 (Kit Activity)
6. Recycle Cycle (Kit Activity)
7. All Wrapped Up
8. Consumers/Conservers

Supplementary Activities

A. Wise Use of Paper
B. Making Recycled Paper (Kit Activity)
C. Recycle Bicycle
D. Solid Waste/Recycling
E. Best Ever Compost
F. Mini-Composts

Assessments

a. Parts I and II and Rubrics
Main Concept:
Vast amounts of solid waste are produced by individuals, families and corporations. The volume of trash can be reduced.

Standards:
MS S3d the student produces evidence that demonstrates understanding of natural resource management and MS S4d the impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.

Activity Objective:
Individual and school-wide awareness of the volume of trash thrown away will be increased.

Materials:
Handout entitled, “Throw-Away Society”, poster board, markers, pens, pencils, crayons, rulers, paper, magazines, scissors, glue, push pins or other materials to secure poster board to a surface, poster boards

Keywords:
recycle, biodegradable, compost, toxic

Teacher Procedure:
Students should be familiar with the keywords either before or after they fill out the handout. A class discussion should follow completion of the worksheet, students should be given the correct answers and they should correct their papers.

Students should complete one large or a series of smaller bulletin boards or posters displaying information from the corrected handouts. Working in pairs or small groups, students should focus on one section/topic mentioned in the handout. They should use printed material, pictures and artwork to create the poster/bulletin board. Posters/bulletin boards can then be displayed in a prominent place in the school building. (The cafeteria is a good choice).

Answers to the handout are as follows:
1-c  2-b  3-b  4-c  5-b  6-c  7-c  8-c  9-a  10-a  11-b

Knowledge and Performance Outcomes:
Knowledge: Students will understand that they contribute to the solid waste disposal problem and will become familiar with solid waste disposal facts.

Performance: Students will complete the “Throw-Away Society” handout and will participate in a class discussion and will correct their handouts. Students will create a bulletin board displaying trash facts that can be prominently displayed in the school building.

Follow-Up:
Students can write a report or fact sheet using the information in the handout. They can take small bulletin boards and/or reports home to share the information with their families.
Do you know what the term “THROW-AWAY-SOCIETY” means? The questions below will help you realize just how much we are throwing away. See how much you know about our “throw-away-society.”

1.) How much garbage do you think a typical American family of four is responsible for in one week? (This includes our individual share of commercial waste.)
   a. about 20 pounds  c. 80-150 pounds
   b. 50 pounds         d. 250 pounds

2.) How much garbage is that for each person for one day?
   a. 1 pound          c. over 10 pounds
   b. 3-4 pounds        d. 22 pounds

3.) What fraction of our garbage is paper?
   a. 1/10            c. 1/2
   b. 1/3                d. 3/4

4.) How many pounds of glass do you think you use in one year?
   a. 50 pounds        c. 500 pounds
   b. 150 pounds        d. 1000 pounds

5.) What does RECYCLE mean?
   a. to burn           c. metal
   b. to make into new product  d. all of these
   c. to break down      d. to throw away

6.) What does BIODEGRADABLE mean?
   a. burn             c. break down or rot
   b. use again         d. throw away

7.) How much paper does a family of four throw away in a week?
   a. 20 pounds        c. 10 pounds
   b. 6 pounds         d. 60 pounds

8.) How much food (scraps) does a family of four throw away in a week?
   a. 50-60 pounds      c. 10-15 pounds
   b. 5-10 pounds       d. 25-30 pounds

9.) Look carefully at this list:
   7 million cars
   7 million TV sets
   62 billion cans
   43 billion bottles
   65 billion tops to cans and bottles
   70 million tons of paper

   The list is probably...
   a. what your country will discard in one year
   b. what your town will discard in one year
   c. what your school will discard in one year
   d. what your family will discard in one year

10.) Which of the following materials found in your garbage, can be recycled or composted?
    a. paper           c. metal
    b. food             d. all of these

11.) Which of these is NOT toxic (poisonous)?
    a. nail polish remover     d. weed killer
    b. vinegar                  e. insect spray
    c. furniture polish
Main Concepts:
1) Information provides a historical background of paper manufacture and use 2) New paper manufacture uses trees, water, toxic chemicals and electricity 3) Recycled paper manufacture conserves trees and other resources and creates less pollution.

Standards:
MS S3d The student produces evidence that demonstrates understanding of natural resource management and MS S4e the impact of science, such as historical and contemporary contributions; and interactions between science and society.

Activity Objectives:
1) Students will learn about the history of paper use and manufacture 2) Students will learn about the volume of resources consumed and pollution produced by paper manufacture and 3) Students will think about their own household paper use and will consider how paper can be conserved.

Materials:

Keywords:
cellulose, fibers, interwoven, flax, pulp, papyrus, reed, linen, cotton, BTU, carbon dioxide, fossil fuels, habitat, erosion, “Greenhouse Effect”, hemp, bamboo

Background:

Knowledge and Performance Outcomes:
Knowledge: Students will understand and will be able to use the vocabulary terms listed in the keywords. They will be able to identify the major steps in the paper making process.
Performance: Students will be able to describe the major historical changes in paper use and in its manufacture. They will successfully complete the student worksheet. Students will be able to describe why recycling of paper is important in resource conservation.

Teacher Notes:
Some students will have heard of some or all of the keywords, but clarification may be necessary. The “Vocabulary Definition/Description” fact sheet may be helpful if students are unfamiliar with certain words.
To complete the worksheet, students may need to reference “Paper” (section 6) in the Resource Material section of the curriculum guide.
After students have completed the worksheet, the teacher should engage students in a class discussion, emphasizing the need to recycle and reuse paper and the need to reduce its consumption.

Teacher Procedure:
1.) Have students read the Paper, Paper, Everywhere handout.
2.) Have students underline the keywords in the handout.
3.) Discuss and define these words for the students.
4.) Have students write the definitions for the keywords in their notebooks for future reference.
5.) Have students complete the student worksheet.
6.) Discuss the student responses.
Paper, Paper, Everywhere

History

Man has always needed a way to record important information such as money paid for goods and important historical information such as how many people live within a town. Such information was recorded on stone or clay slabs that were difficult to write on and to store. They also broke often and were extremely heavy to carry around. Because of this, man first created paper in China in about 100 B.C. but it wasn’t really available until around 800 A.D.

Paper was originally made from flax, papyrus, tree bark, grass and cotton fibers. Some paper was made from recycled fishing nets and clothing made of linen (flax) and cotton. The plants or clothing used to make the paper were crushed or beaten until very soft and mushy and then mixed with water. Some type of cloth was used to hold the mixture and then the mixture was spread very thin over the cloth surface. The water was drained through the cloth and the resulting paper was allowed to dry.

Almost any plant or cloth made from plants can be made into paper because plant cells contain cellulose in their cell walls. It is cellulose that keeps trees standing after the cells have died. The cellulose is tough and lasts a long time.

Insects have been making paper into nests for millions of years by chewing plant fibers and mixing them with water. Wasps are experts at it!

Paper, however made, provided a light, inexpensive way to store information and since it was often made from used clothing, it can be called the original recycled material. But as demand for paper grew, people searched for a new source of cellulose that was available in large supply.

The first major Italian paper-making center was located in Fabriano, Italy, where mills were first set up in 1350. Paper-making was so extensive that used clothing sales became a large industry (rag men).

But by 1850, small plants and used clothing could not provide all of the cellulose needed at the paper mills. Wood became the material of choice in the paper-making industry. The United States, containing large forests, became the leading paper maker and consumer.

Although cellulose still comes from cotton, flax, hemp, straw, bamboo and some grasses that are used for special papers, today most paper is made from trees.
Facts

Paper consumption in the United States is the highest in the world at about 600 pounds per person, per year. This consumption includes computer paper, paper cups, newspapers, paper towels, toilet paper and others.

In the United States, the 600 pounds of paper per person per year has consumed 5-6 trees, about 20,000 gallons of water, and about 7.8 MILLION BTUs of energy that are used to cook the wood fibers with water into pulp (taking 7-10 hours).

The wood pulp is treated with acid or base to release the fibers. This treatment produces dangerous pollutants that used to be dumped into streams, rivers or lakes. Today, environmental regulations prevent most dumping.

Only about 50% of the fibers present in the wood enter the pulp. As a result, for each person, per year, about 44 pounds of solid waste are produced. In addition, 21 pounds of air pollution are created by burning fossil fuels in the factories and about 12 pounds of water pollution are created as some byproducts of paper-making enter local waterways.

In the United States, 35% of our trash consists of paper waste, some of which can be recycled. Recycled paper can be used to make boxes, wrapping paper, cards, paper packing and construction materials and some newsprint. Recycling paper reduces our need for trees, reduces energy use and pollution. Recycling paper may also help to prevent some of the Greenhouse Effect.

When plants carry out their life processes, they absorb carbon dioxide and use it to create energy. As a waste, plants produce oxygen that is necessary for animal life. When large amounts of trees are cut down, carbon dioxide builds up in the atmosphere. The carbon dioxide and other gases help to trap heat in the atmosphere. As a result, the earth heats up (described as the “Greenhouse Effect”). This process can create global warming that has very serious potential effects for the entire earth. So it is essential that MORE trees are saved, and new ones planted; not more trees cut down.

Trees also anchor soil and help to prevent soil erosion. Erosion literally washes land away in some areas, reducing areas that are available for farming and living.
1.) Cellulose- a carbohydrate (starch) present in plant cell walls that surrounds the plant cell membrane. It stiffens plant cells.
2.) Fibers- plants contain cellulose in string-like structures called fibers.
3.) Interwoven- when plants are crushed, fibers are released and added to water, the fibers arrange in a random pattern and become interwoven.
4.) Flax- a plant that can be used to make cloth or paper called linen.
5.) Pulp- when wood fibers are added to water they create pulp.
6.) Papyrus- a reed plant found in Egypt used to make paper. The word paper derives from papyrus.
7.) Reed- a tall, slender type of plant growing in water or in marshy areas.
8.) Cotton- a bushy plant that produces seeds in a fluffy ball of material (cotton).
9.) BTU- energy unit-British Thermal Unit.
10.) Carbon dioxide- a gas produced by animals and man as they exhale. Produced in huge quantities by burning fossil fuels in the presence of oxygen. Absorbed by plants as a requirement for photosynthesis. Increasing amounts in the atmosphere help to trap UV light in the atmosphere leading to global warming (in a process called the Greenhouse Effect).
11.) Fossil fuels- coal, oil and natural gas and their derivatives.
12.) Habitat- the local environment in which an animal or plant lives with other species.
13.) Erosion- the wearing or washing away of sand, soil and rock usually due to flowing water.
14.) “Greenhouse Effect”- the trapping of heat in the atmosphere due to increased levels of carbon dioxide and other pollutant gases.
15.) Hemp- a plant that produces a very coarse fiber often used to make rope.
16.) Bamboo- a very slender, tall, stiff plant with very thick cellulose walls with a soft center.
Please answer the following questions. Use whole sentences.

1.) Name three paper products that you used at home today and explain how you used them. Do not include bathroom tissue.


2.) Name three paper products that you used in school today and explain how you used them. Do not include bathroom tissue.


3.) You have mentioned six paper products in questions # 1 and # 2. Please place each paper product under the categories below.

<table>
<thead>
<tr>
<th>Cleaning</th>
<th>Recreation</th>
<th>Learning</th>
<th>Communication</th>
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<tr>
<td>Art</td>
<td>Personal Hygiene</td>
<td>Storage</td>
<td>Advertising</td>
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</table>

4.) Different types of paper have different uses. Choose three papers that you mentioned previously and explain how each paper is suited for its use.

   a) ______________________________________________________

   ______________________________________________________

   b) ______________________________________________________

   ______________________________________________________

   c) ______________________________________________________

   ______________________________________________________
5.) If you didn’t have the six paper products that you previously mentioned, what would you use instead for each purpose?

a) __________________________________________________________

b) __________________________________________________________

c) __________________________________________________________

d) __________________________________________________________

e) __________________________________________________________

f) __________________________________________________________

6.) After reading the “Facts” section of the “Paper, Paper, Everywhere” handout, why do you think it is important to use recycled paper?

________________________________________________________________

________________________________________________________________

________________________________________________________________

7.) After reading the “Facts” section of the handout, why is it necessary to reduce paper use?

________________________________________________________________

________________________________________________________________

________________________________________________________________

8.) How can YOU reduce the amount of paper that you consume?

________________________________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________
Main Concept:
When purchasing goods, consumers can make choices that reduce consumption of resources and reduce trash generation (eco-friendly shopping).

Standards:
MS S3d: The student produces evidence that demonstrates understanding of natural resource management and MS S4c health, such as nutrition, exercise, disease; effects of drugs and toxic substances; personal environmental safety and resources and environmental stress and MS S4d impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.

Health-Standard 3: Students will demonstrate the ability to practice health-enhancing behaviors and reduce health risks. Standard 6: The student will demonstrate the ability to use goal-setting and decision-making skills to enhance health.

Activity Objective:
Students will apply the principles of eco-friendly shopping by rotating through mock “field trip” stations.

Materials:
1.) Plastic shopping bag, paper shopping bag (illustrates principles 1, 2, 4).
2.) Styrofoam® egg carton, paper egg carton (illustrates principles 1, 2, 4).
3.) Paper made from recycled content, new paper (illustrates principle 1).
4.) Plastic baggie, aluminum foil square (illustrates principles 2, 3, 4, 5, 7).
6.) Styrofoam® cup, paper cup (illustrates principle 4).
6.) 5 lb bag of sugar, individual sugar packets (illustrates principle 6).
7.) Paper tablecloth, vinyl table cloth (illustrates principles 3, 7).
8.) Juice pouch (not carton), juice in recyclable plastic bottle (illustrates principles 1, 2, 5, 7).
9.) Reusable lunch bag, paper lunch bag (illustrates principles 4, 5).
10.) Disposable snack pack in tray, fruit such as banana, apple (illustrates principles 4, 5).
11.) Styrofoam® peanuts, cellulose peanuts (illustrates principles 11, 2, 4)
12.) Individual disposable soup serving, small Thermos® container (illustrates principles 3, 5, 7).

Keywords:
eco-friendly, recycle, durable, disposable, reuse, toxic, packaging, conserve, cellulose, bulk

Knowledge and Performance Outcomes:
Knowledge: Student will know that seven principals that make up the concept of “eco-friendly” shopping (decision-making while planning/shopping that opts to buy recycled/reusable products that conserve resources rather than buying disposables).

Performance: Students will apply the seven principals of “eco-friendly” shopping as they choose items and packaging during the mock field trip to the store. In applying the principals, they will “purchase” reusable, recycled, recyclable items rather than disposables.
Teacher Notes:
Students will need to know the definitions of the keywords before the beginning of the activity. In addition, students will need to know the principles of “eco-friendly” shopping which are:

1.) Buy goods and packaging made from recycled materials.
2.) Buy products that are recyclable or are in recyclable containers.
3.) Buy durable materials rather than disposables.
4.) Avoid buying toxic or potentially toxic goods and packaging.
5.) Buy goods that reduce packaging volume.
6.) Buy in bulk to reduce the need for individual packaging.
7.) Buy items that can be reused rather than thrown away.

Although plastics and Styrofoam® are not toxic when bought, students need to know that most are completely non-biodegradable and produces toxic fumes when burned or in contact with other substances that may be present in a landfill. Cellulose “peanuts” made from corn are biodegradable. Goods made from recycled materials carry a label/statement that indicates that fact. Items at the stations may be substituted as necessary as long as replacements illustrate one or more of the “eco-friendly” shopping principals. The teacher and/or students may need to conduct some research to determine if various communities are able to recycle the materials found at the stations.

Teacher Procedure:
Assemble materials at each of the twelve stations. Students will rotate through the stations in small groups as they complete the worksheet. Students may visit the stations in any order.

Encourage small group discussion during the activity.

Engage the students in a class discussion of the mock field trip and the principals of eco-friendly shopping after the activity.

Have students suggest lifestyle changes that they and/or their families can make to regularly apply the principles of eco-friendly shopping and the principles of reduce, reuse, recycle.
### Smart Shopper In-Class Field Trip

**Name**

Go to each station and observe the paired materials. Then answer the questions below.

**Date**

Does your community recycle these materials?

<table>
<thead>
<tr>
<th>Station Number</th>
<th>Item Made from Recycled Materials</th>
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Does your community recycle these materials again?

<table>
<thead>
<tr>
<th>Station Number</th>
<th>Item Made from Recycled Materials</th>
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How do you know that the items come from recycled materials?

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<th>Station Number</th>
<th>Item Made from Recycled Materials</th>
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### 1.) Items made from recycled materials:

Which items at the stations are made from recycled materials? List them along with the matching station number.

<table>
<thead>
<tr>
<th>Station Number</th>
<th>Item Made from Recycled Materials</th>
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### 2.) Items in recyclable containers:

Which items at the stations come in recyclable containers? List them along with the station number.

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<th>Station Number</th>
<th>Item Made from Recyclable Containers</th>
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What kind of containers do you recycle at home?

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<th>Kind of Containers</th>
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### 3.) Disposable/Durable Items:

Which items at the stations are durable (can be used many times)? List them along with the station numbers.

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<tr>
<th>Station Number</th>
<th>Durable Item</th>
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List 3 benefits of using durable versus disposable items.

<table>
<thead>
<tr>
<th>Benefit 1</th>
<th>Benefit 2</th>
<th>Benefit 3</th>
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List some durable items that are in your homes.

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<th>Item</th>
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Rhode Island Resource Recovery Corporation

Project WASTE Curriculum Guide
4.) Potentially Toxic Items:
Which items at the stations are potentially toxic to humans and wildlife? List them along with their station numbers.


Why are these items considered potentially toxic?


What items could you substitute for the items that are toxic? List the toxic item and a possible substitute for it.


What is the meaning of the word biodegradable?


5.) Reducing Packaging Volume:
Which items at the stations have the least amount of packaging? List the items along with their station number.


Why are these items more eco-friendly?


What materials are most often used for packaging?


6.) Buying In Bulk:
Which items at the stations are bulk-packaged? List them along with the station numbers.


Rhode Island Resource Recovery Corporation

Project WASTE Curriculum Guide
How does buying in bulk reduce waste and conserve resources? Explain using whole sentences.

7.) Reusables:

Which items at the stations can be reused either for the original or for some new purpose? List the items along with their station numbers.

Give examples of how two items can be reused for the original AND a new purpose.

What items does your family buy in bulk?

What resources are conserved by reusing these two items? Explain using whole sentences.
Main Concepts:
1) Packaging is often essential for shipping and safeguarding goods. 2) Packaging may come from renewable or non-renewable sources. 3) Packaging from renewable or non-renewable sources may be recycled or reused in new and novel ways. 4) Packaging accounts for slightly less than half of all household waste. This is a symbol of our “throwaway” society. 5) Creative use of packaging materials can reduce household trash.

Standards:
MS S3d: The student produces evidence that demonstrates understanding of natural resource management and MS S4d Impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions and MS S5e Identifies problems; proposes and implements solutions; and evaluates the accuracy, design, and outcomes of investigations.

MS E2d: The student produces a narrative procedure that provides a guide to action in order to anticipate a reader’s needs; creates expectations through predictable structures, e.g., headings; and provides transitions between steps, includes relevant information, excludes extraneous information, anticipates problems, mistakes, and misunderstandings that might arise for the reader and provides a sense of closure for the writing.

Activity Objective:
Students will identify positive and negative characteristics of packaging materials. They will create new uses and/or new items with two packaging materials or packaging items.

Materials:
Smart Shopper student worksheet and fifteen assorted items and/or packaging that may include:
- Unopened box of pain reliever (box, plastic container, cotton)
- Light bulb(s) in cardboard sleeve (light bulb, sleeve)
- Empty film canister (plastic container)
- Toilet paper in paper wrapping (paper wrapping, cardboard tube)
- Unopened box of toothpaste (box, tube, plastic cap)
- Aerosol plastic caps
- Bubble wrap
- Thin film plastic wrapping
- Styrofoam® popcorn
- Cellulose popcorn
- Plastic bread wrapper
- Clean used baggies
- Plastic milk cartons
- Large cardboard juice/ milk cartons
- Styrofoam® egg cartons
- Materials to create new objects that may include markers, pens, construction paper, scissors, glue, etc.

Keywords:
packaging, resources, reduce, reuse, recycle
Knowledge and Performance Outcomes:

Knowledge: Students will understand that packaging may be essential to secure products and prevent damage in shipping and in stores, but may also be designed to advertise and sell products. Students will be able to define packaging in their own words and will know that reusing and recycling packaging materials reduces the volume of household trash.

Performance: Students will be able to work successfully in small groups to create both a list of packaging benefits and a list of packaging drawbacks. Students will be able to work successfully in small groups of two to four to create new items/uses for two packaging items selected from packaging “waste”.

Teacher Notes:

Students can complete the new product at home as an assignment or in class. The finished items can be displayed in school accompanied by a written explanation as indicated in the Teacher Procedure or students can present the items and describe it to the class.

Teacher Procedure:

1.) Direct students to define packaging in their own words.
2.) Divide students into groups of two to four. Have students brainstorm the possible benefits and drawbacks of packaging. These should be listed on the student worksheet. Student volunteers may transcribe student ideas into class lists.
3.) Students should select two of the packaging materials/items from the materials available. In their group, they must develop an alternative use for the item/packaging. This may be done in class or at home.
4.) In groups, students should create the new item using home/classroom materials.
5.) In oral or written form, students should explain what item/packaging is being used, how the new product was created and how it is to be used.
Smart Shopper Part 2

Name

Date

Group Members

Define packaging in your own words.

List the benefits of packaging.

List the drawbacks of packaging.

Indicate the two items/packaging materials selected.

1.

2.

What is the new use for #1?

What is the new use for #2?

How was #1 recreated? Explain the procedure in detail so that others could make it.

How was #2 recreated? Explain the procedure in detail so that others could make it.
Main Concepts:
1) Consumers can choose to buy products that use fewer of the earth’s natural resources and/or create less trash or pollution. 2) Consumers can identify unnecessary packaging and items that can be recycled.

Standards:
MS S3d: The student produces evidence that demonstrates understanding of natural resource management and MS S4d the impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions; and MS S4c health, such as nutrition, exercise and disease; effects of drugs and toxins; personal and environmental safety; and resources and environmental stress.

Health: Standard 3: Students will demonstrate the ability to practice health-enhancing behaviors and reduce health risks.

Social Studies: Economics: Standard 4: Students will understand that people respond predictably to positive and negative incentives (to purchase products).

Activity Objectives:
Students will examine common household items and their packaging, will identify the resources used to make the item and will determine if the items can be recycled or not. If not, students will estimate the amount of garbage each item produces (when used or broken) and how much garbage the packaging produces immediately.

Materials:
Note- Items are grouped together because they have a common function.
1) cloth dish towel 2) paper towel 3) sponge
4) cloth napkin 5) paper napkin
6) plastic food container 7) aluminum foil
8) plastic cup 9) Styrofoam® cup 10) glass or ceramic drinking cup/mug 11) plastic travel mug
12) ammonia cleaner 13) biodegradable cleaner
14) bar of soap 15) container of body wash
16) dustpan and broom (taped together) 17) vacuum bag
18) unopened packaged item (small toy or makeup article)

Keywords: recyclable, reusable, packaging, resource, biodegradable, non-biodegradable

Background:
Because of the variety of materials that students will examine (including plastics, glass, paper, aluminum foil, cleaners, soap, etc.), it will be necessary for students to have an understanding of the resources and processes used to create the items before they begin the activity. They will also need to have prior knowledge of the concept of biodegradability.

Knowledge and Performance Outcomes:
Knowledge: Students will understand that not all goods that they purchase have the same potential impact on the environment; some goods produce more trash and have more environmental impact than others. Using concepts already learned, students will examine the items displayed and recall prior knowledge.

Performance: Students will use prior knowledge to evaluate items displayed to evaluate 1) the packaging 2) the amount of resources used to create the item 3) recyclability and will successfully complete a worksheet.

Teacher Notes:
Students should have an understanding of the keywords and the concepts they represent before the activity. They must know that plastics derive from petroleum (non-renewable resource), that paper and cardboard derive from wood (renewable resource), that polyester cloth derives from petroleum (non-renewable resource) while cotton cloth derives from the cotton plant (renewable resource). In addition, they must know that aluminum derives from bauxite (non-renewable resource)
and that glass derives from sand (not renewable in the foreseeable future, but not a limited resource), etc.

Students will need to know that soap is made from animal fat and lye and that soap is different from body wash (a detergent).

In a discussion of the benefits, drawbacks of some of the grouped items, it will be difficult for students to decide, for example, if a plastic food container (petroleum) has more benefits than aluminum foil (bauxite ore). Students should be directed toward REUSE and RECYCLABILITY — in which case, both items may come out “even” in discussion as both have benefits and are preferable to completely disposable storage items. A discussion of the efficiency of vacuuming vs. wet/dry mopping and sweeping, use of a dustpan, may be appropriate with an accompanying discussion of electricity needed to power the vacuum.

Students need to know that most glass, aluminum and steel containers are the products of recycling. Some paper products and plastics may also have recycled content. This should be mentioned before the activity to aid the student in the decision-making process.

Students should be shown the symbols for recycled and recyclable items. Recycled symbols indicate that an item was created by using some or all previously-used materials while recyclable means that the item can be remade into another item. The most recyclable items are glass, aluminum and steel which can be recycled as many as several hundred times. Paper items (cardboard, computer paper, magazines and newspapers) can be recycled several times. Only some plastics can be recycled (not in all communities). Students need to be aware that plastics are molded with recyclable numbers that indicate the type of plastic they contain. In all communities, only low numbers (1-2) indicate that the plastic is recyclable.

Higher numbers indicate that although the technology may exist to recycle these items, they are not normally recycled. Students should be shown plastic items containing both lower and higher numbers prior to the activity. Information about plastics may be found in the Plastics (Section 6) in the Resource Materials Section Reference Section of the curriculum guide.

Students should participate in a discussion about which is preferable — a sponge or paper towel; a Styrofoam® cup or a reusable travel mug; a glass or a paper cup, etc. As a class, they should create lists of preferred items that can be displayed in a prominent area of the school.

**Teacher Procedure:**

1.) Students should be chosen as volunteers to pull individual items out of a pillowcase or other container that is opaque.

2.) Instruct students to identify the items as reusable or disposable.

3.) Instruct students to identify the resource(s) used to create each item chosen and to decide if the items conserves resources (reusable) or wastes the resources (disposable).

4.) Instruct the students to think about how the item comes packaged in stores. They should decide if the packaging of the item is necessary or is used to attract the consumer.

5.) Instruct the students that while considering the packaging of the items, they should decide if the packaging itself contains recycled, renewable or non-renewable resource materials.

6.) Instruct students to consider whether the item or its packaging can be recycled in their area.

7.) Instruct students to decide if the item or its packaging can be reused for another purpose.

8.) Instruct students to decide if the ammonia or biodegradable cleaning product is better for the environment and instruct them to explain why they have made such a decision.
As student volunteers, pull items out of a container and identify the resource(s) used to create each item and decide if the resource(s) are conserved (if the item is reusable) or wastes the resources (if the item is disposable). You should think about how the item is packaged in stores. Is the packaging necessary or is it used to attract you to buy it? Is the packaging made from recycled, renewable or non-renewable resources? Can you recycle the item or its packaging in your area?

Item #1

Name

Resources Used to Make

<table>
<thead>
<tr>
<th>Reusable</th>
<th>Yes</th>
<th>No</th>
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Disposable: ○ Yes ○ No

Packaging Materials

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<thead>
<tr>
<th>Packaging is Necessary</th>
<th>Yes</th>
<th>No</th>
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Packaging is Advertising: ○ Yes ○ No

Packaging Made From:

Recyclable Item or Recyclable Packaging Parts: Explain

Repeat this process for every item that is shown. You can continue on the back of this sheet and then on paper as directed by your teacher.
Recycle Cycle

Grades 5-8

Main Concept:
Consumers must buy recycled products (creating a market) in order to create a demand for recyclables. Without demand, recyclables will be discarded and will end up as trash.

Standards:
MS S3d: The student produces evidence that demonstrates understanding of natural resource management and MS S4d the impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions and MS S4e impact of science, such as historical and contemporary contributions; and interactions between science and society.

Activity Objective:
Students will understand that recyclable items can be reformed/remade into useful items thereby conserving resources and reducing trash volume.

Materials:

**Table A**
- Newspaper
- Office/computer paper
- Milk jug
- Styrofoam® cup
- Bicycle or small tire
- 2L soda bottle
- Corrugated cardboard
- Used motor oil
- Glass
- Aluminum cans

**Table B**
- Wall fiberboard (homesote or paper-based ceiling tile)
- Pencil
- House insulation
- Napkins, wrapping paper, note cards
- PVC fencing, decking or plastic molding
- Ruler
- Rubber crumbs (for asphalt, carpet pad or sandal soles)
- Polartec® fleece clothing (or polyester carpet fibers)
- New cardboard
- Recycled motor oil
- Fiberglas® insulation (glass tiles, new bottles)
- Aluminum siding (aluminum cookware)

Keywords:
recycle, recyclable

Knowledge and Performance Outcomes:
Knowledge: Students will understand that for purchased products to be recycled, there must be a market for items made from recycled materials. If there is no market for such items, companies that make these items will go out of business. If this happens, recyclable materials will just be thrown away.

Performance: Students will be able to correctly identify the source (table A) of some recycled products (table B).

Teacher Notes:
Items may be added to the materials list as long as the recyclable AND its recycled product are available. Recyclables and recycled goods should not be placed in the same order on the two different tables, but should be mixed up otherwise students will immediately match them up without thinking.

Additional materials that could be added to the tables include:

**Table A**
- wood chips and small wood pieces
- Steel cans
- Plastic pieces
- Cloth

**Table B**
- Brown paper bags
- Tools such as a hammer, screwdriver
- Felt or shredded filling
- Biodegradable root ball wrappings
- MDF (medium density fiberboard)
- Biodegradable seedling pots
- Frisbees or reusable plastic containers
Teacher Procedure:
1.) Remind students of the meaning of the words recycle, recyclable.
2.) Students should obtain a piece of paper. They should create two columns on their papers, labeling them Source (from table A) and on the other side, Product (from table B).
3.) Students should be instructed to approach the tables with the piece of paper. They should examine the contents of table A (sources) and try to find the recycled item made from the source on table B. Instruct them that more than one item on table B may be made from a source.
4.) After the activity, students should participate in a class discussion about the accuracy of their matching sources with products.
5.) The teacher should emphasize the necessity of recycling and its relationship to resource conservation. The teacher should mention that while some items are turned into the same items when remade (glass bottles, jars), others end up in entirely different products (2L soda bottle into Polartec® fleece).
6.) Remind students that while glass and steel can be recycled hundreds of times; most plastics can be recycled only once, thereby reducing their usefulness as recyclables (another reason to avoid them if possible).
All Wrapped Up

Grades 5-8

Main Concepts:
1) Packaging is needed for a variety of reasons and is often used once and thrown away, wasting raw materials and energy and 2) the volume of packaging added to the waste stream can be reduced.

Standards:
MS S3d: the student produces evidence that demonstrates understanding of natural resource management and MS S3d the impact of technology such as constraints and trade-offs; feedback; benefits and risks; and problem and solutions.

Activity Objective:
Students will understand the purpose of packaging, will be able to identify wasteful packaging and suggest ways to reduce packaging volume.

Materials:
many types of product packaging made form aluminum, glass, plastic, paper, wood, and other materials, magazine advertisements, student handout entitled All Wrapped Up

Keywords:
packaging, recycling, non-recyclable, containment, tampering, shrink-wrap, Styrofoam®.

Background:
Packaging has several uses. It may provide protection to a product during shipping. It may provide protection to the consumer by preventing contamination or tampering. Or it may prove to be a useful marketing tool for the manufacturer. In some cases packaging may serve multiple uses. In the United States, Americans are accustomed to seeing a lot of packaging materials because they expect their purchase items to be placed in a paper or plastic bag as a convenient method of carrying the item. Some Europeans, however, frequent open food markets where they bring their own wicker basket, cloth or string bag to carry purchases; a bag or a basket that can be used over and over again. In addition, U.S. supermarkets often feature fruits and vegetables wrapped in plastic shrink-wrap and polystyrene (Styrofoam®). Open food markets do not use synthetic wrapping; instead they rely on nature's own packaging, i.e. the banana peel or the potato skin.

Why do we buy one product instead of another? Often we buy it because of packaging; packaging used for advertising. Packaging accounts for 10-15% (and sometimes more than 50%) of the cost of a product and accounts for 1/3 of what goes into a family's trashcan. Excess and non-recyclable packaging adds to our energy and waste problems. Nearly $1 out of every $10 spent for food and beverages in the United States pays for packaging. In industrial countries, packaging comprises about 30% of the weight and 50% of the volume of household waste.

We can cut down on packaging.

Knowledge and Performance Outcomes:
Knowledge: Students will understand that although some packaging is necessary to protect food or products, much packaging is not essential and is used solely to promote sales of the item. They will understand that in countries other than the U.S. much less packaging is used, contributing much less volume to the trash problem.

Performance: Students will be able to identify the packaging examined as essential for product protection, protect the health of the consumer. Prevent theft or tampering or to promote the product or provide advertising. Students will be able to create categories that will identify packaging types and will be able to determine whether the packaging used by consumers.

Teacher Notes:
Students need to understand all of the key words listed. If they are not familiar with tampering, shrink-wrap, Styrofoam®, these should be discussed before the activity.

Students should bring in advertisements from old magazines before or during the activity. Students should participate in a discussion about product packaging and should be able to give reasons for their decisions.
Students should work in pairs or small groups during the activity.

Plastics classification numbers and descriptions are included in the Plastics section located at the rear of the curriculum guide.

**Teacher Procedure:**

1. Ask students to bring examples of advertising and packaging to class.

2. Discuss the following:
   - Which products need the protection of packaging?
   - Which products need packaging to protect public health, prevent theft, provide advertising or facilitate handling and shipping?
   - Which packaging is recyclable?
   - How can you identify packaging made from recycled materials? (Look for information on the package)
   - Is any of the packaging unnecessary or excessive?
   - Which of the products can be sold in bulk instead of individual proportions?
   - What is the advantage of larger quantity packaging? (A 3-oz. tube of toothpaste uses 50% more packaging per ounce than a 7 oz. tube)
   - Could the package be made in a way that conserves more resources than energy?
   - Could this product be packaged in fewer materials?

3. Ask the students to suggest ways to package the market products that preserve natural resources and protect the environment. The teacher should list their suggestions on the board. If they do not suggest the following, include these suggestions on the board as well:
   - Avoid products packaged in non-recyclable plastic containers. Find out which plastics are recycled in your area, and buy products packaged in these containers.
   - Buy products and packaging made from recycled/recyclable materials like glass, metal, aluminum, and paper.
   - Buy fewer prepackaged and pre-cooked foods. Cooking from scratch saves energy, costs less, and often is more nutritious.
   - Choose durable shopping bags, string bags, and knapsacks.

**Follow Up:**

Solicit class suggestions about ways to encourage producers and retailers to be more conscious of the environment. Ask each member of the class to undertake one of the following activities and to share the responses they receive with their classmates.

- Complain to retailers about specific products that are over-packaged.
- Encourage retailers to stock returnable and recyclables (e.g. glass milk containers)
- Contact local legislators and ask them to support container standards that expand the use of returnable, reusable packaging
- Write to manufacturers suggesting changes in the amount of packaging they employ.
- Write to packaging companies urging the use of recycled and recyclable materials.

Have students list three examples of recyclable and three examples of non-recyclable packaging.

Have students decide what characteristics were used to decide if an item of packaging was wasteful or necessary.
All Wrapped Up

Name

Date

You are to bring in the following materials to class for the activity:
Two to four advertisements from old magazines
Two to four samples of product packaging.

Your teacher will lead a discussion of the advertisements and you will answer the following questions:

1.) What items are used in packaging of the product?
Examine the packaging items you have brought in. Answer the following questions:

   1.) What are the items used in packaging?
   What are they made of? (List separately for each item)

2.) What are the packaging materials made of?

3.) Which items can you see are ESSENTIAL to protect health, prevent tampering or theft, or are necessary to protect the product?

4.) Which items in the packaging are used only for advertisement?
4.) Are the packaging items essential or wasteful? List items as essential or wasteful and explain why each item has been placed in the essential or wasteful category.

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5.) Does packaging influence how well a product sells? Explain.

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6.) Design a way or several ways to categorize the packaging. Examples of the categories would be “natural” (potato skins, banana peels), recyclable (certain plastics, paper), etc. Place items into your chosen category.

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7.) Have a discussion with your partner or team members. Discuss what happens to the packaging items when they are discharged. Which packaging is the most wasteful, least wasteful. List items under these two categories.

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8.) Consider the item that you brought in. Design a new, less wasteful or more recyclable item. Explain or draw the new packaging below.

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**Main Concept:**
Natural resources are the basis for all products that are manufactured. When we consume products excessively, we contribute to resource depletion.

**Standards:**
MS S3a: The student produces evidence that demonstrates understanding of natural resource management and MS S 4c health, such as nutrition exercise, and disease; effects of drugs and toxic substances; personal and environmental stress and MS S4d the impact of technology, such as constraints and trade offs; feedback; benefits and risks; and problems and solutions.

**Activity Objective:**
Students will learn about the concepts of consumerism and conservation.

**Materials:**
Handout entitled Consume/Conserve: The Choice Is Yours

**Keywords:**
consume, conserve, disposable, reuse, natural resources, depletion, pollution, informed choice.

**Background:**
The increased rate at which resources disappear and the rising mound of waste we have to dispose of are a direct result of the ways that we use our resources in our daily lives. Americans, on a per person basis, consume far more energy, food, and other natural resources than do people in other parts of the world.

Already there has been serious environmental damage caused by improper use of our natural resources. Mineral resources such as lead, zinc, and copper are near depletion. Natural gas and oil are disappearing rapidly. Experts predict that we will run out of these fossil fuel supplies in the next 30-40 years, and our coal supply will be exhausted by the year 2040. Pollution threatens our supplies of air, water, and soil. If we want to conserve natural resources for generations to come and improve our present environment, we must make informed choices as to how we use our natural resources today.

**Teacher Procedure:**
1.) Students should be asked to define the keywords listed above before beginning the activity. The teacher can correct any misunderstandings and give correct definitions or supply definitions for unknown keywords.

2.) The teacher should write the words “consume” and “conserve” on the board and students should be asked to brainstorm examples of items that they currently consume and/or conserve. These should be listed under the headings on the board.

3.) The list lengths should be compared by the students and they should be asked what problems are created by the long under the “consume” heading.

4.) The teacher should distribute the student worksheet. Students should complete it individually.

5.) The teacher should lead a discussion about the worksheet responses. NOTE: possible answers to worksheet questions are provided after the student worksheet as guidelines/suggestions. Encourage students to be detailed and creative in the discussion of the worksheet responses, leading them to an understanding that there are trade-offs and values involved in our decisions to consume and conserve.
You are a **CONSUMER**! Consume is a verb that means, “to do away with completely.” When you consume something, you use it up, wear it out, or finish it. In your lifetime, you will have consumed thousands of sandwiches, gallons of water, and dozens of pairs of socks.

1.) **List some things that you personally consume only in one use (for example, your carton of milk at lunch or a piece of paper you’ve drawn a picture on).**

   ___________________________________________
   ___________________________________________
   ___________________________________________

2.) **List some things that are used many times before they are consumed (such as your shoes, or a coloring book).**

   ___________________________________________
   ___________________________________________
   ___________________________________________

3.) **List some things that are made to be used only once and then thrown away.**

   ___________________________________________
   ___________________________________________
   ___________________________________________

You can **CONSERVE**. Conserve means to preserve, keep safe, or use wisely. You are a conserver when you are not wasteful.

4.) **Look at your list. Suggest some other products or uses that might do the same job while conserving our resources.**

   ___________________________________________
   ___________________________________________
   ___________________________________________

5.) **Are there any changes that YOU could make in your lifestyle that would conserve resources? List them here and on the back.**

   ___________________________________________
   ___________________________________________
   ___________________________________________
   ___________________________________________
Listed below are possible appropriate responses to the prompts on the student handout.

1.) List some things that you personally consume only one use
   - paper products, food, toothpaste, gasoline, electricity

2.) List some things that are used many times before they are consumed
   - toothbrush, hairbrush, clothing, television, car games, furniture, computer, telephone.

3.) List some things that are made to be used only once and then thrown away.
   - paper towels, soda can, bottle, paper napkins, packaging, paper plates, plastic ware, newspapers, disposable diapers, plastic trash bags.

4.) Look at your list. Suggest some other products or uses that might do the same job while conserving our resources.
   - Use cloth towels - wash and reuse, use recycled containers, use cloth napkins, be more thoughtful and use less packaging, use china, use metal silverware, use cloth diapers, use trash cans and load into single plastic bag for disposal, watch TV news instead of reading newspapers.

5.) Are there any changes that YOU could make in your lifestyle that would conserve resources? List them here and on the back.
   - Recycle tin, steel and aluminum cans, glass and plastic soda bottles and newspapers; use a reusable lunch bag instead of a brown paper one, encourage parents to use paper instead of plastic bags at the grocery store; choose products with less packaging; take a shower instead of a bath, and always turn off the water when you brush your teeth.
Wise Use of Paper

Grades 5-8

Main Concept:
Individuals and institutions use a tremendous amount of paper, much of it wasted.

Standards:
MS S3d: The student produces evidence that demonstrates understanding of natural resource management and Ms S5f works individually and in teams to collect and share information and ideas and MS S5e identifies problems; proposes and implements solutions; and evaluates the accuracy, design and outcomes of investigations.
MS M4a: The student produces evidence that demonstrates understanding of statistics and probability concepts; that is the student collects data, organizes data, and displays data with tables, charts, and graphs that are appropriate, i.e., consistent with the nature of the data.

Activity Objective:
Students and teachers will learn how much paper is wasted in their classroom and will learn to conserve it.

Materials:
waste paper, two large boxes, bathroom or other large scale, graph paper

Keywords:
recycle, reuse

Background:
The largest single component of solid waste is paper (about 35% by weight and 50% by volume). Americans consume more paper per person than any other group in the world. Each person in the United States uses approximately 600 pounds of paper annually. Individuals are the first links in the paper recycling process. By reusing and recycling paper we can help conserve resources, protect the environment, and reduce energy use. Each ton of paper that is recycled replaces and preserves approximately seventeen 500-pound trees. Making paper from recycled fibers uses 30 to 50% less energy than making paper directly from trees and reduces the air pollution from the manufacturing process by 95%.

Teacher Notes:
Students need to know how to keep a data table and how to construct a graph using information from the data table before the activity begins. Students should work in pairs or small groups to collect paper, sort it, collect data and create graphs.

Knowledge and Performance Outcomes:
Knowledge: Students will become aware of the volume of paper consumed in their classroom and/or school during normal activities. They will know that much of the paper thrown away can be recycled and reused, contributing to resource and energy conservation and reducing trash volume.
Performance: Students will work successfully in pairs or small groups to collect paper, sort it, weigh it, collect data and create graphs to display data. They will successfully complete the student worksheet and answer the questions included on it.
**Teacher Procedure:**

1.) Instruct students to collect classroom paper normally thrown away each day. To maximize student involvement, small student groups can collect paper from other classrooms as well. The students should collect paper for a one-week period. The students should weigh the paper that they collected and record the weight in a data table. Then the weights are to be totaled for the entire class and recorded in a data table. The totals should be listed on the board.

2.) Using a bar graph, students should then graph their individual daily weights in one color and the class totals in another color.

3.) Students should examine their daily waste paper and divide it into two piles; one that can still be used because of blank space and one that cannot. Piles should be placed in boxes that teachers have pre-marked as REUSE and RECYCLE.

4.) After one week, students be shown both piles and asked the following questions:

   Could individuals and classes in the building use less paper?
   What can be done in class to reduce the volume of waste paper?

5.) Students should be instructed that for the next week, they should try to reduce the amount of waste paper generated in the classroom. If they are collecting from other classes, they must inform the other class that they too should try to reduce the volume of waste paper they produce.

6.) The experiment should be repeated for a second week, using techniques developed in and by the class to reduce the volume of waste paper. Reproduce the student data table for the second week’s data collection.

7.) At the end of the second week, daily and weekly weight totals should be plotted in the same manner either on the same graph or on a new one.

The graphs should be compared.

Students should be asked to determine how successful they were as individuals or small groups in reducing the volume of waste paper generated and how successful were they as a CLASS in reducing waste paper volume. They should answer weekly questions which are: “How many pounds of paper did the class use in week 2?” and “Have you or another class reduced the amount of waste paper that you or others create?” “How have you done this?”

**Follow-up:**

1.) Working with a partner, students should create two lists. One list should contain all of the paper products used in the students’ homes. The second list should contain a corresponding list of possible substitutes for each paper item listed.

2.) Students can complete the “Making Paper” Activity.
**Wise Use of Paper**

**Name**

**Date**

**Partner(s) or Group Number**

**Student Procedure:**
1. Each day, as a pair or small group, collect used paper that you or other students would ordinarily throw away. Keep it in a safe place.

2. As your teacher instructs, weigh the paper each day. Record the weights in the data table. Class totals will be posted. Record these as well.

3. Each time you weigh the paper, decide if the paper can be used again because it contains useful blank space. If it can be reused, place the paper in the box marked REUSE. If it is completely filled, put it in the box marked RECYCLE.

4. Repeat the process each day for one week.

5. Create a bar graph showing both group and class totals.

6. Answer week 1 questions. They are: “Could individuals and the class use less paper?” “What can be done to reduce the volume of waste paper?”

7. As a class, decide what strategies can be used to reduce waste paper volume. Implement your strategies.

8. Repeat the process for a second week. Compare the daily and weekly totals for week one with those from week two.

9. Answer week 2 questions. They are: “How many pounds of paper did the class use in week 2?” “Have you reduced the amount of waste paper that you create?” “How have you done this?”

**Data Table:**

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<tr>
<th>Week #1</th>
<th>Week #2</th>
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<tr>
<td>Group</td>
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**Note:** The data tables above will be used to create bar graphs of your data. You will need graph paper for the graphs.
Main Concept:
Products made from natural resources can be reused and recycled into new and useful products.

Standards:
MS S3d: The student produces evidence that demonstrates understanding of natural resource management and MS S4d the impact of technology, such as constraints and trade-offs; feedback; benefits and risks and problems and solutions.

Art Standard 1: Students select media, techniques, and processes; analyze what makes them effective or not effective in communicating ideas; and reflect upon the effectiveness of their choices. (From the National Standards for Arts Education)

Activity Objective:
Students will learn to recycle classroom paper into new, usable sheets of paper that can be used for art projects.

Materials:
For each group of students
5 sheets of scrap paper (preferable white ledger paper or lightly tinted paper)
decorative filler scraps such as flowers, small seeds, pine needles, small pieces of colorful paper, yarn, threads, feathers, etc.
used, sturdy wooden picture frame approximately 8.5 x 11
nylon fly screening or substitute
many absorbent towels
rags at least as large as the frames
one wash basin
sponge
measuring cup
paper towels
A blender is necessary to mix paper fibers and water, but it isn’t practical to have one per group. For the class, several blenders are preferable.

Keywords:
pulp, fibers, frame, screen

Teacher Notes:
Students will be working in small groups of four or five during this activity.

Students must be told to read and ask questions about the paper making process as indicated in the student handout entitled, “Making Recycled Paper” before the activity begins. If they have not done this, the activity will not be successful.

Students are to collect sufficient white ledged or lightly tinted paper before the activity begins.

The teacher may need to demonstrate each step of paper making before students attempt the process.

Frames must be obtained in advance for each small group of students.

Frames must be found with sufficient wood edges to hold screen tightly when it is stapled to the edges. Wood pulp is relatively heavy when wet and will stretch the screening if the screen is not taut against the wood. Stretched screening will produce paper that isn’t flat.

Washbasins should be pre-filled with water before the activity and must be large enough to completely submerge the frame.

Teacher Procedure:
1.) Assemble all materials.
2.) Review the handout with the students and demonstrate steps if necessary.
3.) Carry out the activity.
4.) In conjunction with the Art teacher, use the newly created paper in an Arts activity or use the suggested follow-up.

Follow-Up:
Students can create poems, haiku or cards using their recycled paper sheets. Students can start a paper-recycling program in their school with help from Rhode Island Resource Recovery Corporation Assistance at 401-942-1430 ext. 124.
Making Recycled Paper

Note- You must read the entire handout before you begin this activity.

Procedure:
1.) Collect paper as instructed by your teacher.
2.) Tear pieces of paper into small pieces approximately 1” square. Five pieces of paper should be enough.
3.) Cover the desk or table top with flat towels.
4.) Obtain a wash basin containing water and carefully move it to your work station and place it over to one side on top of the towels. Obtain a frame with screen.
5.) Fill the blender with enough water to approximately 2/3 full. Add one handful of shredded paper to the water in the blender and blend at medium speed with the cover on for a minute. Stop the blender.
6.) Continue to add small handfuls of paper, blending at medium speed for one minute per handful, until the pulp looks like creamy soup with lumps.
7.) Add decorative accents of your choice (seeds, flowers, feathers, etc.) during the last blending.
8.) Submerge the frame with screen in the washbasin so that it is just below the surface of the water. Carefully pour the blender contents onto the center of the submerged screen and carefully move the screen around until the screen is covered with pulp to about 1” from the edges.
9.) Lift the frame out of the water and hold it over the tub, letting the water in the pulp drain into the tub.
10.) Place the frame on the covered desk or table surface with the pulp side up. Place another towel or clean rag on top of the pulp on the screen. Use a lightly moistened sponge to gently press the towel or rag to remove additional water from the pulp. (BE CAREFUL NOT TO RUB THE SPONGE AGAINST THE TOWEL-JUST PRESS). Press the sponge evenly against the entire towel surface.
11.) Remove the paper from the screen by peeling back the towel VERY CAREFULLY by starting at one corner. The paper should come off the screen and stick to the towel in one piece. If it doesn’t, put the towel back down onto the screen and repress with a moist sponge to remove even more water. When dry enough, the paper will stick to the towel.
12.) When the towel with paper attached has been removed from the screen, lay the towel on the desk or table with the paper side up. Put one or more paper towels on top of the paper to cover completely.
13.) Using a slightly wet sponge, press down evenly over the paper towels to remove more water from the paper. Press down evenly over the entire surface.
14.) Carefully remove the paper towel from the cloth towel by starting to peel the paper towel from a corner. The newly made paper should stick to the paper towel, not the fabric.
15.) Carefully grasp the edges of the newly-made paper sheet attached to the paper towel and place on the desk or table with paper side up.
16.) Allow the paper sheet to dry before attempting to remove it from the paper towel.
17.) Repeat the process to create a second sheet of paper.
Making Recycled Paper
Frame Construction

“Making Recycled Paper”
Frame Construction

Layer 1
Old picture frame or
4 wood strips
(2 for width, 2 for length)
Nylon screening
Staple gun
(if making lath frame)
Cut screen as large as frame.
Staple to frame at 1” intervals

Layer 2 (for stability)
Old picture frame or
4 wood strips
(2 for width, 2 for length)
Nylon screening
Staple gun
(if making lath frame)
Screws
To assemble, place
layer 2 on top of layer 1
and screw layers together
Main Concept:
Students who understand the recycling process will be motivated to recycle at home.

Standards:
MS S3d: The student produces evidence that demonstrates understanding of natural resource management and MS S4d impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.

MS E2a: The student produces a report that: includes appropriate facts and details; excludes extraneous and inappropriate information; provides a sense of closure to the writing.

Activity Objective:
Students will learn that recycling conserves natural resources that would otherwise enter the waste stream, and saves energy that would be used to manufacture new products.

Materials:
glass bottle, plastic soda bottle, newspapers, tin and aluminum cans and other household items normally discarded

Keywords:
cycle, recycle, energy, natural resources, reuse, bicycle

Background:
When we recycle, we conserve natural resources, energy, and keep material out of the landfill.

Teacher Notes:
This is a discussion activity that occurs after students have been asked to save and bring in a variety of household items normally thrown away. These items must be classified by the students during the discussion into groups such as cloth, wood, plastic, glass, metal (steel, aluminum, tin), yard waste, etc. The teacher must help students in the classification process if they are unsure about their items. The teacher must also help students to identify the natural resources used to produce the items brought in.

Knowledge and Performance Outcomes:
Knowledge: Students will know that with every item they choose to consume, they have many options to purchase items that can be reused/recycled or not. They will understand that most natural resources used to create consumables are finite and that choices they make may extend the “life” of the natural resources consumed.

Performance: Students will be able to classify household items into groups of raw materials used to produce them. Students will be able to decide if the household items can be reused, recycled or thrown away. Students will be able to trace a household item from its natural resource(s) through manufacturing to the finished item.
**Teacher Procedure:**

1. Draw a circle on the chalkboard. Point out that a circle is continuous. Compare it to the cycles in nature that are also continuous (water cycle or seasons of the year).

2. Ask the students to list items that they normally throw away and have them bring in some examples of such items. Help students to classify the items into groups: cloth, wood, plastic, glass, yard waste, metals. Explain that each student has a choice, either to start a cycle of reuse or recycle.

3. Write the word “recycle” on the board. Next to it draw a bike wheel with spokes. Write the word “bicycle” above it. Ask the children how these two words are similar.

4. Above each spoke of the wheel, place a label with the name of one of the categories specified by the students. Label the hub Natural Resources. Draw a person on the rim to indicate that each individual has a choice to recycle, reuse or discard the material.

5. Hold up each of the items brought in by the students. Ask what natural resource(s) were used to make the item. Create a list on the board that includes the product and the natural resource(s) used to make the item (plastics-petroleum, newspaper-tree, etc.).

6. Ask the students to research and write reports on the steps involved in manufacturing each of the items.

**Follow-Up:**

Have students give a presentation using artwork, photography or drama that includes a product’s complete cycle from natural resource(s) to manufactured object. Point out the importance of continuing the cycle through recycling.
Main Concepts:
1) Consumers can choose to buy products that use fewer of the earth’s natural resources and/or create less trash or pollution.
2) Consumers can identify items that can be reused, recycled.

Standards:
The student produces evidence that demonstrates understanding of MS S3d natural resource management and MS S4d the impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions and MS S4c health, such as nutrition, exercise and disease; effects of drugs and toxins; personal and environmental safety and resources and environmental stress.

Health: Standard 3: Students will demonstrate the ability to practice health-enhancing behaviors and reduce health risks.

Social Studies: Economics - Standard 4: Students will understand that people respond predictably to positive and negative incentives (to buy products).

Activity Objectives:
Students will be able to identify common trash items as 1) reusable 2) recyclable or 3) over-packaged (creating unnecessary trash), and will understand the benefits of changing lifestyle and consumer habits.

Materials:
common household trash items such as soda cans 2L soda bottles, newspapers, disposable diapers plastic bread bags plastic grocery bags aluminum foil glass jars and bottles corrugated cardboard box paper grocery bags cosmetic product in plastic packaging with cardboard back Styrofoam® cups
“Solid Waste/Recycling” student handout and home survey

Keywords:
recycling, pre-cycling, reuse

Background:
When we throw garbage away, it usually ends up in a landfill. Landfill space is getting increasingly scarce and every time we throw something away, we throw with it the energy, the money, the raw materials and the water it took to make it.

Knowledge and Performance Outcomes:
Knowledge: Students will know that it is important to "pre-cycle"; to buy products that contain less packaging, are recyclable and/or reusable. They will understand that making wise consumer choices reduces the amount of resources used, produces less trash and conserves energy.

Performance: Students will be able to identify common household trash items as expendable, reusable, recyclable and over-packaged. They will be able to suggest alternative and perhaps new uses for the trash items. They will be able to identify habits in themselves and others that contribute to trash volume and will consider ways to change those habits.
The average American throws away four pounds of garbage per day. In 1990, it was estimated that Americans threw away over 1 million tons of aluminum cans and foil, more than 11 million tons of glass bottles and jars, over 4 and one half million tons of office paper and nearly 10 million tons of newspaper. Almost all of this material could be recycled.

Recycling saves large amounts of energy. Recycling one glass jar saves enough energy to light a 100 watt light bulb for four hours. Recycling one soda can saves as much energy as if the can were half full of gasoline.

When waste products are recycled, fewer raw materials are used. Americans threw away 35 billion aluminum cans last year; we threw away enough aluminum to build an entire air fleet, four times over. Recycling paper reduces the need to collect huge amounts of timber from our forests to gather wood pulp.

Teacher Procedure:
1.) Collect a variety of household trash items such as those listed in Materials or ask students to bring them in. Include those items that contain extra packaging, those that cannot be recycled, recyclables and reusables.
2.) Introduce students to background information.
3.) Explain the keywords if students are not familiar with them. Place special emphasis on “pre-cycling”; choosing to purchase an item because it reduces packaging, is reusable and/or recyclable.
4.) Hold up the individual items. Ask the class to make note of the original use for the item, additional uses for the item on their worksheet.
5.) Ask the students to decide if the item and possible components are recyclable and to note their opinion on the worksheet.
6.) Ask the students to determine if the item is commonly found in their own trash containers, marking yes or no on their worksheet.
7.) After completing the worksheets, the teacher should initiate a classroom discussion about the responses. In the discussion, the teacher should display the item and have students talk about new uses for the item.
8.) In the discussion, the teacher should display the item and explain if the item or components is recyclable in their community. Students should make necessary corrections on their worksheets.
9.) The teacher should direct student volunteers to create a list on the board of the trash items found in most students’ households.
10.) The teacher should initiate a discussion about the local recycling center. Students should be asked if any have visited the center and what types of items can be brought there.
11.) After completion of the home survey, the teacher should initiate an additional discussion about public opinion in two ways; a) where most people think trash goes after it leaves the home and b) about how trash volume can be reduced.
12.) After completion of the home surveys, the teacher should ask students how they feel about changing their individual behaviors with regard to pre-cycling, recycling and reuse. They should be asked to discuss why members of their own families might not change their “trash behaviors.”
Common household trash items will be displayed. You are to list the item name, its main use, and are to suggest at least one alternate use for the item. You are to decide if the item is recyclable and if the item is found in your family trash.

<table>
<thead>
<tr>
<th>Item Name</th>
<th>Main Use</th>
<th>Alternative Use</th>
<th>Recyclable</th>
<th>Your Trash</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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</tbody>
</table>
Home Recycling Survey

Name

Date

1.) Put X’s by the items that your household throws away:

- [ ] cans (aluminum and/or tin)
- [ ] glass bottles
- [ ] paper (includes mail)
- [ ] aluminum foil
- [ ] Styrofoam® (containers or packaging materials)
- [ ] cardboard
- [ ] disposable diapers
- [ ] plastic containers
- [ ] newspapers
- [ ] grocery bags (paper and/or plastic)
- [ ] egg cartons
- [ ] batteries
- [ ] clothing
- [ ] catalogs and magazines

2.) Which items of those listed above could be recycled by you or by someone else?

________________________________________________________________________

________________________________________________________________________

3.) Does your town or city collect any of these materials for recycling?

- [ ] Yes
- [ ] No
- [ ] I don’t know
4.) Where does your garbage go once it leaves your house? (Draw a picture or explain in words).

5.) What are the benefits and drawbacks of recycling to your family?

   Benefits:
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

   Drawbacks:
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

6.) List five products commonly purchased by your family that produce instant garbage. They may come packaged in such a way that you throw away packaging as soon as you open them or they may be disposable so that you throw them away after using them only one time. Can you think of any alternatives to these products?

   Instant garbage          Possible alternative
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

7.) How does reusing things help the environment?

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

Adapted from Earth Day 1990: Lesson Plan and Home Survey — K-6, Stanford University, CA.
Main Concept:
Composting turns organic wastes into a valuable product that can be used as fertilizer and the process mimics the natural process of decomposition.

Standards:
MS S1c: The student produces evidence that demonstrates understanding of transfer of energy, such as transformation of energy into heat; light; mechanical motion and sound; and the nature of a chemical reaction and MS S3d natural resource management.

Activity Objective:
Students will learn about composting and about how to create a compost pile.

Materials:
For kitchen compost:
Add some or all of the following ingredients:
- vegetable peels and seeds
- fruit peels and seeds
- coffee grounds
- egg shells
- nut shells
- any other vegetable or fruit scraps

Note: Do not add meat scraps, bones, dairy products, oil or fat. They may attract pests and animals.

For yard or garden compost:
Add some or all of the following ingredients:
- hay or straw
- grass clippings
- leaves
- ashes
- sawdust
- wood chips
- weeds or other garden waste
- manure
- shredded paper

In addition, the following materials are necessary:
- 4 pots
- sand
- soil
- water
- straw
- sawdust
- pitch fork
- shovel
- trowel
- chicken wire
- “waste” lumber

Background:
Composting is nature’s way of recycling. Decomposition will occur whether we help it or not. But since we produce so much waste we get paid back when we help to speed up the composting process. Composted material improves our gardens.

Composting is like baking a cake. Just add ingredients, stir, “bake” and out comes- COMPOST! Whether you compost kitchen wastes or yard and garden wastes, there are a few basic steps to follow. They will be included in the student procedure.

Teacher Notes:
Before the activity, students should be given information about the process of decomposition and about the organisms that carry it out (protozoans, fungi, bacteria, earthworms, insects, etc.). The teacher should explain that soil has to be added to the compost pile to provide bacteria that will carry out decomposition.

Frames for compost piles should be constructed in advance of the activity using scrap lumber, chicken wire or other suitable material. The frame should have no bottom so that it sits on the bare ground but should be closable on top (chicken wire lid) to keep animals out of the compost pile. The frame should be fairly shallow (2 feet
or less) so that students can easily turn over the entire contents of the frame to get compost in a fairly short time.

Teachers should explain requirements for journal entries and explain the schedule for compost pile observation.

The teacher should explain that the compost heats up as chemical energy is released from chemical bonds in compost as the bonds are broken (large molecules broken into smaller ones).

Teachers must decide how students are to keep journals and how many entries are to be made into the journals regarding construction and progress of the compost piles.

**Knowledge and Performance Outcomes:**

Knowledge: Students will know what decomposition and composting mean.

Performance: Students will be able to create a compost pile using common household/lawn waste and simple construction materials. They will observe the decomposition of their compost over time and will keep a journal recording observations. If using the Follow-Up Activity, they will grow plants in “compost-added” and regular soil and will make comparisons between the plants in their journals.

**Student Procedure:**

You are to keep a journal about the construction and progress of your compost pile. Your teacher will decide how many entries you are to make.

Choose a container for making your compost or have someone help you to construct one from scrap lumber and chicken wire or use a wooden box.

Place kitchen or yard wastes into the composting bin. Chop or shred organic materials if you want them to compost quickly.

Spread soil or “already done” compost over the compost pile. This layer contains the microorganisms and soil animals that do the work of making the compost. It also helps keep the surface moist. The pile should be about 4 cubic feet in size.

Adjust the moisture in your compost pile. Add dry straw or sawdust to soggy materials, or add water to a pile that is too dry. The materials should be damp to the touch, but not wet enough to produce drops of water when you squeeze the material of the compost.

Allow the pile to “bake”. It should heat up quickly and reach the desired temperature (90-140 degrees F or 32 to 60 degrees C) in four to five days.

“Stir” your compost as it bakes by turning it with a pitchfork or shovel if you want to speed up the baking time.

The pile will settle down from its original height. This is a good sign that the compost is baking properly.

If you mix or turn your compost pile every week, it should be “done” or ready to use in about one or two months. If you don’t turn it, the compost should be ready in about six to twelve months.

Your “Best Ever Compost” should look like dark, crumbly soil mixed with small pieces of organic material. It should have a sweet, earthy smell.

Feed compost to hungry plants by mixing it with soil.

**Follow-Up:**

Students should try to grow a few beans or other seeds in four pots; 1 pot contains sand, 1 pot contains sand and compost, 1 pot contains regular soil and 1 pot contains regular soil and compost. Compare how well the seedlings grow. Discuss the plants’ need for nutrients to ensure healthy growth. Make sure that students know that sand is a poor nutrient source and that it does not store water. Note that when compost is mixed in, both of these needs are better met. Gardeners can similarly enrich their gardens using compost.
Ingredients for a Compost Pile

**Soil:** Contains microorganisms that help decomposition.

**Organic Wastes:** Such as leaves, food scraps and grass clippings. Wastes should be varied, including materials with both carbon (browns) and nitrogen (greens). By alternating layers of high-carbon and high-nitrogen materials, you can create good environmental conditions for decomposition to occur.

**Nitrogen:** Many of the organisms responsible for decomposition need nitrogen, thus nitrogen is necessary for rapid and thorough decomposition. Nitrogen is found naturally in many organic wastes, such as manure and green grass clippings, as well as in many commercial fertilizers.

**Worms:** They “eat” organic material, helping to break it down; make castings (worm feces) that enrich the soil, tunnel through and aerate the waste, facilitating decomposition, and eventually die and become part of the compost. They are not required for compost but they are extremely helpful to the process.

**Water:** Necessary for normal life functions. Too much water in the compost pile will make it soggy and slow decomposition by reducing available oxygen.

**Air:** The biological activity of fungi, bacteria, small insects and other organisms results in decomposition. Most biological processes require adequate amounts of oxygen.

**Time:** Decomposition takes time. To speed up decomposition, aerate your pile every few days; otherwise just leave it and wait.

**Heat:** Heat is produced by chemical reactions resulting from increased biological activity that occurs during decomposition. Heat helps sanitize compost by killing certain organisms (weed seeds, pathogens, harmful insect larvae).

**Mass:** In order to generate enough heat for optimal decomposition, the pile must contain at least one cubic meter of organic material. Thus temperatures generated in an aquarium compost pile may be different from those generated in a larger one.
Mini-Composts

Grades 5-8

Main Concept:
Organic waste can be recycled by composting, an activity that enriches soil and mimics the natural process of decomposition.

Standards:
MS S2d: The student produces evidence that demonstrates understanding of populations and ecosystems, such as the role of producers, consumers and decomposers in the food web; and the effect of resources and energy transfer on populations and MS S23d natural resource management and MS M3b represents relationships with tables, graphs in the coordinate plane and verbal or symbolic rules.

Activity Objective:
Students will learn about recycling organic matter by observing a miniature compost pile.

Materials:
aquarium or prefabricated bin, organic wastes, garden soil (not potting soil), thermometer, trowel or large spoon, 1-2 dozen red-worms, watering can, student journal, “Mini-Compost” student worksheet

Keywords:
compost, organic, decomposition, biodegradable, bacteria, fungi, humus, nitrogen, digest, excrete, red-worm or earthworm

Background:
When we mention “recycling”, we often think of recycling glass bottles, aluminum cans and newspapers. However, in Rhode Island, another 30%-35% of household “garbage” we throw out can also be recycled. Food scraps, leaves, grass clippings, and other biodegradable organic wastes can be recycled by composting. Simply stated, composting creates optimal conditions for decomposition to occur. Decomposition is the biochemical process by which bacteria, fungi, and other microscopic organisms break organic “wastes” into nutrients that can be used by plants and animals. Decomposition occurs whenever a leaf falls to the ground or an animal dies. It is essential for the continuation of life on earth. The result of decomposition in a compost pile is a nutrient-rich humus that is excellent for improving soil quality and plant growth.

Knowledge and Performance Outcomes:
Knowledge: Students will know what composting and decomposition mean and will understand that they are important for animal and plant survival.
Performance: Students will help to create a mini-compost pile, will help to aerate it, will test the temperature of the compost pile, will construct a graph of the daily temperature and will keep a journal of their observations. They will be able to successfully complete a “Mini-Compost” worksheet.

Teacher Notes:
Students should be familiar with the keywords, background information and should be able to construct a point or bar graph that records the temperature of the compost pile before the compost pile is constructed.

The aquarium or bin should be located in a prominent area in the classroom and should be maintained at room temperature, out of direct sunlight. Individuals or student groups should be assigned a variety of organic wastes that they can gather and will add to the pile. They should be instructed to bring the wastes to school in a baggy or sealable plastic bag to prevent mess and odors. Instruct students that very large pieces must be precut or torn into smaller pieces.

Students should collect organic wastes for the pile avoiding fats, oils, bones, dairy products or meat as they will produce odors and should place them in the pile on the day they are brought to school to reduce odors, bacterial growth and mold spore formation. Some large pieces of waste should be chopped into smaller pieces again, while others should be left as is. The teacher should decide which thermometer is to be used to measure the temperature of the compost pile and should insert it into
the pile to the same depth each day and should have students record the measurement. Students should keep a daily journal that records observations and the temperature of the compost pile and should fill out the student activity worksheet either during or after the activity. Students are asked questions about earthworms and red-worms on the worksheet. Students should be given access to references so that they can conduct a bit of independent research to answer the questions.

**Teacher Procedure:**

1.) Introduce the ideas of decomposition and natural recycling. Ask students what the word “compost” means. Explain that decompose means to take things apart. Decomposers help nature recycle by breaking materials down so they can be cycled over and over again. This process can be accelerated in a compost pile. Ask: What is composting? What are the necessary ingredients for a good compost pile? How is composting related to the concept of recycling? How can composting reduce waste?

2.) Set up the aquarium or bin in the proper place and assign students wastes they are to collect. Ask students why large pieces of waste must be chopped into smaller pieces. Leave some pieces of the same materials larger than others so that students can compare the rate of decomposition. Ask students if they think that the size of the waste piece affect the rate.

3.) Alternate layers in the aquarium or bin as follows (amounts are approximate):

   One inch of soil, two inches of organic waste, a sprinkle of manure or green grass clippings and a sprinkle of water. Repeat several times. Cover with an inch of soil. Water pile enough to keep it moist, but not soggy. It should feel like a damp sponge.

4.) Add red-worms or earthworms and observe their behavior.

5.) Gently mix the compost once a week to aerate it. Use a thermometer to test the temperature of the pile using the same depth and location each day. Instruct students to make a graph of the results.

6.) Discuss composting. Ask students how it reduces the amount of waste that would ordinarily be thrown out. Ask students what they think happens to organic wastes that end up in a landfill. Ask students if the landfill is a gigantic natural compost pile or are there problems with placing large amounts of organic material in landfills.

**Follow-up:**

Construct a compost pile as a group at school or at home. Contact RI Resource Recovery Corporation (www.rirc.org or 401-942-1430) for plans or to find out if prefabricated bins are available for donation to schools. Also, begin a school garden. Use the soil you’ve made in the compost pile to plant some flowers or vegetables.
Mini-Composts

Student Procedure:
1.) You will be assigned an organic waste to bring in to contribute to the compost pile such as leaves, pine needles, grass clippings, sawdust, hair, kitchen scraps, etc. You will need to place the items in a baggy or other plastic bag that can be tightly closed to keep the items from soiling your clothing or backpack. Avoid meat scraps, bones, dairy products, fats and oils. Kitchen scraps should include small and slightly larger pieces.
2.) Assist the teacher in placing about 2" of soil in the bottom of the aquarium or bin.
3.) Add some of your organic waste to the top of the soil. Save some of it for another layer.
4.) Add some grass clippings to the top of the organic waste layer.
5.) Observe the teacher or student assistant as he/she sprinkles water over the top layer.
6.) Assist the teacher in creating another layer by placing about 2" of soil on top of the watered grass clippings.
7.) Add the last of your organic waste on top of the soil layer.
8.) Add some grass clippings to the top of the organic waste layer.
9.) Observe the teacher or student assistant as he/she sprinkles water over the top layer.
10.) Assist the teacher in placing 1 more inch of soil on top of the grass clippings.
11.) Observe the teacher or student assistant as the pile is watered enough to make it moist, but not soggy (should be as wet as a moist sponge).
12.) Add red-worms or earthworms to the compost pile and observe their behavior.
13.) Record your observations about the making of the compost pile and observations about earthworm behavior in your journal.
14.) Take turns using a trowel or spoon to stir the compost pile once per week.
15.) Record the daily temperature of the pile in your journal.
16.) Observe the compost pile each day and record your observations in your journal.
17.) Complete the rest of the student handout either during or after the activity.
18.) Create a graph of the daily temperatures of the compost pile as your teacher instructs.

Name

Date
Mini-Composts

Please answer the following questions using complete sentences.

1.) What is composting?

2.) What ingredients are necessary for a good compost pile?

3.) How are composting and recycling related?

4.) How does composting reduce waste?

5.) Some pieces of waste were larger than others. Was there a difference in the time it took for the different pieces to decompose? Explain.

6.) What did you observe when the earthworms were first placed in the pile?

7.) What do earthworms eat in the compost pile and how do they digest?

8.) What do earthworms excrete?

9.) What happens to organic wastes that end up in a landfill?

10.) Is the landfill a giant compost pile or does placing large amounts of organic material in a landfill creates problems? Explain.

Graphing

Your teacher may give you graph paper or will tell you how and where the graph of the temperature readings is to be constructed.
Assessment 1

Part I

1.) Write an explanation of the “Three R’s”. What is their ultimate goal?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

2.) How and why are the “Three R’s” helpful to the environment?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

3.) Name five products commonly produced by a family that produce “instant garbage.” Think of an alternative for each.

<table>
<thead>
<tr>
<th>Instant Garbage</th>
<th>Possible Alternative</th>
</tr>
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<tbody>
<tr>
<td>1. Ex: Paper Cup</td>
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<tr>
<td>2. Ex: Individual Juice Cartons</td>
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Part II

As a result of looking at our neighborhood trash on trash pickup day, we discovered how much is thrown away.

1.) Chris has just seen Jordan throw away a plastic water bottle. Write what Chris could say to Jordan to increase Jordan’s awareness.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

2.) Mrs. Smith went shopping at the grocery market and purchased the following items:

   Large (5 lb.) bag of sugar
   Paper lunch bags
   Cereal box made from recycled paper
   Instant soup in a Styrofoam® cup with a paper package
   Juice boxes

What could you tell Mrs. Smith about her selections with respect to the principles of pre-cycling. State what she has done well and explain how she could improve on some of her purchases.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Rhode Island Resource Recovery Corporation  Project WASTE Curriculum Guide
Part I Question 1

4- ABOVE STANDARD
   Student response to question #1 demonstrates complete understanding of reduce, reuse and recycle by including the following:
   To reduce, a consumer buys products that have less packaging, can be use longer and produce less toxic waste.
   To be reused, a product is used more than once in the same form for the same or a different purpose.
   Recycling involves separating and collecting recyclable materials for processing into new forms that can be used as raw materials for new products.
   Whole sentences.
   Proper use of grammar, punctuation and spelling.

3- AT STANDARD
   Student response to question #1 demonstrates good understanding of reduce, reuse and recycle by including the following:
   Definitions of reduce, reuse, and recycle.
   Most of the points mentioned in the definitions of reduce, reuse and recycle.
   One or two omissions in the definitions of reduce, reuse, and recycle.
   A minor error in the definition of reduce, reuse, or recycle.
   Whole sentences.
   Proper use of grammar, punctuation and spelling with few errors.

2- BELOW STANDARD
   Student response to question #1 demonstrates some understanding of reduce, reuse and recycle by including the following:
   Definitions of two of the three words including most of the points mentioned in 4, above standard, OR
   Definitions of the three words including a few of the points mentioned that are correct.
   Sentence fragments.
   Problems with grammar, punctuation and spelling.

1- SERIOUSLY BELOW STANDARD
   Student response to question #1 demonstrates little understanding of reduce, reuse and recycle by including the following:
   Definition of one of the words including most of the points mentioned for the definition of the word in 4, Above Standard, OR
   Definitions of two of the three words including a few of the points previously mentioned that are correct.
   Sentence fragments or single words.
Part I Question 2

4- ABOVE STANDARD
Student response to question #2 demonstrates complete understanding and includes the following:
Reuse, reduction and recycling conserve natural resources, conserve energy, and reduce pollution (waste).
Whole sentences.
Proper use of grammar, punctuation and spelling.

3- AT STANDARD
Student response to question #2 demonstrates good understanding and includes the following:
Reuse, reduction and recycling conserve natural resources, conserve energy, and reduce pollution (waste).
Whole sentences.
Some minor problems with grammar, punctuation or spelling.

2- BELOW STANDARD
Student response to question #2 demonstrates some understanding and includes the following:
Two of the three components of the complete answer.
Whole sentences.
Problems with grammar, punctuation or spelling.

1- SERIOUSLY BELOW STANDARD
Student response to question #2 demonstrates little understanding and includes the following:
One of the three components of the complete answer.
Sentence fragments OR
Complete sentences with major problems with grammar, punctuation and spelling.
Part II Question 1

4- ABOVE STANDARD
   Student response demonstrates complete understanding and includes the following:
   Throwing the water bottle away does not: 1) conserve oil used to make the plastic 2) conserve oil, coal or natural gas used to create electricity for manufacturing plants 3) conserve wood used to create packaging materials 4) conserve gasoline to power transport vehicles.
   Throwing the water bottle away contributes to pollution (waste, trash). Plastics are non-biodegradable and persist in landfills.
   The bottle could be reused or recycled instead of thrown away.
   Uses whole sentences.
   Proper use of grammar, punctuation and spelling.

3- AT STANDARD
   Student response indicates good understanding and includes the following:
   Throwing the water bottle away does not conserve the natural resources mentioned above in 4, Above Standard. Response does not list natural resources used to make, package, or transport the bottle.
   Throwing the water bottle away contributes to pollution (waste, trash). Response does not indicate that the plastic is non-biodegradable.
   The bottle could be reused or recycled instead of thrown away.
   Uses whole sentences.
   Proper use of grammar, punctuation and spelling.

2- BELOW STANDARD
   Student response demonstrates some understanding and includes the following:
   Two of the three points mentioned in a complete answer (conservation of resources, contribution to pollution, reuse or recycling).
   Uses whole sentences.
   Problems with grammar, punctuation and spelling.

1- SERIOUSLY BELOW STANDARD
   Student response demonstrates little understanding and includes the following:
   One of the three points mentioned in a complete answer (conservation of resources, contribution to pollution, reuse or recycling.)
   Sentence fragments and/or single words.
   Major problems with grammar, punctuation and spelling.
Part II Question 2

4- ABOVE STANDARD
   Student demonstrates complete understanding of pre-cycling and response includes the following:
   Praise of Mrs. Smith for her ability to pre-cycle.
   Mention of bulk sugar package as a good choice because of size.
   Mention of cereal package as a good choice because of size and is constructed of recycled paper.
   Mention of reusable lunch box or bag instead of paper lunch bag to conserve trees and limit waste.
   Mention of soup purchase in a recyclable steel can or storage in a reusable container.
   Mention of large juice container that could be divided into single servings transported in a thermos or reusable container.
   Uses whole sentences.
   Proper use of grammar, punctuation, and spelling.

3- AT STANDARD
   Student demonstrates good understanding or pre-cycling and response includes the following:
   Praise of Mrs. Smith for her ability to pre-cycle.
   Mention of all of the points listed in 4, Above Standard, with a minor omission or error.
   Uses whole sentences.
   Proper use of grammar, punctuation, and spelling.

2- BELOW STANDARD
   Student demonstrates some understanding of pre-cycling and response includes the following:
   Praise of Mrs. Smith for her ability to pre-cycle.
   Mention of some of the points listed in 4, Above Standard, with omissions and/or errors.
   Contains sentence fragments.
   Whole sentences with major problems with grammar, punctuation, and spelling.

1- SERIOUSLY BELOW STANDARD
   Student demonstrates little understanding of the concept of pre-cycling and response includes the following:
   Praise of Mrs. Smith for her ability to pre-cycle.
   One or two points listed in 4, Above Standard, with omissions and errors.
   Contains sentence fragments.
   Serious problems with grammar, punctuation, and spelling.
Outcome: Tracking and Application

Activity
1. Investigating Waste

Supplementary Activities
A. Household Toxic Chemicals
B. Is Cleaning Hazardous to Your Health?

RHODE ISLAND RESOURCE RECOVERY CORPORATION
Main Concept:
Students can use an investigation to apply principles from Steps 1-3 to gather information and draw conclusions.

Standards:
MS S5f: The student works individually and in groups to collect and share information and ideas and MS S6b the student demonstrates competence with the tools and technologies of science by using them to collect data, make observations, analyze results and accomplish tasks effectively. Students will collect and analyze data using concepts and techniques in Mathematics Standard 4, such as average, data displays, graphing, variability and sampling and MS S7a the student represents data and results in multiple ways, such as numbers, tables and graphs; drawings, diagrams, and artwork; and technical and creative writing and MS S7d the students will critique written and oral explanations, and use data to resolve disagreements and MS S8 the student demonstrates scientific competency by completing projects drawn from investigations, including MS S8a (an experiment), MS S8b (a systematic observation, such as a field study, MS S8d (non-experimental research) using print and electronic information, such as journals, video or computers.
Mathematics: MS M4 The student demonstrates understanding of a mathematical concept by using it to solve problems, representing it in multiple ways (through numbers, graphs, symbols, diagrams, or words) and explaining it to someone else. All three ways of demonstrating understanding — use, represent, and explain — are required to meet this standard.

Activity Objectives:
Students will:
Perform an investigation by using prior knowledge gained in the three previous steps.
Create a scientific journal for this procedure.
Analyze their information in daily class discussions about their family's behaviors and will select positive alternative behaviors when appropriate so that the result is a more environmentally responsible family.
Use technology to communicate the results of their investigations.
Use technology to make charts and graphs of the information gathered.

Materials:
Folders, pencils, pens, crayons, computers, journal pages, student handout entitled Investigating Waste

Keywords:
investigate, scientific journal, scientific method, research, data, graph, data table

Knowledge and Performance Outcomes:
Knowledge: Students will understand and recall the principles learned in steps 1-3. They will be familiar with the scientific method including: hypothesis, experiment, reevaluation of the hypothesis, and communication of results.
Performance: Students will identify a problem that concerns them, will develop a hypothesis, will test the hypothesis by conducting an experiment, will reevaluate the hypothesis and will communicate the results to others.
Teacher Notes:

Students must be familiar with the scientific method and its components before beginning this activity.

The teacher must set the parameters for this research as he/she sees fit: how detailed must the experiment be, must it be from principles learned in one step, or can the experiment include principles from several steps, what kind of record keeping will be required, how much data must be collected, how will the results be communicated, etc.

Students should get teacher approval for the experiment before proceeding. Teachers must also instruct students about keeping a journal and must inform students about what is to be written in the journal pages on a daily basis.

The teacher must set definite time limits for the experiment itself and for reporting the results.

Teacher Procedure:

1.) Pass out journal pages or instruct students how to format their own paper. Instruct students about keeping journal pages during their investigation.

2.) Remind or instruct students about the scientific method: hypothesis, experimentation with data collection, analysis of results, reevaluation of hypothesis and communication of results.

3.) Indicate important dates for the end of the experiment, the compilation of results and the communication of the results.

4.) Arrange a schedule for presentations by the students.
You are going to perform an experiment that deals with principles you have learned in Steps 1-3 of Project Waste. Follow the steps below for complete success.

1. Select an area of Steps 1-3 that interests you. Pick a topic and develop a hypothesis about your family’s, friend’s or community’s behavior with regard to waste and its generation. Have the topic approved by your teacher.

2. Begin keeping a journal to record your hypothesis, plan of experimentation and results.

3. Write in the journal each day as the experiment proceeds.

4. Discuss the results with others on a daily basis.

5. Keep a record of any data that is created and transform it into a data table and/or graph.

6. When the experiment is finished and you examine your data or results, reevaluate your hypothesis and decide if your hypothesis was correct or not. Record this reevaluation in your journal.

7. Decide how you will communicate your results to the class or others. If you will be doing a class presentation, make arrangements for a suitable time for your teacher. If you will be doing a PowerPoint or web page presentation, arrange this with your teacher as well.
Household Toxic Chemicals

Grades 5-8

Main Concept:
Many household chemicals are toxic (hazardous to health/environment).

Standards:
MS S1a: The student produces evidence that demonstrates understanding of properties and changes of properties in matter, such as density and boiling point; chemical reactivity; and conservation of matter and MS S4c health, such as nutrition, exercise and disease; effects of drugs and toxic substances; personal and environmental safety; and resources and environmental stress and MS S4d impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.

Activity Objective:
Students will learn that chemicals and toxins are common to every household and that other substances that are non-toxic may be substituted for them.

Materials:
4-5 cleaning products, solvents and/or pesticides, tape, pencils or pens, butcher or other stiff paper, Handouts entitled “Home Toxin Survey” and “Possible Substitutions for Household Toxic Substances”

Keywords:
toxin, acute, chronic, cancer, mutations, poison, solvent, pesticide, risk, benefit, fact, opinion

Background:
A toxic substance is anything containing a toxin that is capable of harming a person if ingested, inhaled, or absorbed through any body surface. Toxic substances vary widely in the types of harm in how and under what conditions they become harmful. Acute reactions are sudden ones such as vomiting or dizziness. Chronic reactions occur over longer periods and include symptoms such as decline in mental alertness, change in behavior, cancer, and mutations that can harm unborn children of exposed parents. Because toxins can cause both acute and chronic reactions, they are a broader category than poisons, which produce only acute reactions. For this reason, the words TOXIN and POISON are not interchangeable.

Nobody is “for” toxic chemicals in the sense of wanting to endanger ourselves and others, and yet many toxic substances seem to be a necessary part of our lives and have come to be considered essential in our homes, our workplaces, and our schools. Needing substances that sometimes produce undesirable effects creates a predicament and forces people to make choices about what is acceptable to them. Different people are willing to take different risks related to toxic chemicals and have varying concerns about the effects of toxins on themselves and people around them. Some people know that many of the products they use are potentially toxic but consider the risk worthwhile. Others try to avoid toxins and thus give up the benefits of certain products.

Many people do not know that household chemicals can be toxic. Most of the dangerous substances in the home are found in cleaners, solvents, pesticides and products used for automotive care.

NOTE: It is not always possible to avoid the use of toxic substances. For example, if you have termites, you can either move out or use a pesticide to remove them.

In this activity, students survey themselves and their families to find out about attitudes and beliefs that people hold about toxic substances.

Knowledge and Performance Outcomes:
Knowledge: Students will understand and be able to use the keywords, will understand that toxic household substances can have temporary and permanent health effects. Students will know that use of toxic substances may carry “acceptable” risk because the alternative is unacceptable. However, they will understand that many household substances have safe, non-toxic alternatives.

Performance: Students will be able to complete the home toxin survey to create a class chart that records the results. Students will be able to participate in class discussions about household toxins and will be able to work in groups of four to answer questions about toxins. Students will be able to present group answers to the class. Students will be able to record and use vocabulary words and will be able to discuss their interview results with the class.
Teacher Notes:
The teacher must decide how much detail from background information is to be given to and used by students. Terms such as acute, chronic, cancer, mutations, poisons, solvents and pesticides can lead to other discussions that may or not be appropriate at the time of the activity.

Results of the survey and adult interviews will contain opinion, not fact. A discussion of fact and opinion will result in students needing more information about household substances. Additional information will result in increased understanding and compilation of facts that students will share with adults in their households. Additional information about household products and substitutions is located at the end of this activity.

Teacher Procedure:

1.) Collect, or have students collect, four or five familiar cleaning products or other substances mentioned in the materials. Tape the lids on so that students cannot open the containers. Prepare a chart on butcher or other paper titled “Toxic Substance Survey Results” that students can use to record the results of their surveys.

The chart should list all of the survey questions and allow space for recording the responses.

2.) Introduce the activity and the unit by displaying the household products you or students have gathered. Ask students, “What are these things? What are they used for? What do we know about them? Is there anything dangerous about using them? What don’t we know about these chemicals that might be important to know?” In order to find out more about what we, as a class, think about toxics, have students complete the “Toxic Substance Survey Results” Handout.

3.) Hand out one “Home Toxic Substance Survey” to each student and explain that the survey is not a test; students do not need to write their names on the survey and there are no right or wrong answers. Give the students a few minutes to complete the survey.

4.) Divide the students into groups of four. Have each group discuss the following questions using the survey:

   What are toxic substances?
   Where do we find toxic substances?
   Who uses toxic substances? Why?
   Are we always aware of the presence of toxics?

5.) Have each group share their responses to these questions with the class.

   Accept all responses; do not provide answers at this point. This is a time for students to begin thinking about toxics substances and for you to assess their initial understanding and attitudes. Talk with students about the idea that nobody is “for” toxic substances but most people think these substances are a necessary. Tell them that some people know many of the products they use are toxic yet consider it beneficial to continue using them, while other people avoid toxic substances by using an alternative or omiting some products altogether.

6.) Introduce the words RISK and BENEFIT. Help students discuss the meaning of these words.

7.) Tell students that people's knowledge of toxic substances differs, as do their opinions, and that over the next two days the students are going to learn more about toxic substances. Tell them that they are going to interview their families to find out what family members know and think about toxic substances.

8.) Ask students to interview one of the adults in their home.

Class discussion questions:

   Are most people concerned or not concerned about toxic substances?
   What does toxin mean?
   What ideas did most people in the survey agree on?
   What else have we learned?
   Was there anything that surprised you?
   What does OPINION mean?
   What is the difference between FACT and OPINION?
   What would you like to learn about toxic substances?
   What choices can we make that are more beneficial to the environment and therefore to all of us?
Student Procedure:

1.) Complete the “Home Toxic Substance Survey” handout.

2.) Move to an area with other students in your group. Discuss and record group answers to the following questions on a piece of paper.
   - What are toxic substances?
   - Where are toxic substances found?
   - Who uses toxic substances? Why?
   - Are we always aware of the presence of toxic substances?

3.) Choose a spokesperson who can share your group answers with the rest of the class.

4.) Record the meanings of the words RISK and BENEFIT.

5.) Interview an adult in your home and ask the adult the following questions. Record their answers.
   - What is a toxic substance?
   - Do we have toxic substances in the house?
   - Do toxic substances worry/concern you? Why or why not?
   - What could we use instead of a toxic substance?
   - Do toxic substances have any health effects?
   - What happens to toxic substances when we throw them away, flush them, rinse them into the sink?

6.) When you have interviewed the adult in your home, bring your answers back to the class.

7.) Answer the following questions and participate in a class discussion about the following:
   - Are most people concerned/not concerned about toxic substances?
   - What does toxic substances mean?
   - Looking at the survey results, what do most people agree on?
   - Did any of the survey results surprise you?
   - Did your adult know anything about toxic substances?
   - Do you think your adult will substitute a non-toxic for a toxic substance?
   - What is the difference between fact and opinion?
   - What would you like to learn about toxic substances?
   - What choices can we make about household substances that are more beneficial to the environment/our health and therefore to all of us?
### Home Toxic Substance Survey

**Name**

1.) What is your age? _______
   Are you a male or female? _______

2.) What do you think of when you hear the word toxic?

3.) Which of the following do you use? Which of the following do you consider toxic? (Leave blank if you don’t use these products.)

<table>
<thead>
<tr>
<th>Item:</th>
<th>Use</th>
<th>Consider toxic</th>
</tr>
</thead>
<tbody>
<tr>
<td>The laundry detergent used to wash clothes.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The cleanser used in your house to clean sinks and bathtubs.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The furniture polish used to clean and shine furniture.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The drain cleaner used in sink and bathtub drains.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The glass cleaner used to clean windows and mirrors.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The baking soda used in cooking.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The air freshener used to make the air smell fresh.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The ant spray used to kill ants in and around the house.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The hairspray some family members use to keep their hair in place.</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

4.) When do you think it is okay to use something that is toxic?

5.) What room in your home do you think contains the most toxic substances?

6.) Which statement best describes your home?
   - ☐ There are no toxic substances in my home.
   - ☐ There are some toxic substances in my home.
   - ☐ I do not know if there are toxic substances in my home.

7.) Would you want to be told if something you are about to buy might be toxic?
   - ☐ Yes  ☐ No  ☐ Sometimes

8.) Do you think that people who work where there are toxic substances should be told this when they are hired?
   - ☐ Yes  ☐ No  ☐ Sometimes

9.) Do you think individuals should decide to buy and use toxic substances, or do you think the government should make it illegal to sell toxins?
   - ☐ Individual should decide.
   - ☐ Government should make it illegal.
   - ☐ I don’t know.
### Some Substitutions for Household Toxic Substances

<table>
<thead>
<tr>
<th>Instead Of</th>
<th>Try:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Freshener</td>
<td>Set vinegar out in an open dish.</td>
</tr>
<tr>
<td>Drain Cleaner</td>
<td>Pour boiling water down the drain, or use a plunger or a metal snake.</td>
</tr>
<tr>
<td>Furniture Polish</td>
<td>1 tsp. lemon oil in 1 pint mineral oil, or rub crushed raw nuts on the wood for an oily polish.</td>
</tr>
<tr>
<td>Houseplant Insecticides</td>
<td>Wash leaves with soapy water, then rinse.</td>
</tr>
<tr>
<td>Mothballs</td>
<td>Put clothes in cedar chests, or place cedar chips around clothes.</td>
</tr>
<tr>
<td>Oven Cleaner</td>
<td>Salt, baking soda, water (and elbow grease!).</td>
</tr>
<tr>
<td>Roach Spray</td>
<td>Chopped bay leaves and cucumber skins, or boric acid (sold in powdered form), or 1 part borax and 1 part brown sugar set out in dishes (these are not as effective, and the latter two may be hazardous to animals and children).</td>
</tr>
<tr>
<td>Silver Cleaner</td>
<td>Soak silver in 1 qt. warm water containing 1 tsp. baking soda, 1 tsp. salt, and a piece of aluminum foil.</td>
</tr>
<tr>
<td>Toilet-Bowl Cleaner</td>
<td>1/2 cup bleach.</td>
</tr>
<tr>
<td>Window Cleaner</td>
<td>2 tbsp. vinegar in 1 qt. water</td>
</tr>
</tbody>
</table>

Is Cleaning Hazardous To Your Health?

Grades 5-8

Main Concept:
Hazardous household products are required to have information about the hazardous ingredients they contain on the label.

Standards:
MS S4c: The student produces evidence that demonstrates understanding of health such as nutrition, exercise, and disease; effects of drugs and toxic substances; personal and environmental safety; and resources and environmental stress and MS S 4d impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.

Activity Objective:
Students will learn about the ingredients in hazardous household products, and will identify the potential effects of such products in humans.

Materials:
handout entitled, “Warnings” and “Dictionary” Chart (one per pair/group)

Keywords:
toxin, carcinogen, ventilate, acute, teratogen, isolation, chronic, irritant, mutagen, corrosive, EPA, documented, stringent, miscarry, thalidomide

Background:
Since 1959 the Environmental Protection Agency (EPA) has required the testing of chemicals that will be used in commercial products. Chemicals in use prior to 1979 were given blanket (untested) approval. Until health hazards are documented against a certain chemical, it is presumed safe. If adverse health effects are suspected, the product remains on the market until the EPA completes additional testing. Testing may result in a product being banned or restricted, or more stringent labeling may be required.

Tests are most commonly performed on rats, monkeys, rabbits, and pigs. While animals can give us an indication of a chemical’s safety, the reaction is not always applicable to humans. For instance, rats cannot vomit or miscarry and they manufacture Vitamin C within their own bodies, to detoxify poisons. The drug thalidomide was tested on rats with no adverse reactions, yet that was certainly not true for humans. Use of thalidomide as a painkiller by expectant mothers resulted in terrible, unexpected birth defects.

Testing of new chemicals requires testing only for acute reactions and only in isolation. Yet in actual usage, few chemicals are actually used in isolation (Consider the number of cleaning agents one might use in a single day!). Testing is completed by the manufacturers who wish to market the product, with the results submitted to the EPA. Perhaps they would want the test results to be favorable, as their own test results greatly influence the EPA’s decision to announce them as Safe.

Knowledge and Performance Outcomes:
Knowledge: Students will understand the meaning of the keywords and will be able to use them. Students will understand that in many cases, non-toxic materials may be substituted for toxic substances. Students will understand that some products contain toxic substances that are not indicated on the labels, thereby creating unknown personal hazards. Students will know that they must protect themselves from undue exposure to hazardous substances by following product safety recommendations.

Performance: Students will be able to participate in class discussions about ingredients and safety of household products. Students will be able to complete the student handout entitled, “Warning” and will be able to suggest safe alternatives to the products listed where possible.
Teacher Notes:
Teachers should discuss both the background information and keywords with students before the activity. Since some students may not have knowledge of DNA, reproduction, pregnancy, miscarriage, etc., the teacher is advised that some extra information may have to be presented in some grade levels. Students may work in pairs or in small groups.

Teacher Procedure:

1.) Ask students how they would find out what ingredients are in a household product and if it is safe to use.
2.) Explain that by reading a label we can become aware of some of the toxins around us, but that the labels do not list all of the ingredients and are not required to advise consumers of the acute or chronic health effects resulting from use of a product.
3.) Explain that consumers may suffer reactions from using certain chemicals. Acute effects are immediate reactions—such as getting jittery after drinking coffee or soda with caffeine. Other acute reactions include nausea, headaches, or light-headedness. Chronic reactions occur over time and include things as lung cancer after a lifetime of smoking or are the result of limited exposure to a dangerous substance. Researchers have found that only a brief or infrequent exposure to a carcinogenic substance may be all that is required to alter certain body cells irreversibly. Liver and kidney damage, central nervous system damage and cancer are among the chronic effects from toxic substances. Birth defects can be yet another reaction to toxins; a teratogen is a toxic substance which affects a developing fetus (including cigarettes, alcohol, drugs, and many other chemicals). A mutagen can affect the unborn by altering the cells in a parent’s body with those changes passed on to the cells of the offspring.
4.) Distribute the worksheets. Discuss/brainstorm non-hazardous alternatives to products listed on the “Warnings!” handout and ways to reduce exposure when using the products listed on the “Warnings!” sheet (ventilation, protective clothing, etc.) if there is no substitute. Have students examine their mini-dictionary, defining any unfamiliar terms as necessary, and consult the “Alternatives to Hazardous Products” Fact Sheet. Upon completion, the chart may be reproduced on the board for student discussion purposes. Students may recognize that that there are some toxins for which precautions for the user would be inadequate, and/or that non-hazardous alternatives do not exist for some items. Then discuss the option of making an informed choice as a consumer not to purchase such products, and the consequences of such a decision.
5.) Explain to students that the laws requiring labeling of household substances are limited. One reason for this is the manufacturer’s desire to protect their products from competitors. Thus, companies don’t want to divulge the list of ingredients contained in their products. Some pressure is being applied through worker “Right to Know” Laws. Companies are now required to notify workers who will be using toxic substances and to provide adequate protection against those substances.
6.) Consumers however, may unknowingly be exposed to toxins. Some shampoos contain captan, a chemical known to cause cancer. Yet these shampoos are not labeled with that information (or even with all ingredients), forcing consumers to make uninformed choices. Encourage students to discuss the dilemma of manufacturers rights vs. consumer rights, assigning roles to students to represent all sides of the debate.

Follow-Up:
Students may compare “Warnings!” sheet ingredients list to actual products found in their homes (with parental supervision and without actual exposure to the product contents). Examination of the label is sufficient.

Ask student to answer the following questions:

What ingredients are listed on the product label?
(Note: Not all ingredients are listed)

Which of the ingredients are toxic?

What precautions are advised by the manufacturer to protect the product user?
Dictionary of Toxins
Potential Health Effects of Certain Chemicals

ammonia vapor irritates eyes, skin, nose, and lungs; may cause long term damage to these organs

ammonium hydroxide vapor is extremely irritable to skin, eyes, nose and lungs; swallowing causes tissue burns

benzene flammable; causes cancer; builds up in fat, bone marrow and liver tissue

cadmium suspected of causing cancer in animals as well as birth defects; may cause kidney damage

carbaryl causes cancer; causes kidney damage; respiratory irritant

dichlorvos possible cancer causing agent; may damage genes

diethylene glycol causes central nervous system depression and destroys tissue in liver and kidneys

ethylene glycol very toxic; 3 ounces can kill an adult; damages cardiovascular system, blood, skin and kidneys

formaldehyde causes cancer; irritates eyes, nose, throat and skin; may cause nausea, headaches, nosebleeds, dizziness, memory loss and shortness of breath

hypochloric acid causes burns from skin contact or inhalation; ingestion may be fatal

lead damage to most major body systems including digestive and nervous systems; results in anemia and brain damage

lye destroys body tissue; mists, vapors and dust cause small burns

methanol moderately toxic; ingestion may cause coma or respiratory damage

methyl alcohol flammable; damages eyes, skin and central nervous system

methylene chloride may cause cancer; causes liver and kidney damage in animals

nitrosamines causes cancer in animals; can cause liver damage; jaundice and fever

perchloroethylene damages liver and kidneys; breaks down slowly; may cause cancer

phensl flammable; very toxic; damages heart, respiratory and circulatory systems

potassium hydroxide eats away at all body tissues

sodium acid sulfate see hypochloric acid

toluene may cause reproductive problems; irritates eye and respiratory system and skin

trichloroethene damages liver and kidneys; breaks down slowly

xylene may cause reproductive problems; damages liver and kidneys; can cause skin problems

2, 4-D causes liver and kidney damage in animals; may cause convulsions and skin problems in humans

The health effects found in this list focus on long term problems. It should warn you of the dangers of the chemicals. The full effect of a chemical on a person's health is not known. Little is known about the combined effects of most chemicals; that is, what happens when one chemical is used with others.

It is important to note that some people may be more sensitive and react more easily to certain chemicals. Different people react differently to toxins.
## Is Cleaning Hazardous?

**Name**

**Date**

**DIRECTIONS:** Pick eight products from the “Warning!” sheet. Using the “Dictionary of Toxins,” look up the health effects of the chemicals found in those products. List them on the chart. Then decide if a safe alternative from the Alternatives to Household Hazardous Products fact sheet exists, or think of ways to reduce exposure. An example is done for you. Continue the chart on the back of your paper.

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>TOXIC SUBSTANCES</th>
<th>HEALTH EFFECTS</th>
<th>ALTERNATIVE/WAY TO REDUCE EXPOSURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>flea powder</td>
<td>carbaryl</td>
<td>causes cancer, kidney damage, irritates respiratory tract</td>
<td>baths for pets, cooled boiling water/lemon mixture, vacuum with salt in the bag, pyrethrum flea powder, sprinkle rosemary eucalyptus around sleeping areas</td>
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Rhode Island Resource Recovery Corporation

Project WASTE Curriculum Guide
### WARNING!
These Products May Be Hazardous to Your Health

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<td>Methylene Chloride</td>
<td>Perchlorethylene or Trichlorethane Amonium Hydroxide</td>
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Alternatives to Household Hazardous Products

The Problem:
Most people don't realize that their homes are filled with hazardous chemicals. Many of these chemicals are contained in commonly used products which are stored in basements, garages, and underneath kitchen and bathroom sinks. These products include cleaning, painting, and automotive supplies, as well as pesticides, herbicides, and fertilizers. Hazardous products are harmful to the environment during manufacture, consumer use, and when they are discarded. If these materials are disposed of in the household trash and buried in a landfill, they could leak into nearby waterways, or create dangerous gases. Hazardous home products can also pose health risks to workers who make them, to individuals who use them, and to sanitation workers who dispose of them.

The Solution:
Avoid buying products that contain hazardous chemicals. Read labels carefully—words such as “danger,” “poison,” “warning,” and “caution” indicate that a product contains hazardous chemicals. If you must buy a hazardous product, make sure to: 1) buy only what you need; 2) follow instructions exactly; 3) keep the unused potion in the original container and store in a safe place; 4) determine the best disposal method by reading the label, or by calling the Rhode Island Resource Recovery Corporation Eco Depot at 942-1430 ext 241. Be sure to clean clothes before storing them; store them with cedar chips, dried lavender, cloves, rosemary, mint leaves or dried lemon peels. The best solution, however, is to stop bringing dangerous products into your home in the first place. Refer to the list below for safe alternatives to household hazardous waste; these alternatives are not only easy to make, but are easy on the pocketbook as well!

Safe Alternatives

Household Cleaners

All Purpose Cleaners: Clean with hot water, soap, and borax. Or use cup washing soda (available in most supermarkets) per bucket of water. Add cup lemon juice or vinegar for a more powerful solution.

Disinfectants: Mix cup borax in 1 gallon hot water. This disinfectant is approved for use in hospitals.

Toilet Cleaners: Use soap and borax to clean and disinfect, use baking soda to freshen. Remove stubborn rings with white vinegar or pumice stone.

Oven Cleaners: Clean spills when they occur. Clean oven with paste of baking soda and hot water. Steel wool or pumice stone will remove black spots.

Glass Cleaners: Wash with a mix of white vinegar, water, then wipe with lint free cloth towels, a squeegee, or used newspapers. (Dry newspapers and recycle.)

Drain Cleaners: Use a drain basket. Clean clogs with cup baking soda followed by cup vinegar. Cover drain and sink overflow vent tightly until fizzing stops, flush with hot water. If clog persists, use a metal drain snake.
Wood Polish: Dust furniture and floors with a barely damp cloth. On unfinished wood, replenish lustre by polishing with vegetable oil. Polish finished wood and floors with butcher’s wax once or twice a year.

Deodorizers: Ventilate. To absorb odors, put out baking soda or white vinegar in small dishes. Several varieties of houseplants also absorb pollutants in the air. Try simmering cloves and cinnamon on the stove.

Aerosols: Purchase products in spray pumps or other non-aerosol spray bottles.

Pest Control Products

Roach Control: Mix 1 cup of borax with cup flour, cup powdered sugar, and cup cornmeal. This non-toxic poison is effective. Try dusting boric acid around baseboards. Bay leaves and garlic repel roaches when placed around points of entry and baseboards.

Ant Control: Trace point of entry: block it with a line of boric acid, cayenne pepper, or citrus oil. Seal off entry with petroleum jelly. Don’t leave dirty dishes out; clean counters with citrus oil. Block new points of entry.

Flea and Tick Control: Give your pet lengthy baths to drown the pests. Pour 2 cups of boiling water over 2 sliced lemons, let mixture stand overnight. Sponge on your pet. Vacuum rugs frequently with salt in the vacuum bag to kill fleas and larvae. For prevention, mix brewer’s yeast or garlic into your pet’s food. Sprinkle rosemary or eucalyptus around your pet’s sleeping areas. Purchase pyrethrum flea powder, a botanical, non-chemical insecticide.

Rat and Mouse Control: Set spring traps, use rubber gloves to eliminate human smell. Many baits will work: fasten bait onto the trap with fine wire. Make a rat trap by hanging bacon over a garbage can filled with soapy water. Cover the can with paper; cut a slit in the middle. Set up ramps using boards so the rat can climb up and fall in.

Mosquito Control: Leave an open bottle of pennyroyal or oil of citronella in a mosquito filled room. Rub apple cider vinegar on exposed skin. Eat extra garlic.

Moth Control: Be sure to clean clothes before storing them; store them with cedar chips, dried lavender, cloves, rosemary, mint leaves or dried lemon peels.

Insecticide/Herbicide: Use organic gardening methods. For help, call the University of Rhode Island Cooperative Extension at 1-800-448-1011. (Hours vary.)
Advocacy

Suggested Activity
1. Changing Behaviors

Supplementary Activities
A. The Lorax
B. Letter Writing Campaign
C. Design A Poster
D. Public Service Announcement
E. The Garbage Diet — A Skit
F. Environmental Health Presentation
Changing Behaviors

Grades 5-8

Main Concept:
Reuse, recycling and reduction of waste volume are important to protect the earth.

Standards:
MS S3d: the student produces evidence that demonstrates understanding of natural resource management and MS S4a big ideas and unifying concepts, such as order and organization; models, form, and function; change and constancy; and cause and effect and MS S4d impact of technology, such as constraints and trade-offs; benefits and risks; and problems and solutions; and MS S4e impact of science, such as historical and contemporary contributions; and interactions between science and society and MS S5f works individually and in teams to collect and share information and ideas.

Activity Objective:
Students will apply environmental principles learned in previous lessons and will demonstrate these principals as they make choices to protect the environment.

Materials:
Changing Behaviors handout and Changing Behaviors survey form

Knowledge and Performance Outcomes:
Knowledge: Students will recall information from previous activities and will use this information.
Performance: In small groups, students will use previous information to respond to scenarios presented in the worksheet. Working in small groups, students will apply environmentally sound principles to create written answers.

Teacher Notes:
Students will need a few days to create the surveys in small groups and to collect responses.
The discussion about the surveys should have students identify consumer habits that they have changed for themselves and should also have students ask themselves how they can help others to change their consumer behaviors.
Students may have difficulty in creating the required list of consumer questions. The teacher can lead students to questions by mentioning reuse, recycle and recycled products as well as mentioning questions such as:
- Do you recycle used plastic shopping bags?
- Do you use a thermos to carry drinks to school?
- Do you use a refillable coffee cup for school/work?
- Do you donate used clothing and shoes?
- Do you reuse seal-able plastic bags?
- Do you save and reuse paper that has blank space?
- Do you use cloth instead of paper towels?
- Do you use cloth instead of paper napkins?
- Do you choose goods that contain recycled materials?
- Do you recycle cardboard?
- Do you reuse plastic containers such as butter tubs?
- Do you reuse glass jars?
- Do you reuse aluminum foil?
- Do you place grass, branches, and leaves in a home compost pile?
- Do you use compost in the garden or yard?
- Do you choose plastic containers/products with low recycling numbers?
Teacher Procedure:

Part I
1.) Pass out the Changing Behaviors worksheet.
2.) Divide the class into small groups.
3.) Explain to the class that they are to choose three of the eight scenarios (you may add to those on the handout) to examine. In their small groups, they are to respond to the chosen scenarios, creating a brief paragraph for each.
4.) Engage students in a class discussion of the responses.

Part II
1.) Pass out the Changing Behaviors survey form.
2.) Divide the class into small groups or retain the original groups.
3.) Explain to the class that they are to create a list of 10-20 questions that they will ask other students, parents and friends about their consumer habits. Questions should cover the topics of reuse and recycling in the home and school, and buying recycled goods.
4.) Explain to students that each person should copy the list of consumer habit questions. Each student is to ask fellow students, friends and/or parents to respond to the questions. Each student should ask three people to respond.
5.) Explain to students that responses should be recorded on the Changing Behaviors survey form.
6.) Engage the class in a discussion about the survey responses and about behaviors that responders would be willing to change.
Changing Behaviors Scenarios

A. Your family discards a great deal of paper such as computer paper, paper napkins, and paper towels. How can you convince family members to change their behaviors?

B. Friends and family say that recycling takes too much time and effort. How can you help to convince them to recycle?

C. Most students throw all of their lunch packaging away. How can you change your lunch packaging to create less waste?

D. Many grocery items are packaged in plastic that cannot be recycled because the number in the recycling symbol is 3 or higher. Your family doesn’t examine the symbols. How can you change their behaviors?

E. Buying laundry detergent in very large containers saves money and reduces plastic waste. Your family buys in small or medium containers. How can you convince them to buy in bulk?

F. A huge amount of paper is discarded in school every day. Your school doesn’t have a paper recycling program. How can you convince the school to begin one? Where can you go to get assistance? Who in the school can help you?

G. Your family uses a lot of plastic wrap to protect leftovers, wrap sandwiches and cover food in the refrigerator. What can your family do to eliminate plastic wrap?

H. Wrapping paper, white and colored tissue, and cards are thrown away after presents are opened. How can these materials be recycled in your school’s art program? Who can you ask about recycling these materials in art classes?
You and your group are going to create a list of ten to twenty questions (your teacher will tell you how many) that you will ask other students, parents, relatives and friends. The questions will deal with consumer habits and should involve the concepts of reuse, recycling and waste reduction.

You should record your questions on this sheet. To help you with ideas, a sample question is listed below.

When your sheet is complete and you are asking the questions, record the answers in a special notebook or section of a notebook so that responses will be easy to locate when you are done.

Example: Do you recycle newspapers? If not, would you be willing to change your behavior?

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10.
Main Concepts:
1) Manufacturing and consumption of goods affects natural ecosystems and 2) Conservation of the earth’s natural resources is very important.

Standards:
MS S3d: The student produces evidence that demonstrates understanding of natural resource management and MS S4a big ideas and unifying concepts, such as order and organization; models, form, and function; change and constancy and cause and effect and MS S4d the impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.

Activity Objective:
Students will read or listen to an environmental fable and understand the concept of an ecosystem. From this, students will be able to draw conclusions and make predictions about the wise use of resources and the impact of human behavior on ecosystems.

Materials:
“The Lorax” by Dr. Seuss, (book or film) and student worksheet

Keywords:
pollution, ecosystem, uninhabitable, wasteland, interrelated

Background:
In “The Lorax,” Dr. Seuss introduces the Once-ler who cuts down the beautiful Truffula trees so that he can use their wonderful silk tufts to knit “thneeds”. Thneed sales are so successful that the Once-ler builds a factory and invents the Super Axe Hacker which cuts down four trees at a time. The Lorax speaks up in defense of the trees, animals, air and water that the Once-ler is destroying in pursuit of bigger and bigger profits. Finally, when the last Truffula tree is cut down, production of thneeds ends. Closed factories, polluted air, polluted water and an uninhabitable wasteland are all that remains on the once beautiful site. The Lorax can no longer live there, but he leaves behind a small pile of rocks on which the word UNLESS is inscribed.

“The Lorax” illustrates an ecosystem, a natural unit in which living and non-living parts interact. All of the parts are linked together and function as one unit. When one of the parts is altered or damaged, the entire system may fail.

Knowledge and Performance Outcomes:
Knowledge: Students will understand that manufacturing and consumption of goods can have devastating effects on natural ecosystems and that it is vitally important to conserve natural resources.

Performance: Students will successfully complete the student Lorax worksheet, answering both explicit and implicit questions. Students will participate in a class discussion that extends their knowledge of what an ecosystem is, extends their understanding of the disastrous consequences of human behavior.
Teacher Notes:
Students may have very little understanding of the structure and function of an ecosystem. As a result, the concept of an ecosystem should be a part of a pre-Lorax discussion. After the discussion, students should understand that cutting down the Truffula trees had many impacts; more than just the loss of the trees, and the loss of jobs for those working at the factory. Losing the trees created devastation and a wasteland as other organisms left the area or died off from lack of food, water and shelter.

Teacher Procedure:
1) Discuss the concept of an ecosystem with students. Select an area that most are familiar with and introduce producers, consumers and decomposers. Discuss photosynthesis and its relationship to the absorption of carbon dioxide and production of oxygen. Discuss the fact that plants and trees anchor the soil, help it to retain water, and provide shelter for all types of animals.
2) Instruct students to read or watch “The Lorax” by Dr. Seuss or have it read to them.
3) Have students individually complete the handout entitled “The Lorax.”
4) Have students participate in a discussion about their responses to handout questions. Focus the follow-up discussion on the concept of an ecosystem and note how each step of the Once-ler’s developing business removed a piece of the ecosystem until the entire ecosystem ceased to function.

Follow-Up:
Have students write poems about real forests and the wildlife that inhabit them.
Distribute drawing paper (ideally re-use blank back sides) for before and after pictures of the Truffula tree forest.
Have students create a collage of thneeds (things we think we need), either as a class project or individually, by cutting out pictures from old magazines.
Create ads for Natural Resources, modeled after the Once-ler’s ad for the thneed:

A Thneed’s a Fine-Something-That-All-People-Need. It’s a shirt. It’s a sock. It’s a glove. It’s a hat. But it has other uses. Yes, far beyond that. You can use it for carpets. For Pillows! For Sheets! Or curtains! Or covers for bicycle seats.

The Lorax spoke for trees “for trees have no tongues.” Ask students what they would choose to speak for and what would they say. Have students plan a one-minute talk on behalf of something that cannot speak for itself.
Have students illustrate their needs and wants as contrasting pictures.
“The Lorax”

1.) Why did the Once-ler cut down the Truffula Trees?
2.) Why did the Brown Bar-ba-loots have to leave?
3.) What kinds of problems does the thneed factory cause for the environment? Name at least three.
4.) What happens to the Once-ler when there are no more Truffula trees?
5.) What happens to the Lorax?
6.) What do YOU think the Lorax’s message “UNLESS” means?
7.) What could the Once-ler have done to minimize his factory’s effect on the environment?
8.) Is bigger always better? Give an example to back up your opinion.
9.) A “Thneed” is defined as a fine thing that everyone thinks they need. What are some examples of thneeds - things we think we need?
10.) If you were the Lorax, what would you have done differently to protect the environment?
1. Why did the Once-ler cut down the Truffula Trees?
   The Once-ler uses the Truffula trees to make Thneeds.

2. Why did the Brown Bar-ba-loots have to leave?
   Truffula fruit, their main food, becomes scarce when Truffula trees are cut down. The Bar-ba-loots get crummy tummies from hunger.

3. What kinds of problems does the thneed factory cause for the environment?
   Name at least three.
   Created smog, polluted pond, cut down all trees, forced wildlife relocation

4. What happens to the Once-ler when there are no more Truffula trees?
   Manufacturing ends, the factory closes down and all the Once-ler's relatives leave. The Once-ler lives alone at the top of his store.

5. What happens to the Lorax?
   He leaves the forest forever.

6. What do YOU think the Lorax's message “UNLESS” means?
   Students should mention the need for future generations to care for the earth.

7. What could the Once-ler have done to minimize his factory's effect on the environment?
   Install air and water pollution safeguard devices, replant Truffula trees continuously.

8. Is bigger always better? Give an example to back up your opinion.
   Student opinion/answers will vary.

9. A “Thneed” is defined as a fine thing that everyone thinks they need. What are some examples of thneeds - things we think we need?
   Answers will vary. Students may mention some of the items they feel pressure to buy to fit in with peers.

10. If you were the Lorax, what would you have done differently to protect the environment?
    Student opinion/answers will vary.

Adapted with permission from Oscar's Options Ocean State Cleanup and Recycling, Department of Environmental Management, Providence, RI 02908
Letter Writing Campaign

Grades 5-8

Main Concept:
Writing letters can inform and influence others to be environmentally responsible.

Standards:
MS S5f: The student demonstrates scientific inquiry and problem solving by using thoughtful questioning and reasoning strategies, common sense and conceptual understanding from Science Standards 1 through 4, and appropriate methods to investigate the natural world; that is, the student works individually and in teams to collect and share information with others.

English MS E4b: The student analyzes and subsequently revises work to clarify or make it more effective in communicating the intended message or thought, made in light of the purposes, audiences and contexts that apply to the work. Strategies include adding or deleting details; adding or deleting explanations; clarifying difficult passages, rearranging words, sentences and paragraphs to improve or clarify meaning; sharpening the focus; reconsidering the organizational structure.

Health-Standard 5: The student demonstrates the ability to use interpersonal communication to enhance health.

Health-Standard 7: The student demonstrates the ability to advocate for personal, family, and environmental health.

Activity Objectives:
1) Students will collect factual information about an environmental issue that concerns them from a variety of sources.

2) Using English conventions and collected facts, students will compose a business letter about the environmental issue.

3) Students will discuss collected information and discuss feelings about environmental issues with others during the letter construction.

Materials:
paper, pencils, pens, names and addresses of corporate or public officials, newspaper editors, student handout entitled, Letter Writing Campaign, names and addresses of public officials, business executives, newspaper editors, etc.

Keywords:
business letter, advocacy, proofread

Background:
This activity should follow a lesson on writing business letters.

Knowledge and Performance Outcomes:
Knowledge: Students will understand that writing letters to business leaders, public officials, newspaper editors and others is a form of advocacy that can possibly affect public policy. Students will know the conventions of a business letter and the grammar, punctuation, spelling and organization of its construction.

Performance: Students will identify an environmental issue that they feel strongly about. Individually or in small groups, students will compose a business letter concerning the issue that will be sent to a public official, newspaper editor, business executive or other person.

Teacher Notes:
In order for this activity to be effective, the teacher must include a lesson on writing a business letter BEFORE the activity begins. Students must create first drafts, have them proofread and must rework the letters before they are mailed. Proofreading should first be done by fellow students, then by the teachers so that students can comment on the letter contents and structure, a valuable learning tool for them.
Teacher Procedure:
1.) Make a list of your school, city or town officials, and target officials that are directly responsible for waste disposal guidelines or other environmental policies.

2.) Discuss key points found within student areas of interest and discuss the differences between fact and opinion.

3.) Have students write a first draft of the letter.

4.) Have students proofread each other's letters and ask them to share ideas with each other about content and construction.

5.) Have students edit and revise their letters.

6.) Have students proofread each other's final drafts and make suggestions, if any.

7.) Have students complete the final draft of the letter and mail it.
You are going to construct and mail a business letter to a business executive, public official, newspaper editor or other adult about an environmental issue that concerns you.

Procedure:

1. Collect facts, not opinions, that support your point of view. Make sure that sources are up to date.

2. Construct a brief outline that reflects an introduction, body and conclusion of the letter.

3. Create a first draft of the letter. Your teacher and/or members of your class will read the letter and offer comments and suggestions for its improvement.

4. Revise your letter's structure and facts to make it more effective.

5. Have someone read the revised letter and offer comments and suggestions.

6. Create a final draft of the letter, proofread it and mail it.
Design A Poster

Grades 5-8

Main Concept:
Advocacy for environmental issues can be communicated to others by using the visual arts.

Standards:
MS S5f: The student demonstrates scientific inquiry and problem solving by using thoughtful questioning and reasoning strategies, common sense and conceptual understanding from Science Standards 1 through 4, and appropriate methods to investigate the natural world; that is, the student: works individually and in teams to collect and share information with others.

Health-Standard 5: The student demonstrates the ability to use interpersonal communication to enhance health.

Health-Standard 7: The student demonstrates the ability to advocate for personal, family, and environmental health.

Art- Standard 1: The student engages in self and group expression by creating, producing, and performing/exhibiting original or interpretive work.

Art- Standard 5: The student relates various types of arts knowledge and skills with and across the arts and other content areas.

Activity Objectives:
The student will 1) create a poster that expresses feelings about environmental issues; 2) use the visual arts to communicate ideas; 3) relate human activity to environmental issues.

Materials:
poster or drawing paper, crayons, paint, rulers, scissors pictures from different sources, computer clip art, and any other materials that students would find helpful in poster construction

Keyword:
advocacy

Background:
Students need to understand that visual media is a method of communicating an important message.

Knowledge and Performance Outcomes:
Knowledge: Students will understand that concrete ideas about environmental issues can be expressed using the arts. Students will understand that art and graphics can deliver powerful messages with few or no words.

Performance: Students will use individual artistic expression to create a poster that expresses concerns about environmental issues. They will develop a theme or point of view into a poster that uses a variety of media, is neat and organized and makes good use of space. They will present their posters to the class, explaining and/or answering questions about it and will display it in a prominent place.
**Teacher Notes:**

Before the activity, the teacher should discuss the concept of advocacy and relate advocacy to the poster activity, explaining that the poster should attempt to 1) bring a situation/condition to the attention of others and/or 2) change public attitudes/practices that challenge or endanger the environment, etc. They can be informed that advocacy could take other forms as well such as writing letters to corporate or elected officials, protesting, advertising, educational campaigns, etc.

Before the activity, the teacher must give students specific parameters for poster construction; how big the poster should be, how many concept words should be used, how colorful the poster should be, what kind of materials should be used, etc. It is suggested that the posters be scored against a class-generated rubric to ensure that posters meet basic requirements. An excellent source of rubrics is the Internet site http://school.discovery.com/schrockguide/assess.html. (visual arts rubrics are included).

**Teacher Procedure:**

1.) Generate a list of key words from previous steps that students might use for their poster.

2.) Have students develop a theme or point of view to capture their audience: students may create a slogan, jingle, or caption using the selected words.

3.) From the materials provided, instruct students to design and create their poster.

4.) Have students present their poster to the class, explain it and/or answer questions about it.

5.) Have students display completed posters in prominent places in the school, in local businesses, and public areas in the community.
Main Concept:
The media, including public service announcements, can be used to inform, persuade and advocate for environmental health.

Standards:
MS S8d: The student demonstrates effective science competence by completing projects drawn from secondary research, such as the use of others’ data and MS S7e communicates in a form suited to the purpose and audience such as by writing instructions that others can follow; critiquing written and oral explanations; and using data to resolve disagreements.
MS E2e: The student produces a persuasive essay that develops a controlling idea that makes a clear and knowledgeable judgement, creates and organizes a structure that is appropriate to the needs, values and interests of a specified audience, and arranges details, reasons, examples and anecdotes effectively and persuasively, includes appropriate information and arguments, and supports arguments with detailed evidence, citing sources of information as appropriate.

Health-Standard 5: The student demonstrates the ability to use interpersonal communication to enhance health.
Health-Standard 7: The student demonstrates the ability to advocate for personal, family and environmental health.

Activity Objectives:
1) Students will research an environmental issue that concerns them 2) Students will create a public service announcement using information gathered during research 3) Students will present their public service announcements to the school in oral (intercom), written (posters) and/or video or tape-recorded forms.

Materials:
research materials such as magazines, books, newspapers, Internet, paper, pencils, pens, poster board (optional), video camera or tape recorder (optional), examples of public service announcements, student instruction handout

Keywords:
advocacy, public service announcement (PSA)

Background:
Discuss the role that media plays in informing the public, the differences between fact and opinion and ask students to watch for examples of PSAs on television.

Knowledge and Performance Outcomes:
Knowledge: Students will know that oral, public communication can be an effective tool to persuade and advocate for environmental health.
Performance: Students will use information collected during independent research to create a public service announcement and will present their product to the class.

Teacher Notes:
The teacher can identify what form or forms the PSAs will take. Some students will have access to video cameras and tape recorders while others will not. As a result, they must have several options for creating their PSA.
Students must be provided with research materials such as newspapers, magazines, books and Internet in order to research their environmental issue.
The audience should include individuals from outside the classroom (other students, parents, teachers, administrators, etc.)
Students must understand the concept of advocacy and that successful advocacy presents facts as well as opinions and persuasive language to make an impact and change people’s minds and behaviors.
The teacher may spend a class period showing examples of PSAs and having the class critique them, discussing their structure, factual content and effectiveness.
Teacher Procedure:
1.) Discuss what a PSA is and does, then ask students to look for PSAs on television or in magazines or newspapers.

2.) Show examples of several PSAs to students. Ask them to identify their message and purpose.

3.) Discuss how and why the PSAs work. Discuss the differences between fact and opinion.

4.) Generate a list of possible topics from previous steps in the Curriculum Guide.

5.) Direct students to research materials.

6.) Have students research their environmental issue.

7.) Have students create their PSA using a variety of materials.

8.) Have students deliver their PSA to a small group of students for critique and analysis.

9.) Have students modify their PSAs as necessary.

10.) Have students select forums appropriate to their forms of PSA and put the PSAs in place.
You have decided to create a Public Service Announcement about an environmental health issue that concerns you. Follow the steps below to ensure success.

1. Research your environmental health topic using a variety of sources including magazines, books, newspapers, Internet and others.

2. Collect notes from your research that you will use to create your PSA.

3. Create a written text for all forms of the PSA.

4. Show the written text to someone who can offer comments and/or suggestions.

5. If using a video camera or tape recorder for your PSA, select a helper who will read or memorize the written text and present on tape for you if you will be busy with another task.

6. If creating a poster or an announcement to be read over the intercom, copy the written text onto poster board and include graphics, artwork, etc. or create a clean copy of the text that someone will read over the intercom.

7. After showing your PSA to a small group of students who will offer suggestions for revision, revise the text and the rest of the PSA as necessary.

8. Present the PSA yourself or have another present it (depending on the form you have chosen) in the appropriate place to a larger audience.
The Garbage Diet — A Skit

Grades 5-8

Main Concept:
Waste generation can be reduced if humans change their lifestyles and behaviors.

Standards:
MS S3d: The student produces evidence that demonstrates understanding of natural resource management and MS S4d the impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.

Activity Objective:
Students and adults will be helped to think about lifestyle changes that would result in less waste.

Materials:
For the skit:
table and chairs
garbage can
old radio

For advertising the skit:
poster board
markers
defs and pencils
rulers
copy paper for note to parents

Keywords:
reduce, reuse

Background:
Brief description of major skit roles.

MOTHER- Mrs. Green works as an engineer. She works hard at her job because she wants her family to have things. She leaves home around 7 a.m. each day and returns about 6 p.m. She commutes to her job.

FATHER- Mr. Green works as a teacher. He leaves home about 7:30 a.m. and returns about 3:30 p.m. Then he starts to cook dinner and do other household chores.

MARIA- She is a high school student and is very popular. She does well in school.

JOSEPH- He is a third grade student. He is very interested in the environment, which he is now learning about in school.

GRANDMOTHER- She was born in 1918. She has seen many changes. When she was born, there was no TV, no radio and almost no one owned a car.

Knowledge and Performance Outcomes:
Knowledge: Students will understand that resources are finite and that human behaviors can be changed to reduce waste generation.

Performance: Students will assume different responsibilities in a production of the skit entitled, The Garbage Diet. Some will be in the cast, others will direct, promote, stage rehearsals, etc. Students will successfully produce the skit for an audience outside the classroom.
Teacher Notes:
The teacher should define the roles that students will have as actors, support personnel (props, advertising, memo writing, artwork, etc.) and roles should be assigned. Students can also assist the actors in memorizing their lines, act as assistant directors or directors, etc.
A date should be selected for the production. An outside audience of other students, teachers and administrators should be invited by memo or other method. Parents should be informed about their children's involvement in the production and asked to both support the production and attend it.
A rehearsal schedule should be arranged and posted. Students should memorize their lines.
Advertising materials should be created by the students and displayed in prominent areas of the school. Announcements should be made on the PA system for an appropriate time before the performance.
Students may critique the performance afterward and create suggestions for future productions of The Garbage Diet.

Teacher Procedure:
1.) Assign cast and support roles.
2.) Make copies of the skit for students.
3.) Create a schedule for rehearsals.
4.) Have students assemble props and costumes.
5.) Have students create advertising materials and announcement to be delivered over the PA.
6.) Begin rehearsals and advertising.
7.) Send memos to other teachers and administrators informing them of the performance. Assemble a list of attendees.
8.) Send memos to parents, asking for their support and attendance at the performance. Assemble a list of attendees.
9.) Make arrangements to obtain a suitable place to hold the performance.
10.) Ask maintenance personnel for necessary chair set up to occur before the day of the performance, if possible.
11.) Arrange for takedown after the performance.
12.) Assemble a group of students to clean up after the performance.
13.) Have students critique the performance and have them assemble a list of suggestions to be added to this activity for future performances.

ENTIRE CAST
1.) Mother- 42 years old, Mrs. Linda Green, Engineer
2.) Father- 42 years old, Mr. Ken Green, Teacher
3.) Teenager- 16 years old, Maria Green
4.) Elementary school student- 8 years old, Joseph Green
5.) Neighbor- Mrs. Gray
6.) Relative- Aunt Alice, from New Jersey
7.) Grandparent-Grandma (or Grandpa), 70 years old
8.) Dawn (Maria's friend)-16 years old
9.) Narrator
The Garbage Diet — A Skit

NARRATOR:
The play begins with Mr. & Mrs. Green, Maria, and Joseph sitting around the table eating dinner.

MR. GREEN:
What did you do in school today, Joseph?

JOSEPH:
Well, we learned about garbage, Dad.

MR. GREEN:
Garbage? Are you kidding? I don't think that's a subject for the dinner table, Joseph.

JOSEPH:
Oh, but it is. Mrs. Driscoll says each person makes 3-4 pounds of garbage everyday. For homework she told us to make a list of some of the things in our garbage.

MARIA:
I don't make four pounds of garbage a day.

NARRATOR:
The play begins with Mr. & Mrs. Green, Maria, and Joseph sitting around the table eating dinner.

MR. GREEN:
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JOSEPH:
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MR. GREEN:
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JOSEPH:
Oh, but it is. Mrs. Driscoll says each person makes 3-4 pounds of garbage everyday. For homework she told us to make a list of some of the things in our garbage.

MARIA:
I don't make four pounds of garbage a day.

JOSEPH:
Mrs. Driscoll says teenagers make more than four pounds of garbage a day.

MARIA:
I don't believe that. I'll bet you make more garbage than I do.

JOSEPH:
Bet I don't.

MRS. GREEN:
Why don't you have a contest to see who can make the least amount of garbage in a week?

JOSEPH:
We could all do it.

MRS. GREEN:
I suggest that instead of a contest we make it a family project. OK? Let's separate things that get thrown out from things that could be reduced, re-used, or recycled.

JOSEPH:
That will reduce the amount of trash that goes to the landfill, Mom!

MRS. GREEN:
Is everyone agreed?

EVERYONE:
“OK”
NARRATOR:
It’s now a quarter to seven in the morning. Maria and Joseph are eating breakfast.

JOSEPH:
Now remember, Maria, newspaper in one pile, then there are cans for deposit, no-deposit cans, bottles for deposit, no-deposit bottles, food scraps, plastic...

MARIA:
I can’t remember all that. Who cares about garbage anyway. I’m too busy.

JOSEPH:
It’s important, Maria. If we don’t do something about the garbage, we’re going to have serious problems.

MARIA:
Like what?

JOSEPH:
For one thing, we won’t have any place to put it! For another, it really hurts the water.

MARIA:
That’s not my problem. Is it?

MRS. GREEN:
Hey kids - it’s getting late. Joseph your lunch is on the counter.

JOSEPH:
But Mom, you used plastic. Plastic is not recyclable.

MRS. GREEN:
Joseph, what should we do?

JOSEPH:
Maybe I’ll save this clean plastic bag and re-use it tomorrow.

NARRATOR:
It is now evening. Grandmother, Aunt Alice (from New Jersey), and a neighbor have come to visit.

AUNT ALICE:
I hear you folks are going on a garbage diet.

MRS. GREEN:
Yes, but it’s so much extra work.

GRANDMOTHER:
Well, this might surprise you, but when I was a child we had no garbage at all.

MARIA:
No garbage? How come Grandma?

GRANDMOTHER:
Well no one did. We just put it in a compost pile.

NEIGHBOR:
I've got one of those. I just throw the food in a bin in the corner of my backyard. Then later, I put it on my flowers. Sure makes them grow.

MRS. GREEN:
I don’t want a smelly pile of food rotting in my backyard.

NEIGHBOR:
It doesn’t smell as long as someone remembers to “TURN” it with a shovel every month, or more often if you have time.
MARIA: But that’s work!

GRANDMA: Well, Maria, most worthwhile things do involve some work. But the work has to be shared. For example, your parents work away from home all day so it might be up to the rest of you to help out.

NEIGHBOR: Here in our community recycling’s easy. All you need are two bins. One green for paper products, the other blue for plastic, glass and metal items.

MARIA: But Grandma, what did you do with all the packages after the food was all gone?

GRANDMA: Well, there were almost no packages.

JOSEPH: You must have starved!

GRANDMA: It wasn’t as easy to get food as it is now, but we managed.

MARIA: What did you do?

GRANDMA: Well, just about everyone grew a lot of food in the backyard. Then we cooked the food and stored them in special jars. That’s called “canning.” Just about everyone had a canning closet full of food which they hoped would last a long time. Potatoes, turnips, carrots, and sweet potatoes were kept in the basement. No plastic bags, no metal cans, no cardboard boxes.

MRS. GREEN: And no food in February.

GRANDMA: Oh, it rarely got that bad, but it’s like anything else…there are advantages and disadvantages to having packages.

JOSEPH: Weren’t there stores when you were young Grandma?

GRANDMA: Oh there were stores, but you had to bring your own container in which to take the food home. Or, the store gave you a container which you had to give back later.

AUNT ALICE: It seems to me that you people in cities have more garbage problems than in other places.

MRS. GREEN: That’s because our drinking water is under the ground. When garbage is thrown out on the ground, any parts that dissolve can go into the water if not properly managed.

MARIA: But that means we can never throw anything out!

MRS. GREEN: That’s not as hard as it sounds, Maria. Take that old radio you threw away this morning.

MARIA: Oh, that radio was broken, Mom.

GRANDMA: Yes, but I’ll bet your school has a course in electricity.

MARIA: Why didn’t I think of that? They could probably have fixed it. But I don’t want that radio anyway.
GRANDMA:
Yes, but there are people who don’t have any radio at all. I’ll bet they’d be happy to get a fixed-up old radio.

MARIA:
How come you’re so smart, Grandma?

JOSEPH:
She’s not smart, Maria. She’s just old.

MR. GREEN:
JOSEPH!

GRANDMA:
Joseph is right. People learn by making mistakes. The older you are, the more mistakes you’ve made, and the more you’ve learned.

MR. GREEN:
That’s why we have recycling. It’s as though everyone is saying, “we’ve made mistakes, but now we’ve learned.” But even if we repair, reuse, recycle, and reduce, we still will have some garbage that will need to be incinerated or sent to a landfill.

GRANDMA:
What have you learned, Ken?

MR. GREEN:
I was afraid you were going to ask me that. I’ve learned that going on a garbage diet isn’t easy.

JOSEPH:
But it’s important. Right, Dad?

MR. GREEN:
Right, Joseph.

NEIGHBOR:
It’s not enough to talk about it. Everyone has to do something about it. Wouldn’t it be great if every family went on a garbage diet?

MARIA:
We would have the world’s smallest garbage dump!

MRS. GREEN:
And the cleanest water. Joseph has taught us that.

DOOR BELL RINGS...

MRS. GREEN:
Maria, it’s your friend, Dawn.

DAWN:
Hi, Maria. Want to go to the mall?

MARIA:
OK, Dawn, but first I have to go through my garbage pail.

DAWN:
Your garbage pail?

MARIA:
Yes. I want to find an old radio I threw out this morning.

DAWN:
OK, but some people are weird.

MARIA:
It’s not weird. You want clean water, don’t you?

DAWN:
Well, sure, I guess.

MARIA:
Well it’s not enough to talk about it. We have to do something about it.

MR. GREEN:
We ALL have to do something about it.

Adapted from Wrap Sessions: Town of Islip Recycling Curriculum, by Department of Environmental Control, Town of Islip, NY.
Environmental Health Presentation

Grades 5-8

Main Concept:
Technology, such as PowerPoint, can be used to inform, persuade and advocate for environmental health.

Standards:
MS S8d: The student demonstrates effective scientific competence by completing projects drawn from secondary research, such as the use of others’ data and MS S7e communicates in a form suited to the purpose and the audience, such as by writing instructions that others can follow; critiquing written and oral explanations; and using data to resolve disagreements.

Health-Standard 5: The student demonstrates the ability to use interpersonal communication to enhance health.

Health-Standard 7: The student demonstrates the ability to advocate for personal, family and environmental health.

Technology- Performance Indicator 5: The student applies productivity/multimedia tools and peripherals to support personal productivity, group collaboration, and learning throughout the curriculum.

Performance Indicator 6: The student designs, develops, publishes and presents products using technology resources that demonstrate and communicate curriculum concepts to audiences inside and outside the classroom.

Performance Indicator 7: The student collaborates with peers, experts, and others using telecommunications and collaborative tools to investigate curriculum-related problems, issues and information and develops solutions or products for audiences inside and outside the classroom.

Activity Objectives:
1) Students will research an environmental health issue that concerns them
2) Students will create a PowerPoint presentation using information gathered during research
3) Students will share the PowerPoint presentation with a selected audience combining computer technology with comments.

Materials:
research materials such as magazines, books, newspapers, Internet, computer, PowerPoint software, student instruction sheet.

Keywords:
PowerPoint presentation, advocacy

Background:
In order to complete this activity, students need to be able to use a computer and PowerPoint software successfully. They also need to know how to complete basic research.

Knowledge and Performance Outcomes:
Knowledge: Students will know that use of technology such as PowerPoint, can be an effective communication tool that can be used to persuade and advocate about and for environmental health.

Performance: Students will use information collected during research to create a PowerPoint presentation and will present their product to a selected audience.
**Teacher Notes:**
This activity is best suited to students who have good computer skills. In order to assist students experiencing difficulty in creating the presentation, the teacher should be familiar with PowerPoint or must enlist the help of another faculty member who can be used as a resource. Students must have regular access to a computer and PowerPoint software within the school building as well as another source because in-school time will be limited. They must also have access to resource materials such as newspapers, magazines, books, Internet, etc. to research their environmental health issue.

The selected audience should include individuals from outside the classroom (other students, parents, administrators, etc.)

Students must understand the concept of advocacy and that successful advocacy presents facts as well as opinions and persuasive language to make an impact and change people’s minds and behaviors.

**Teacher Procedure:**

1.) Have students select an environmental issue as previously discussed in the Project WasteCurriculum Guide.

2.) Inform students that they can work individually or in small groups to create their presentation.

3.) Instruct students to conduct the necessary research.

4.) Instruct students to create the PowerPoint presentation, with written text, using teacher help as necessary.

5.) Have students demonstrate the completed project to someone who can offer suggestions/comments.

6.) Have students make changes/revisions to their projects.

7.) Select the audience with student input.

8.) When presentations are finished, select a time for the presentation.
You have decided to create a PowerPoint presentation about an environmental issue that concerns you. Follow the steps below to ensure success.

1. Research your environmental issue/topic using a variety of sources such as magazines, books, newspapers and the Internet.

2. Collect notes that you will use to create comments for your presentation.

3. Create a written text and use PowerPoint software to add pictures, graphics, artwork and other materials to your text.

4. Show the first version of your presentation to someone who can offer suggestions/corrections.

5. Make changes to your presentation as necessary.

6. Present your PowerPoint project to your audience with written text.