INTRODUCTION TO WASTE MANAGEMENT

Municipal Solid Waste Management
Waste Management in Alabama is as diverse as the state's natural resources. Municipal solid wastes are generated in homes, commercial establishments, institutions, and industries. Municipal solid waste varies from yard waste to food scraps and from construction and demolition debris to office and classroom paper. In the United States, each individual produces 2,555 pounds of garbage each year. In Alabama, each individual produces approximately 4.5 pounds of municipal solid waste a day. Local governments, waste management companies, and consumers have established methods of disposing of waste in an environmentally friendly manner.

Recycling is the process by which used items are reconditioned and are adapted to a new use or function. Recycling is a waste management method that can be a responsible, cost-effective way to help solve some of Alabama's waste disposal problems. Recycling helps preserve natural resources, reduce pollution, and save energy.

Composting is a low-cost disposal method whereby organic material is accumulated in mounds or containers to bring about decomposition by microorganisms such as bacteria or fungi. Composted items can be used as a soil conditioner in landscaping and gardening.

Incineration is a disposal method involving the burning of solid waste to reduce volume, with or without the recovery of energy.

Landfilling is the major disposal method of solid waste in Alabama. A landfill is a system of trash and garbage disposal in which waste is buried between layers of earth in such a manner that minimizes environmental hazards. New EPA regulations called subtitle D make landfilling more environmentally friendly than before, but much more expensive.

Hazardous Waste Management
In addition to municipal waste management, Alabama also must manage hazardous wastes produced in the state. *Hazardous waste* is any solid, liquid, or gaseous material that is no longer of use in its present form and would cause injury or death to living organisms and would pollute land, air, or water if improperly disposed. Some examples of hazardous wastes include oil, batteries, pesticides, and oil paints. Hazardous wastes may be managed through minimization, resource recovery such as recycling or reuse, treatment, or disposal.

The *Resource Conservation and Recovery Act* (RCRA) classifies hazardous waste into two categories: characteristic hazardous waste and listed hazardous waste. *Characteristic hazardous wastes* exhibit one or more of the following traits: ignitability, corrosivity, reactivity, or toxicity. *Listed hazardous wastes* are incorporated into lists from the RCRA rules. They exhibit one of the previously listed characteristics or contain any number of toxic constituents that have been shown to be harmful to health and the environment.

Household hazardous waste, unlike hazardous waste generated by industry, is not regulated in Alabama by the Alabama Department of Environmental Management or the U.S. Environmental Protection Agency. The best way to manage household hazardous waste is to avoid generating hazardous products.

Disposal may be reduced or eliminated by giving leftover products away, recycling materials when possible, using less hazardous alternatives when possible, and buying only the amounts of products needed.

What A Waste!

OBJECTIVES:

The student will be able to:
1. Analyze the components of garbage.
2. Collect and sort a few day's worth of garbage.
3. Chart the results of an investigation.

Grades:
3-5

Subjects:
Science, Math

Time Needed:
Two class periods, time lapse of about two days

Materials:
vinyl tablecloth
one garbage bag per student
student handout

BACKGROUND:

Solid wastes are generated from activities in the home and in the commercial establishments, industries, agriculture, and mining. The wastes include food scraps, containers, plastics, textiles, abandoned cars, dead animals, construction scrap materials, waste treatment sludge, and individual items.

In 2012, U. S. residents, businesses, and institutions produced more than 251 million tons of municipal solid waste (MSW), which is approximately 4.38 pounds of waste per person per day! Municipal solid waste is composed of the following components: paper (27.4%); yard waste (13.5%); food waste (14.5%); plastics (12.7%); metals (8.9%); rubber, leather, and textiles (8.7%); glass (4.6%); and other (3.4%).

Currently, in the United States, 34.5 percent of municipal solid waste is recovered and recycled or composted, 11.7 percent is burned at combustion facilities, and the remaining 53.8 percent is disposed of in landfills.

VOCABULARY:

composting - collecting and layering organic material, such as lawn clippings, leaves, kitchen scraps, and manure, in order to decompose into fertile humus
incinerate - to burn to ashes
landfill - an area set aside for burying waste under layers of dirt
municipal solid waste - garbage produced in homes and in the work place
recycling - the collection and reprocessing of manufactured materials for reuse either in the same form or as part of a different product
sludge - a heavy, slimy deposit of mud and mire covering the ground or forming a deposit at the bottom of bodies of water

ADVANCE PREPARATION:

1. Reproduce the attached pie chart onto a vinyl tablecloth.
   - Use an opaque projector for accuracy.
   - Use permanent markers for durability.
2. Collect a sample of garbage from a kitchen wastebasket the night before this activity.

PROCEDURE:

Setting the stage
1. Discuss solid waste using the background information.
2. Describe the contents of the United State's solid waste.
3. Brainstorm problems that exist about managing solid waste.

Activities

1. Analyze the contents from a day's worth of kitchen garbage.
   - Place the tablecloth on the floor and organize the students around its perimeter.
   - Display the contents from the garbage can.
   - Sort the trash and place it on the tablecloth in the appropriate spot.
2. Collect the garbage each student uses for a predetermined amount of time (two days is suggested).
   - Provide each student with a plastic garbage bag.
   - Instruct students to place all the garbage they would throw away into the bag. Discuss any guidelines you wish to impose. Consider asking them to carry the bag with them wherever they go.
   - Complete the Student Activity Page.
   - Provide scales to weigh the garbage.

Follow-Up

1. Discuss the results of the activity.
   - Share the completed student handouts.
   - Develop a class chart displaying totals.
2. Compare individual results with the pie chart.

EXTENSIONS:

1. Remove the garbage cans in the classroom. Do not allow anything to be thrown away for a few days! Discuss the effects. Remind students that where to put garbage is an important issue that many communities face.
2. Construct a bar graph using the data collected by students.
3. Classify collected garbage according to how it could be disposed (incineration, landfill, recycle, reuse).

ORIGINAL DEVELOPMENT RESOURCES:

Cooperative Extension Service. (1989). *Lessons in solid waste management: 3-R's*. Manhattan, KS: Kansas State University.

Kraft General Foods. (1993). *Solid thinking about solid waste*.

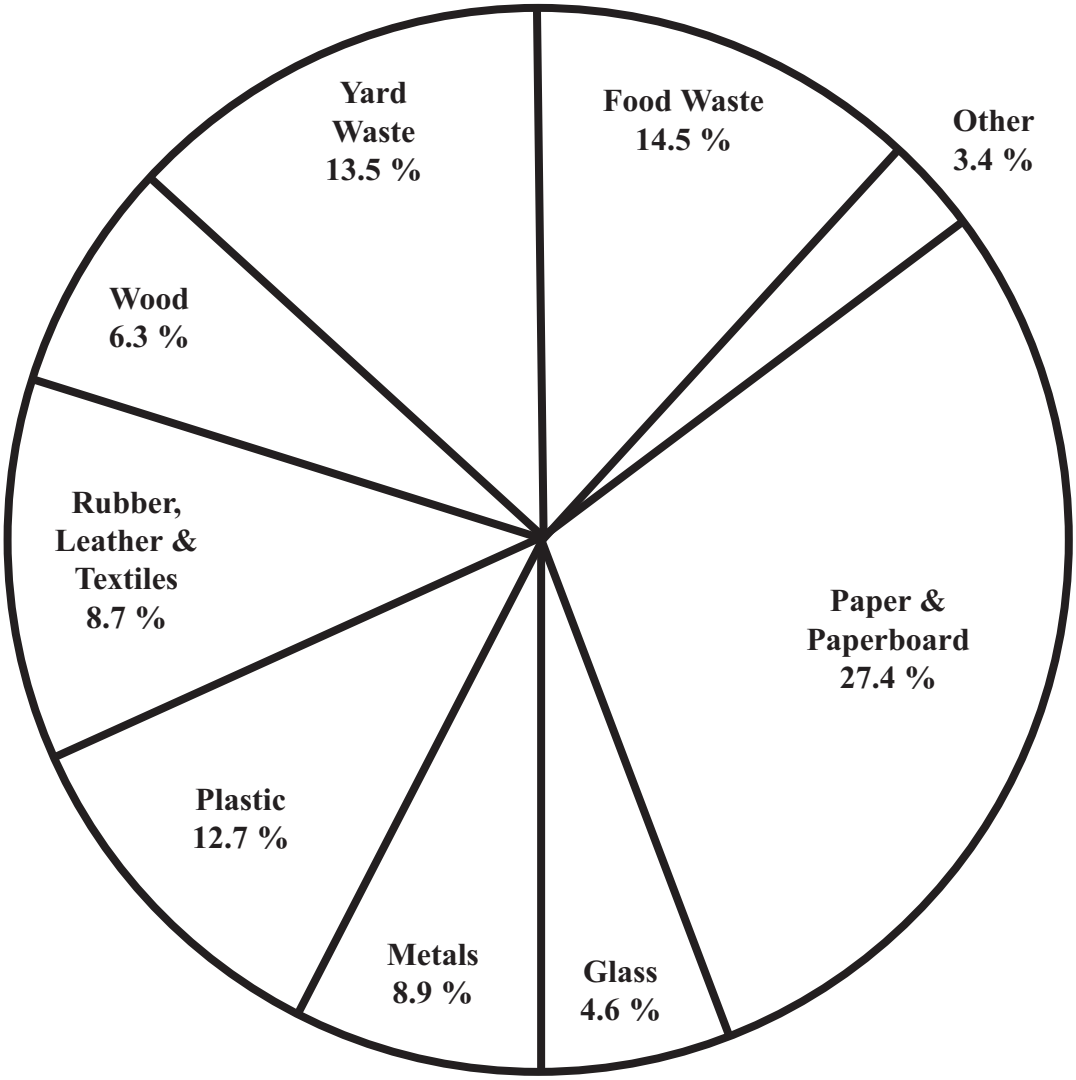
www.epa.gov

ADDITIONAL RESOURCES:

Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012 - http://www.epa.gov/waste/nonhaz/municipal/pubs/2012_msw_fs.pdf

http://www.paperrecycles.org/

Composition of Municipal Solid Waste

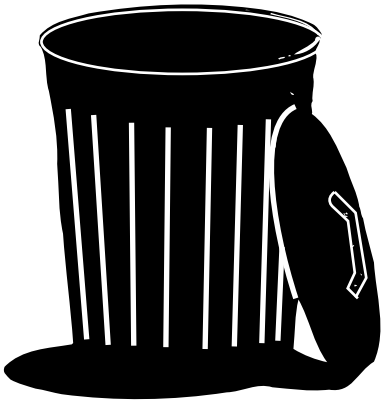


Name_____

What A Waste!

Directions: Record the amount of trash you produce in _____ days on the chart below.

	Amount	Examples
Paper	_____**lbs**	
Yard Waste	_____**lbs**	
Metals	_____**lbs**	
Plastic	_____**lbs**	
Food Waste	_____**lbs**	
Glass	_____**lbs**	
Miscellaneous	_____**lbs**	
Total	_____**lbs**	



Trash Flash Through Time

OBJECTIVES:

The student will be able to:

1. Describe ways solid waste was disposed in the past and the present.
2. Survey an older citizen about solid waste disposal methods.
3. Discover solid waste practices from long ago.

BACKGROUND:

According to the U.S. Environmental Protection Agency (EPA), Americans generated about 152 million tons of trash in 2012.

This tremendous amount of materials represents either a large waste disposal chore or a resource recovery opportunity, depending on one's viewpoint. Recycling is one way to manage this waste. Recycling is not new. It was practiced extensively during World War II to recover scarce materials and other materials vital to the war effort. Even earlier than that, recycling and reuse were practiced for similar resource conservation and home economic reasons.

Grades:

3-5

Subjects:

Science, Language Arts

Time Needed:

One class period and survey assignment

Materials:

copy of "Older and Wiser Survey" for each student
student handouts

VOCABULARY:

recycle - to separate a given waste material from other wastes and to process it so that it can be used again
reuse - to extend the life of an item by repairing, modifying, or creating new uses for it

ADVANCE PREPARATION:

1. Make copies of student handouts.
2. Gather materials.

PROCEDURE:

Setting the stage

1. Display an old tin cup, a cola bottle, and a cola can.
2. Relate the change in product packaging and disposal throughout history.
3. Read the included story "Trash Flash Through Time" to the class.

Activities

1. Immediately following the story, ask the class to consider these questions:
   - Which of these items was tossed out the window and onto the streets of London 700 years ago? (cans, glass, paper, aluminum, plastic containers, food wastes)
   - What was the method of disposing of garbage 700 years ago?
   - What is the composition of modern-day garbage? (food and yard wastes, cardboard and paper, metals, plastic, glass, rubber, leather, textiles, wood and miscellaneous inorganic wastes)
   - What is our method of disposing of garbage? (primarily land filling and incineration)
   - What do you think was the first attempt to recycle? Did your grandparents recycle? How can we find out?
   - What can we learn about recycling from our past? Our grandparents and their parents recycled or reused many materials that are commonly thrown away today.

2. Have students interview a grandparent or other older person in their family or neighborhood using the survey included with this lesson.
   • Practice interview skills.

Follow-Up

1. After students have completed their interviews, have them participate in this discussion.
   • What items did your grandparents or friends recycle?
   • How did they conserve resources?
   • What materials were used for packaging then?
   • How did they keep food items from spoiling?
2. Write an "I learned" statement regarding your grandparent's use of resources. (Compile a class list on chart paper.)

EXTENSIONS:

1. Complete the questionnaire "Trash Flash Today".
   Answers to the questionnaire:
   • 4.5 pounds (2kg) can be attributed to each person; 8 pounds (3.6kg) per person per day includes all wastes such as manufacturing wastes combined with household wastes.
   • Paper and cardboard make up 40 percent.
   • In Alabama, 80 percent of garbage is land filled. In Huntsville, garbage is incinerated at a waste to energy facility.
   • No, sanitary landfills have liners to protect the soil and groundwater nearby; dumps are illegal.
   • 34.8 billion. Imagine that each can is half-filled with gasoline because that's how much energy is lost ! More than 55 percent of aluminum cans are recycled.
   • 32 percent by weight and 30 percent by volume.
   • True. Example: recycling newspaper into cardboard boxes or melting used glass jars to make new ones.
   • Open discussion; explain why.
2. Have students write their own stories about trash in the past or in the future.
3. Encourage students to write "Thank You" notes to the people they interviewed.

ORIGINAL DEVELOPMENT RESOURCES:

Perez, K. (1990). *Solid waste management in Alabama: Handbook for county extension agents.* Auburn University, AL: Department of Agricultural Economics and Rural Sociology, Alabama Cooperative Extension System.

Waste Disposal. (1988). *World book encyclopedia*. (Vol 21, pp. 112-113)

www.epa.gov

ADDITIONAL RESOURCES:

Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012 - http://www.epa.gov/waste/nonhaz/municipal/pubs/2012_msw_fs.pdf

Let's Take a

Trash Flash Through Time

You are walking through a quiet, beautiful forest. You feel happy to be in such a peaceful, lovely place as this. You come to an opening under a canopy of leaves; and in the rays of sunshine, you see a strange and unexpected sight. it looks sort of like a car, sort of like a thing one would ride at a carnival. It looks like a whole lot of fun, whatever it is, so you open the door and step inside a most miraculous little machine.

There are lights , buttons, levers, graphs, clocks, dials, calenders, and computer screens..and you know at once - This is a time machine !

Carefully following the instructions on the screen, you fasten your safety belt, set the clock in reverse, and wait. Dials spin, buzzers sound, and you feel yourself being thrust back into your seat. On the big computer screen above your head, you see events in time come to life: the first trip to the moon; World War II planes flying over Europe; George Washington crossing the Delaware during a harsh winter storm; the Nina, Pinta, and Santa Maria ships heading westward. Wait ! It's going too fast ! You've got to stop this thing ! Your finger finally finds a button marked STOP. You press it and the number 1250 flashes above. The machine stops ! And the door opens slowly behind you....

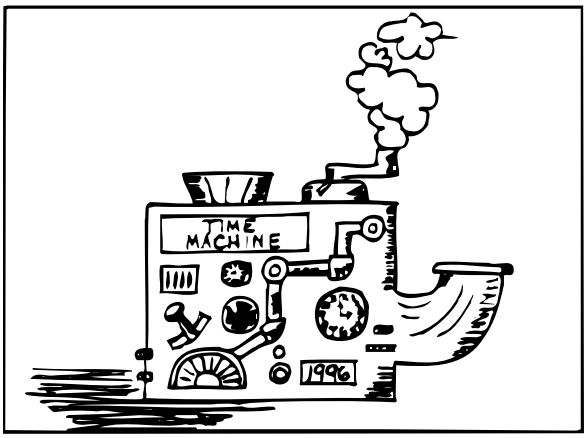
It is a misty morning on a cobbled stone street. Fog is rolling in, and there is a chill in the air. Signs hanging above the shops let you know you're in London, England. The clopping hooves of a horse drawn cart can be heard in the distance. Squealing piglets are being joyfully chased by children running all about.

Then from above, SPLASH ! PLOP ! Out of an open window comes a shout, "GARDY-LOO !" followed by a heaving bucket of garbage. Vegetable peels and table scraps fall right onto the street below. It barely misses you ! And now here come the pigs, rushing to the scene to investigate the tasty morsels of garbage they might eat.
Can you imagine people throwing garbage out of their windows and onto the streets? Pigs run freely about to eat whatever is edible.

"GARDY-LOO !" The call comes again. Oh ! No ! Look out. Running, ducking, jumping over slippery, slimy garbage, you head back to the time machine, set the dials to the present, and hit the buttons again. You feel yourself being flung forward in your seat. Dates fly past on the dial; and before you know it, you're back, right where you were when you found the machine.

WHEW ! What a trip ! The door opens behind you, but you remain seated as your mind continues to spin with the memory of your adventure.

Just think of all the garbage ! It's good to be back home.



Trash Flash Through Time

Older & Wiser Survey

Begin by explaining: We are conducting interviews with the older generations so we can learn how people handled their garbage and resources in the past. Your stories are valuable to our research. Thank you for agreeing to do this interview.

Please answer all of the questions for the time period when you were my age.

1. What is your full name?_____
2. Where were you born?_____
3. What was the year when you were my age?_____
4. What did you do for fun?_____
5. How old were you when you got your first TV?_____
6. What chores did you do?_____
7. How did you get to school?_____
8. What toys did you have?_____
9. What were they made of?_____

Food

10. How was your family's food kept fresh?_____
11. How did store-bought food come packaged?_____
12. What did you do with the package or container when it was empty?_____
    _____
13. Did you pack your own lunch?_____
14. If you ever brought food home from a restaurant, how was it packaged?_____
    _____

Paper

15. What did you do with old papers, magazines, and books?_____
16. Did you use old papers, magazines, or towels?_____
    If not, what did you use?_____
17. Did stores provide paper shopping bags?_____

Glass

18. What types of glass containers did you have? (jars, soda bottles, milk bottles)_____
    _____
19. Did you throw them away, reuse, or recycle them?_____

Aluminum

20. Did you have aluminum?_____
    For what uses?_____
21. Did you throw it away?_____

Older & Wiser Survey (continued)

Tin Cans

22. What kinds of food did you buy in cans?_____
23. What did you do with the cans when they were empty?_____

Plastic

24. Were there plastic containers?_____
    What came in them?_____
25. What was in your first plastic bottle?_____

Garbage

26. Where was your garbage thrown?_____
27. Was any of it recycled or reused?_____
28. Did your community provide a curb-side pick-up service?_____

Wrap-up Questions

29. Did people talk about recycling and conserving resources then?_____
    _____
30. How do you think people today have changed in their attitudes?_____
    _____
31. Would you rather be a child in today's times or the times when you were a child?_____
    _____

Thank You !

Trash Flash Today !

Can you answer these questions?

1. How much trash does each person in the Unites States throw away daily?

2. What material is thrown out more than any other?

3. Is most of our garbage
   - buried in landfills?
   - burned?
   - reused?
   - recycled??

4. Are dumps and sanitary landfills the same?

5. How many aluminum cans are thrown away each year rather than recycled?

6. How much of our trash is recycled?

7. To recycle means to process waste materials into new products. True or False?

8. If you could change something about the way you recycle, what would it be?

Trash Patrol

OBJECTIVES:

The student will be able to:
1. Explain what happens to garbage.
2. Graph the amount of waste the school lunchroom produces.
3. Identify ways to reduce the amount of plastic, paper, and food waste within the school lunchroom.

BACKGROUND:

The U.S. Environmental Protection Agency estimates that over 250 million tons of municipal solid waste are generated in our nation each year ! Many areas in Alabama currently face serious problems in safely and effectively managing the garbage they generate. As a state, Alabama is generating more trash than ever before. As the waste continues to increase, capacity to handle it is decreasing. Landfills are no longer the only answer.

Recycling saves energy, natural resources, and room in the landfills. It provides raw materials for new products and helps Alabamians move away from a "throw away" society. Alabama law now requires that cities and counties develop and adopt comprehensive solid waste management plans. Alabama law also requires that all state agencies, K-12 public schools, state universities, and post secondary schools implement their own recycling programs.

Grades:
3-5

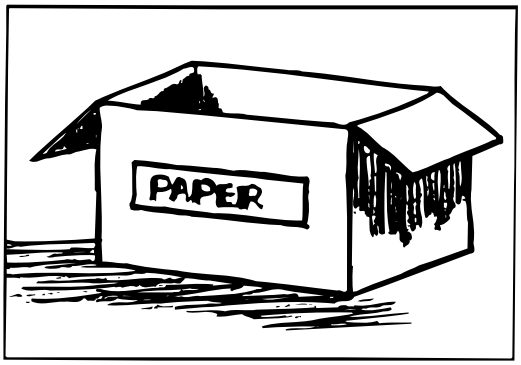
Subjects:
Science, Social Studies, Math

Time Needed:
One to two weeks

Materials:
buttons or name tags labeled "TRASH PATROL"
clipboard
paper
pencil
chart paper
poster board
colored pencils
rubber gloves
scales

VOCABULARY:

data - facts or figures from which conclusions can be drawn
Environmental Protection Agency - the federal agency charged with the enforcement of all federal regulations having to do with environmental pollutants
garbage - the organic or inorganic food waste thrown away
landfill - an area set aside for burying waste under layers of dirt
recycle - to separate a given waste material from other wastes and process it so that it can be used again
reduce - decreasing the amount of waste generated



ADVANCE PREPARATION:

1. Gather materials.
2. Make signs to put on garbage cans labeled "paper", "plastic", and "food waste".
3. Copy Student Activity Sheet.

PROCEDURE:

Setting the stage
1. Write the word garbage on the board.
   - Ask students to give their own definitions.
   - Write responses on the board.

2. Ask students to recall where garbage goes. (garbage can, garbage trucks, landfill)
3. Write the word landfill on the board.
   - Discuss what a landfill looks like.
   - Allow students to share if they've been to a collection site.
4. Explain that the class is going to gather data about the amount of waste generated in the school lunchroom.

Activities

1. Brainstorm items that are thrown away in the lunchroom. (napkins, milk cartons, paper or Styrofoam plates, bowls, plastic utensils)
2. Divide students into groups of five or six and assign each group a particular date to work.
   - Explain that one person will be the recorder, two students will collect lunch trays, and the remaining team members will sort the trash into the appropriate container.
   - Assign students to be on duty for the school's entire lunch period. Make arrangements for the team to eat earlier, if necessary. The recorder weighs the amount of each type of garbage and writes down any unusual or interesting observations. (For example, one class noticed an unusual number of unused plastic utensils still in their plastic bags, so they began to keep a count of these.)
   - The team records its findings on a class chart and writes a brief entry about its observations.
   - This process is continued until all groups have gathered their information. Daily reports and discussions are important.
3. Upon completion, discuss the activity.
   - Tape the class chart to the board and have each group choose a way to display the data. Give each group poster board, colored pencils, and markers to complete the graphs.
   - Have the groups analyze the data and suggest ways to reduce lunchroom waste.
   - Write these suggestions on the board and have students brainstorm ways to implement the suggestions. (For example, students notice a large number of unopened ketchup, mustard, and mayonnaise packets being thrown away, so they develop a short commercial encouraging students to take only what they need and perform the commercial on morning in-house television announcements, if system available.)

Follow-Up

1. Collect charts and graphs.
2. Have students write one to two paragraphs discussing one area of waste in the lunchroom and possible solutions.

EXTENSIONS:

1. Invite a waste disposal company spokesperson or a recycling center representative to speak to the class.
2. Have students write down everything they throw away for one day and then determine how they could reduce their amount of personal waste.
3. Visit a local landfill.
4. Compare daily menus to the amount of daily waste.

ORIGINAL DEVELOPMENT RESOURCES:

Alabama Department of Environmental Management. *Be part of the solution recycle Alabama*.

Plastic Bag Information Clearing House. (1994). *Don't let a good thing go to waste.*

Alabama Department of Environmental Management. *Get down to business...reduce, reuse, recycle - a waste management guide for small business and commercial firms.*

Trash Patrol

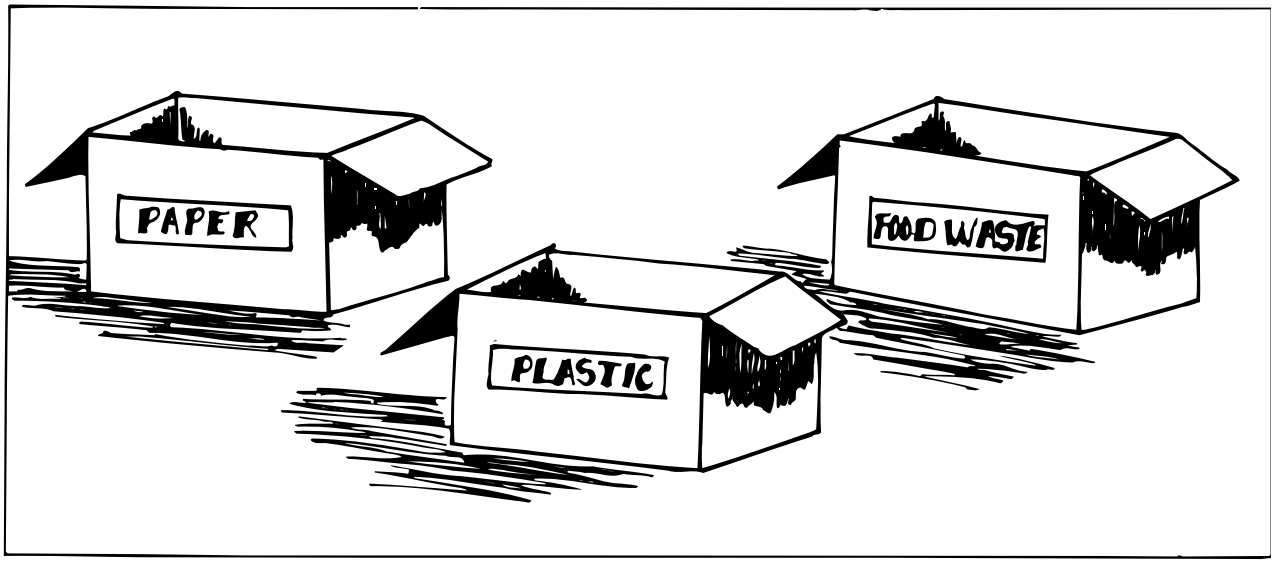
Recorder: _____

Sorters: _____
_____
_____

Collectors: _____

Time: _____
Date: _____

Type of Waste	Observations	Weight
Paper		
Plastic		
Food Waste		



Notes

We're Down In The Dumps

OBJECTIVES:

The student will be able to:
1. Predict the life cycle of a piece of trash.
2. Explain the purpose of a landfill.
3. Classify the items found in a landfill.
4. Recognize the components in a landfill.
5. Reconstruct a model of a landfill.

BACKGROUND:

Americans produce more and more garbage each year. More than 27 percent of this solid waste stream consists of the paper and paper products we discard. Yard wastes make up another 13.5 percent of the total. Approximately 14.5 percent of our trash is food waste. Plastic (12.7 percent), metal (8.9 percent), rubber, leather and textiles (8.7 percent), glass (4.6 percent), wood (6.3 percent). and other (3.4 percent) items make up the rest.

Solid waste management is primarily a local responsibility. Most communities collect their refuse either through a municipal collections service or through one provided by a private contractor. If the wastes are not recycled, composted, or incinerated, they are deposited in a sanitary landfill.

In Alabama the number of landfills with available space is decreasing. At the same time, the amount of municipal solid waste is increasing. In 1989 there were approximately 142 sanitary landfill sites in Alabama. Currently, there are 32 sites. By 2007, 91.7 percent of Alabama's wastes were landfilled. That amount is very high compared to the amount of solid wastes that were recycled, composted or incinerated.

Grades:
3-5

Subjects:
Science, Language Arts, Social Studies

Time Needed:
One class period

Materials:
poster board
sentence strip
litter (collected from students)
baggies (three per student)
clear cups (one per student)
spoons (one per student)
graham crackers (two per student)
fruit roll-up (one for every four students)
vanilla pudding w/chocolate chips
oreo cookie crumbs (three cookies per student)
coconut, colored green
licorice (one per student)
optional: garbage can, Plexiglass

Sanitary landfills consist of a series of cells or sections. Wastes are deposited on a certain area of one cell at a time. They are spread and compacted throughout the day. At the end of each day, a layer of soil about six inches thick is laid down and compacted over the wastes. This cover controls vermin and prevents fires from starting in the refuse pile. When a sanitary landfill is filled to capacity, it is covered with material of low permeability, such as clay soil, to keep rainwater out of the refuse. If no cover were provided, the rainwater would seep down through the materials to the bottom, leaching pollutants on the way and carrying them into groundwater or surface water.

VOCABULARY:

landfill - an area set aside for burying waste under layers of dirt
leach - to pass a liquid (as water) through to carry off the soluble components
monitoring wells - pipes in a landfill used as a means of controlling and measuring methane escape
permeate - to penetrate or diffuse through something
solid waste - any of a wide variety of solid materials that are discarded or rejected

ADVANCE PREPARATION:

1. Make pudding. Add chocolate chips right before class, or they will dissolve. Color coconut green.
2. Assemble journals.
3. Optional: Create a visual of Figure 3 out of a garbage receptacle and Plexiglass (obtained from a hardware store)
   - Cut receptacle in half.
   - Apply Plexiglass cover with clear caulk.
   - Make labels
   - Allow students to fill with "real" trash according to the percentages on the chart.
4. Optional: Make poster of Figure 3. have students cut pictures of different items from magazines and glue onto chart according to percentages.

PROCEDURE:

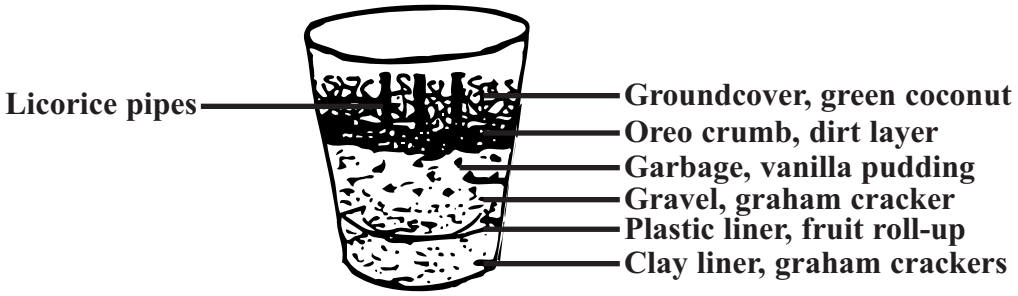
Setting the stage

Pass out a piece of candy for the students to eat or display a candy wrapper.

- Distribute garbage can journals.
- Ask students to respond to this journal prompt: Predict the life cycle of the candy wrapper.
- Collect wrappers.

Activities

1. Using the background information, discuss the main ideas with the students.
   - Ask students to predict which of the following solid waste products compose the largest amount in a landfill. List products - either Figure 3 or 4.
   - Explain the make-up and percentages of solid waste according to Figure 4.
2. Reconstruct a model of a landfill.
   - Give each student a durable clear cup, a spoon, a baggie with two graham crackers, a baggie with three oreos, and a baggie of green coconut.
   - Allow students to crush the graham crackers and oreos.
   - Layer the ingredients from the bottom up.
     Licorice pipes - represent monitoring wells
     Coconut, colored green - represents ground cover/grass
     Oreo crumbs - represent dirt cover
     Vanilla pudding with chocolate chips - represents garbage
     Graham cracker crumbs - represent gravel
     Fruit roll-ups - represent the plastic liner (cut in pieces first)
     Graham cracker crumbs - represents a clay liner
     Bottom of cup - represents solid ground.
   - Explain the purpose of each layer as you go along.



Follow-Up
Conclude the lesson.

- Summarize main ideas.
- Emphasize the fact that landfills are similar to Egyptian mummies. They both are wrapped tightly and stored in cool dark places. there is little air or sunlight in a landfill, so things do not break down.
- Discuss the 3 R's of waste management: Reuse, Reduce, Recycle.
- Ask this question for thought : What kind of legacy are we leaving future generations?

EXTENSIONS:

1. Create a rap in small groups.
2. Use the Student Activity Page "My Garbage Can Journal" for composing a story.
3. Graph the information given in Figure 4.
4. Illustrate the amount of land needed for a landfill.
   - Have four students stand at four points, 209 feet apart, in a square.
   - Relate landfill size to a football field. A sanitary landfill seven feet deep and one acre in surface area is needed each year for every 10,000 people in a community.
   - Form a scale model of a landfill using saltdough or clay.
5. Visit a local landfill.
6. Create a large poster using pictures cut from magazines (Figure 3 as an example).
7. Read *Recycle*. by Gail Gibbons.
8. Read *Cleaning Up: How Trash Becomes Treasure*. by Eve and Albert Stwertka.

RESOURCES:

Perez, K. (1990). *Solid waste management in Alabama: Handbook for county extension agents*. Auburn University, AL: Department of Agricultural Economics and Rural Sociology, Alabama Cooperative Extension System.

U.S. Environmental Protection Agency. (February, 1989). *The solid waste dilemma: An agenda for action.*

ADDITIONAL RESOURCES:

Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012 - http://www.epa.gov/waste/nonhaz/municipal/pubs/2012_msw_fs.pdf

Alabama Solid Waste Management Plan, May 2008 - http://www.adem.state.al.us/alEnviroReglaws/files/FinalSWMP_08.pdf

Figure 1

Permitted Sanitary Landfills In Alabama

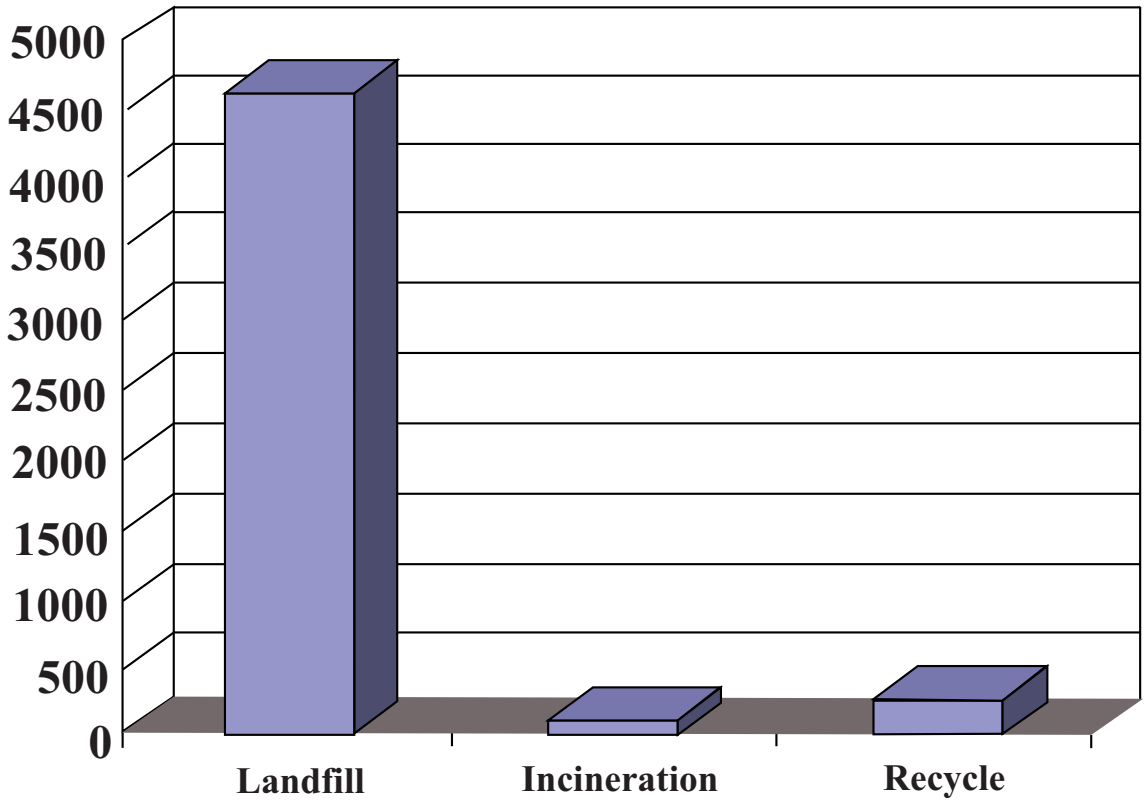
Match the sanitary landfill to the appropriate county.

	Landfill Name	Landfill City	County		Landfill Name	Landfill City	County
1.	Magnolia Sanitary Landfill	Bay Minette	Baldwin	16.	Salem Waste Disposal, Inc.	Opelika	Lee
2.	Chilton County	Clanton	Chilton	17.	Athens/Limeston County	Athens	Limestone
3.	Coffee County	NewBrockton	Coffee	18.	Huntsville	Huntsville	Madison
4.	Cullman Env. Waste Mgmt. Ctr.	Cullman	Cullman	19.	Bishop Sanitary Landfill	Alberville	Marshall
5.	Ft. Payne Sanitary Landfill	Fort Payne	Dekalb	20.	Chastang Sanitary Landfill	Mobile	Mobile
6.	Timberlands	Brewton	Escambia	21.	North Montgomery	Montgomery	Montgomery
7.	City of Dothan	Dothan	Houston	22.	Trinity (Decatur)	Decatur	Morgan
8.	Scottsboro Balefill	Scottsboro	Jackson	23.	Brundidge Waste Disposal Ctr.	Brundidge	Pike
9.	Valley View	Stevenson	Jackson	24.	Highway 70	Columbiana	Shelby
10.	Mt. Olive		Jefferson	25.	Harmons Sanitary Landfill	Cropwell	St. Clair
11.	New Georgia		Jefferson	26.	Acmar Regional Landfill	Moody	St. Clair
12.	Eastern Sanitary Landfill	Birmingham	Jefferson	27.	Tuscaloosa Balefill	Tuscaloosa	Tuscaloosa
13.	Turkey Creek	Birmingham	Jefferson	28.	Pine View	Dora	Walker
14.	Florence Sanitary Landfill	Florence	Lauderdale				
15.	Lawrence Coutny	Moulton	Lawrence				

2002, U.S. EPA

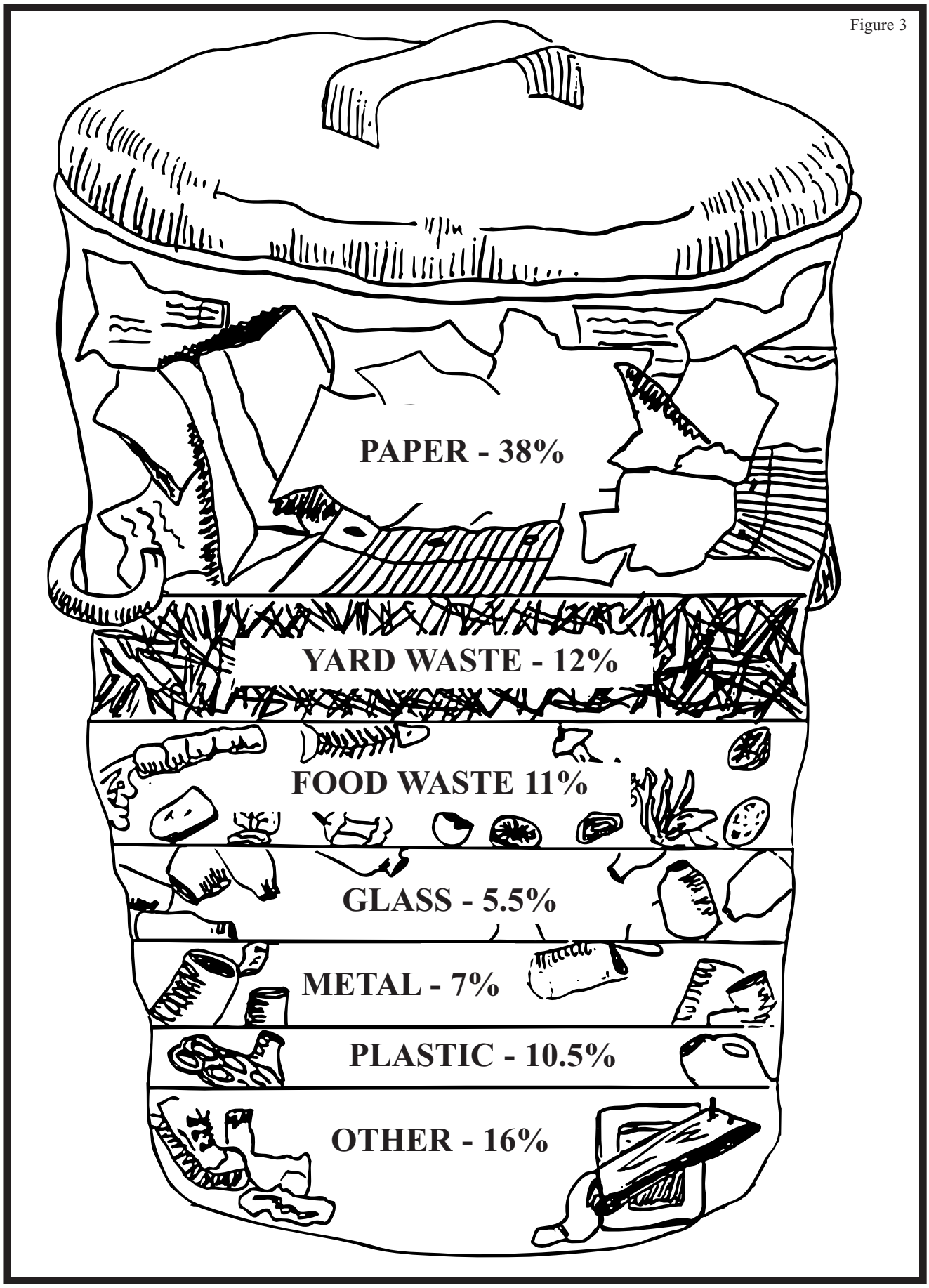
Figure 2

Solid Waste Generation, Alabama 1989



Numbers are in thousand tons. **From : ADEM, 1989**

Figure 3


PAPER - 38%
YARD WASTE - 12%
FOOD WASTE 11%
GLASS - 5.5%
METAL - 7%
PLASTIC - 10.5%
OTHER - 16%

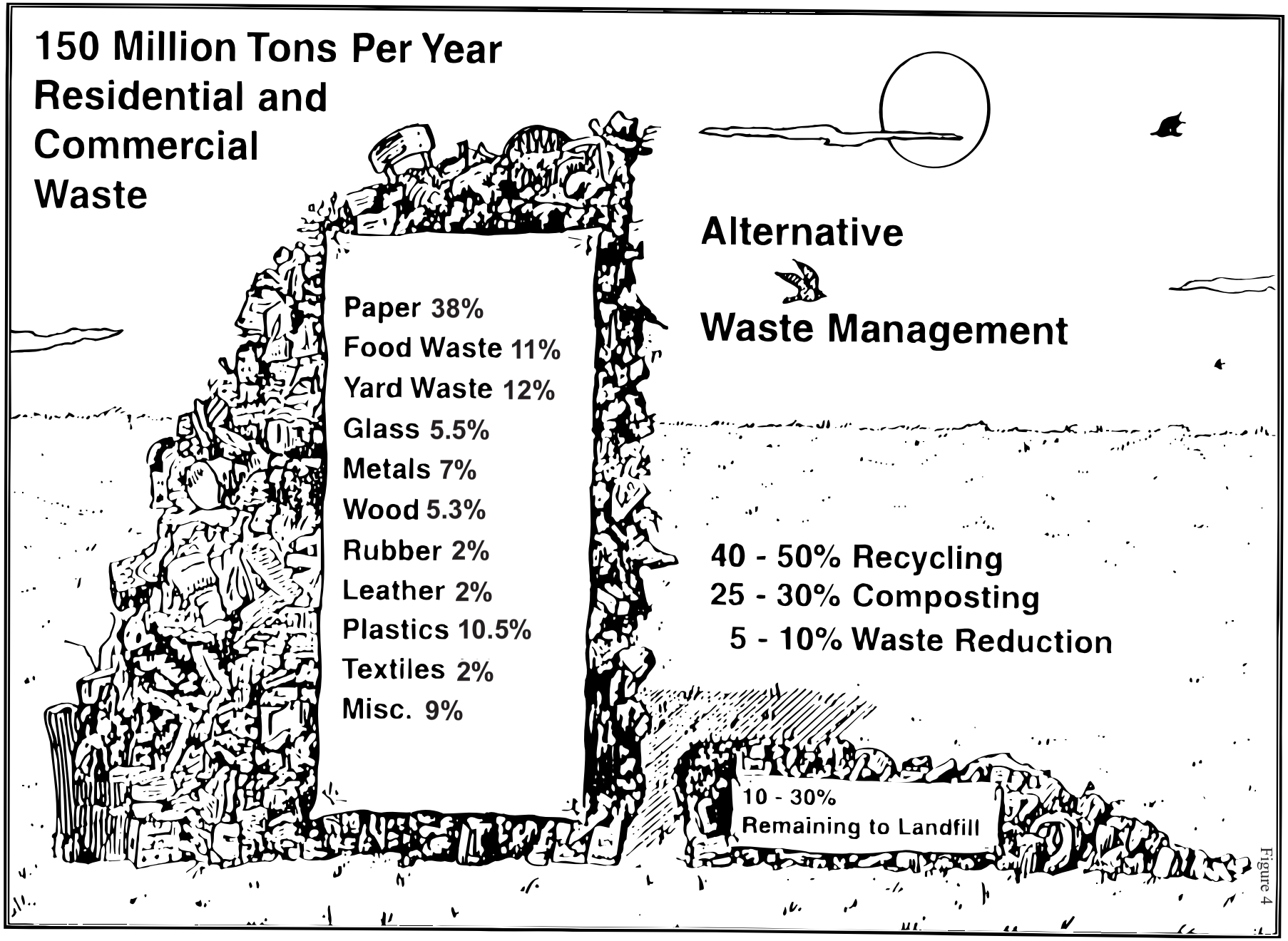

150 Million Tons Per Year
Residential and
Commercial
Waste
Paper 38%
Food Waste 11%
Yard Waste 12%
Glass 5.5%
Metals 7%
Wood 5.3%
Rubber 2%
Leather 2%
Plastics 10.5%
Textiles 2%
Misc. 9%
Alternative
Waste Management
40 - 50% Recycling
25 - 30% Composting
5 - 10% Waste Reduction
10 - 30%
Remaining to Landfill

Figure 4

Notes

Dump It

OBJECTIVES:

The student will be able to:
1. Identify legal dumping sites.
2. Understand the effect of illegally dumping waste.

BACKGROUND:

Illegal dumping is discarding garbage along roadsides or in the woods, where it degrades the beauty and health of nature. Illegal dumping can be considered a deliberate, malicious act.

People dump wastes illegally to avoid fees at landfills or to avoid traveling to landfills. The hours that a landfill is open may be an inconvenience to some people.

Illegal dumping occurs more often in rural and undeveloped suburban areas than urban areas. The penalty fees that a county charges for illegal dumping is higher than landfill charges.

VOCABULARY:

degrade - to lower in quality
illegal dumping - disposing of waste in an unofficial location
urban - in, relating to, or characteristic of a city or town
suburban - a district lying immediately outside a city or town

ADVANCE PREPARATION:

1. Gather materials.
2. Hide a nerf ball labeled garbage in one of the student's desk.
3. Obtain copies of county maps.

PROCEDURE:

Setting the stage
1. Tell students that garbage is hidden in one of their desks. It is like a hot potato. The idea is to make it someone else's responsibility by giving it to him or her. Above all, the student should not be caught with it.
2. Define illegal dumping on the board.
3. Prepare copies of the Student Activity Page.

Activities
1. Supply the students with paper money - ten $10.00 slips each (pattern is found on activity sheet). The money will be used to pay a $30.00 fine if someone is caught illegally dumping the garbage.
2. Call for each student to pay $10.00 to cover the community cost of cleaning up illegal dumps. Collect this fee periodically throughout the game.
3. Allow the game to continue for a predetermined amount of time, usually when everybody has had a chance to participate.
4. Help students identify the locations of recycling centers and legal waste disposal programs in the community.

Grades:
3-5

Subjects:
Social Studies, Math

Time Needed:
One class period, on-going game

Materials:
nerf ball
paper money
county map
student activity page

Follow-Up

1. Discuss the activity.
   - Ask, "Why do people dump waste illegally?"
   - Ask, "In what ways does illegal dumping degrade the environment?"
2. Have students do the student activity page and then discuss it with the class.
3. Brainstorm ways that illegal dumping affects public health.

EXTENSIONS:

1. Take pictures of illegal dumping sites around the community.
2. This game can be played like hot potato with music. Whoever is caught when the music stops must pay for the garbage.

ORIGINAL DEVELOPMENT RESOURCES:

Adapted with permission from activity, "Out of sight but not out of mind." p. 12, Alabama PALS: People Against a Littered State, April, 1987. *Alabama PALS litter education guide*.

NAME _____

If Bagging Trash Is Your Game, This Match Is For You

Match each word on the left with the phrase that best describes it.

Trash

Litter

Reuse

Natural Resources

Landfill

Recycling

Paper

Reduce

Compost

A. To find a new use for something instead of throwing it away.

B. A recyclable material made from trees.

C. To buy less and throw away less trash.

D. Leaves and grass clippings broken down by natural forces, used on gardens.

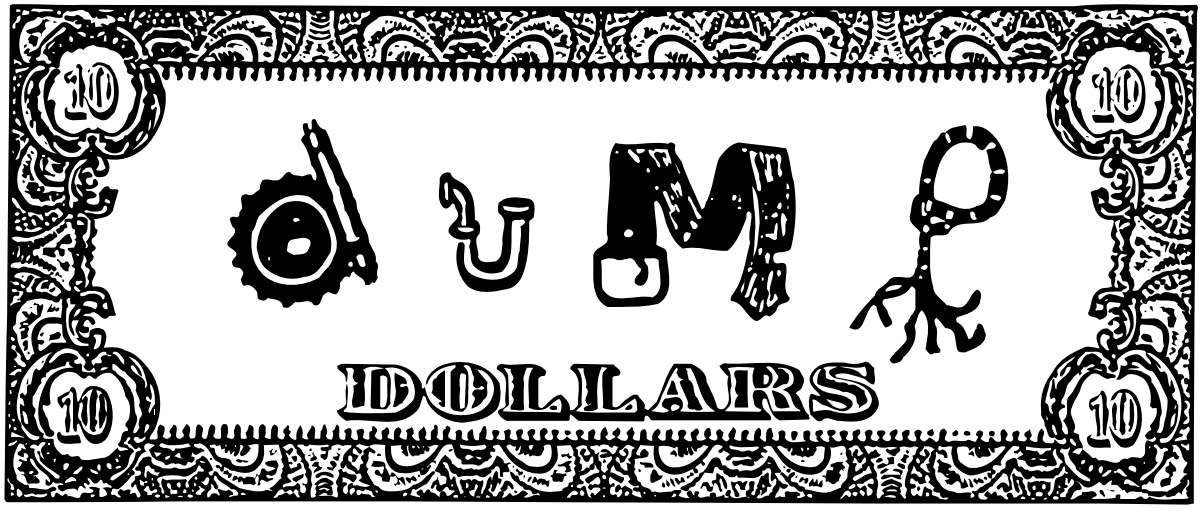
E. Our garbage, all things we throw away.

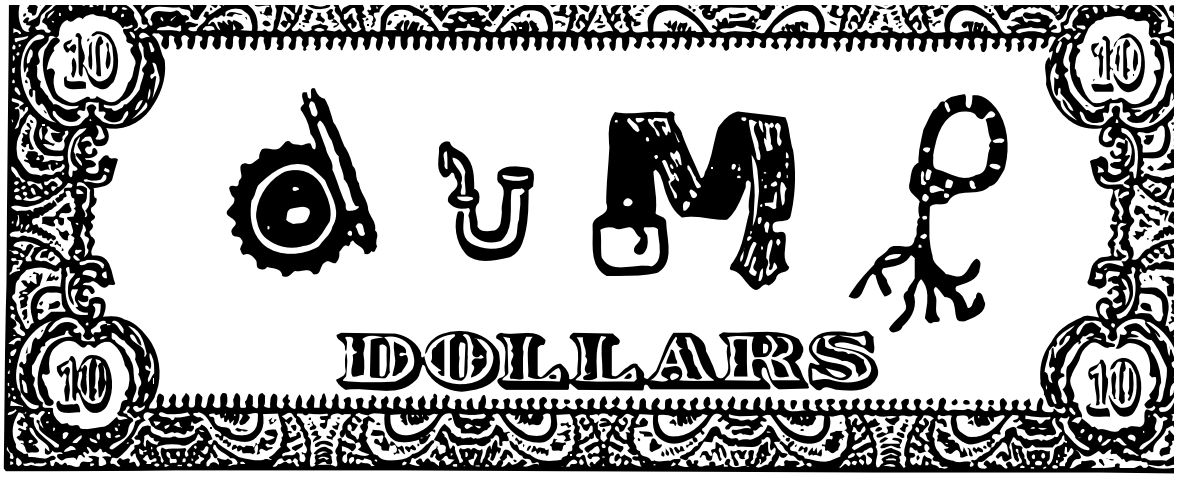
F. Trash in the wrong place such as on the ground or street.

G. A process that makes something new out of something old.

H. A special place where trash is buried.

I. Things found in nature that we must have to live.


10
10
DUMP
DOLLARS
10
10


10
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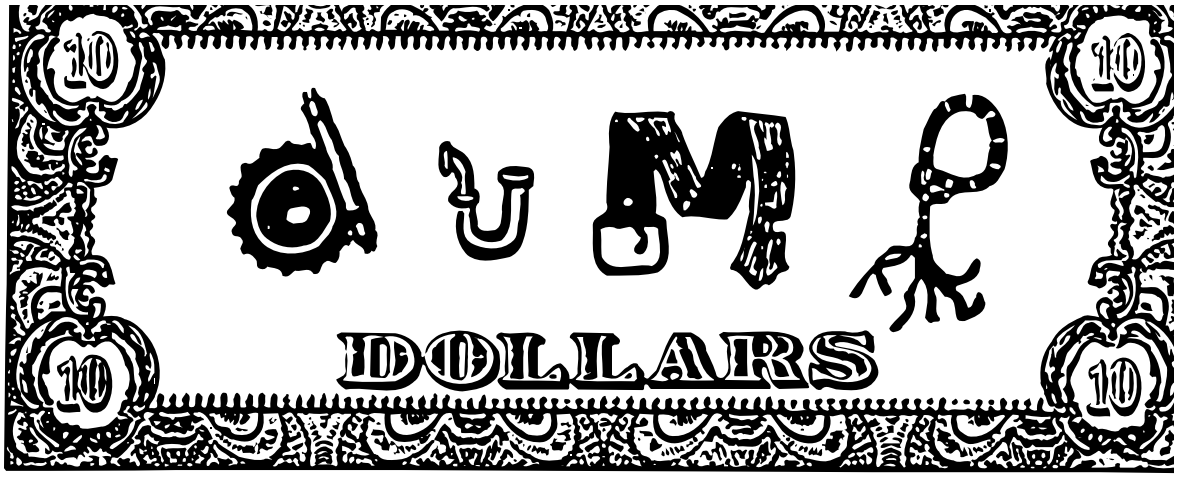
DUMP
DOLLARS
10
10


10
10
DUMP
DOLLARS
10
10

It's A Gas

OBJECTIVES:

The student will be able to:
1. Collect organic material and set up an experiment.
2. Observe gas formation during the decaying process.
3. Measure heat production during the decaying process.

BACKGROUND:

When buried garbage decays at a landfill or dump, it produces gas, similar to natural gas, called methane. A crude but workable method of producing gas from waste involves tapping directly into landfills to collect the methane gas produced by anaerobic digestion (decomposition without oxygen). The methane is collected through an automatic collection system, processed, piped to homes and businesses, and used in the same manner as natural gas. Methane is also being produced from municipal sludge and from animal manure at some feedlot operations.

These methods of obtaining methane are becoming increasingly popular because they help to solve the problems of waste disposal as well as to meet increased energy needs.

VOCABULARY:

bioconversion - changing matter from once-living things into a source of energy
compost - a mixture of decayed organic matter; to decay organic wastes partially decomposed by aerobic bacteria
decay - rot
landfill - an area set aside for burying waste under layers of dirt
methane - an odorless, flammable gas produced by decaying organic matter
natural gas - gas from the Earth's crust; a fossil fuel
organic - relating to living or once living material

Grades:
3-5

Subject:
Science

Time Needed:
Two class periods, several days observation

Materials:
a few pounds of raw manure (*caution: when handling be sure to wear protective covering)*
two plastic bags per student (1 gallon size)
thermometer
small light or lamp and box (may need several depending on numbers of students participating)
student activity pages

ADVANCE PREPARATION:

1. Gather materials.
2. Prepare copies of student activity pages.

PROCEDURE:

Setting the stage

1. Show students the picture on the attached sheet, "Images and Explorations."
   - Discuss what is happening in the picture.
   - Ask students the following questions.
   How can the energy from garbage be changed into useful energy? (Answers will vary; accept all answers.)
   How is garbage like traditional fuels?
2. Have students read the paragraphs at the bottom of "Images and Explorations."
   - Give students the list of terms (see background information) and their definitions.
   - Ask students to circle the terms in the paragraphs.

Activities

1. Give each student a copy of the included student activity page "Making Methane."
2. Have necessary materials ready for the activity.
   - If Bag "A" is filled almost full, expansion will be easier to detect.
   - Temperature must be about 90 degrees Fahrenheit to produce desired results. Place the light or lamp inside the box to produce a warm atmosphere.
   - Bag "A" will expand if the bag is completely sealed and if methane gas is produced by the decomposing organic matter.
   - Temperature rising above 90 degrees Fahrenheit inside the material indicates a chemical reaction is taking place during decomposition.
3. After several days, direct students to think about the questions on the second part of "Making Methane." Ask students how we could use our garbage as a source of energy. (Encourage many creative ideas.)
4. Have students draw an illustration of a possible methane-producing operation in the community.

Follow-Up

1. Have students complete the evaluation activities on the included Student Activity Page "Thinking About It."

D	K	O	G	B	F	K	W	X	J	W	L	I	S	X	H	N	R	O
F	E	Z	H	X	V	F	A	A	D	R	R	M	K	P	O	K	S	I
G	I	C	O	M	P	O	S	T	E	N	P	J	L	I	L	Q	U	S
A	S	B	A	U	E	I	Q	F	J	B	X	C	S	Q	G	T	J	V
Q	B	Y	D	Y	C	T	N	A	D	T	G	R	L	I	L	A	M	A
W	J	B	O	V	A	B	H	D	X	X	E	X	K	R	X	S	L	M
X	N	Q	G	P	L	M	T	A	K	V	Z	H	T	C	K	O	Q	U
O	L	F	O	N	A	L	O	F	N	A	T	U	R	A	L	G	A	S
K	D	P	L	H	N	S	L	O	E	E	Z	C	C	H	X	Q	A	F
G	W	K	T	J	D	J	C	R	T	Y	W	S	X	T	V	Q	G	V
K	N	C	A	G	F	O	B	G	B	J	L	L	O	Q	H	O	P	X
O	R	G	A	N	I	C	A	H	Z	H	V	U	Q	K	L	M	F	X
H	X	N	Y	B	L	J	G	Z	K	W	W	G	S	X	J	P	V	V
J	C	J	U	L	L	V	O	T	C	Q	M	N	E	K	X	Q	I	L

2. Answers are as follows:
   - Word Find - (1) organic, (2) methane, (3) natural gas, (4) compost, (5) landfill, (6) decay, (7) bioconversion.

ORIGINAL DEVELOPMENT RESOURCES:

Energy from waste. (1979). *The new book of popular science*. (Vol. 2). Danbury, CT: Grolier.

Tennessee Valley Authority, Consumer Outreach Section, Office of Power. *The energy sourcebook sixth grade unit.*

Making Methane

1. Ask the teacher for a small amount of manure (organic matter).

2. Place half the manure in a plastic bag (one gallon size), labeled A.

3. Remove as much air from Bag A as you can.

4. Seal the bag completely.

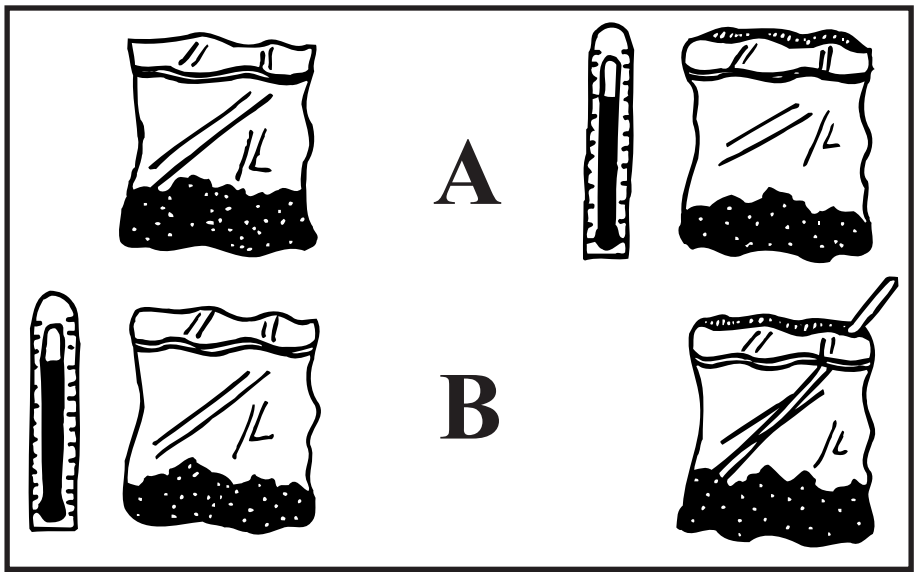
5. Put the bag in a warm place - about 90 degrees.

6. Place the other half of the organic matter in another plastic bag, labeled B.

7. DO NOT SEAL Bag B.

8. Put Bag B in a warm place - about 90 degrees.

9. Every day for several days, use a thermometer to measure the temperature in the middle of the material in Bag B. Record the temperature. (NOTE: Be careful - do not disturb the material.)



Making Methane

(continued)

After several days, answer the following questions.

1. Does Bag A appear to have expanded a little? _

   If the answer is yes, why has it expanded? _

   _

2. Compare the daily temperature readings of Bag B.

   Day 1 _

   Day 2 _

   Day 3 _

   Day 4 _

   Day 5 _

   Day 6 _

   Day 7 _

   Day 8 _

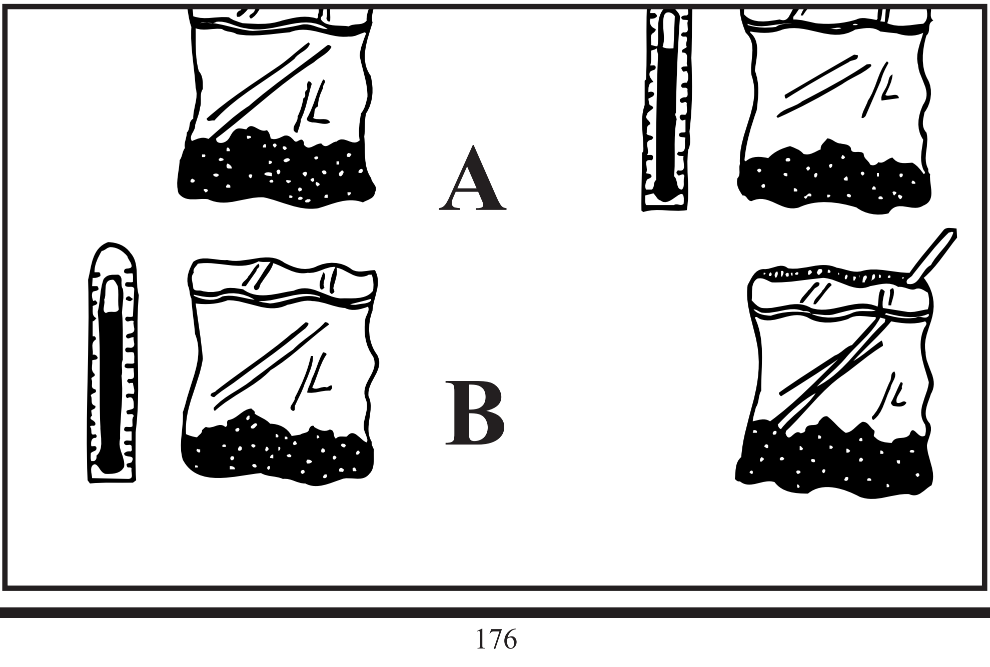
   Day 9 _

   Day 10_ _

   Was there a change in temperature? _

   If the answer is yes what is causing the change? _

   _



Thinking About It

Word Find

Find and circle these words.

Bioconversion	**Decay**	**Natural Gas**	**Methane**
Landfill	**Compost**	**Organic**	

D	K	O	G	B	F	K	W	X	J	W	L	I	S	X	H	N	R	O
F	E	Z	H	X	V	F	A	A	D	R	R	M	K	P	O	K	S	I
G	I	C	O	M	P	O	S	T	E	N	P	J	L	I	L	Q	U	S
A	S	B	A	U	E	I	Q	F	J	B	X	C	S	Q	G	T	J	V
Q	B	Y	D	Y	C	T	N	A	D	T	G	R	L	I	L	A	M	A
W	J	B	O	V	A	B	H	D	X	X	E	X	K	R	X	S	L	M
X	N	Q	G	P	L	M	T	A	K	V	Z	H	T	C	K	O	Q	U
O	L	F	O	N	A	L	O	F	N	A	T	U	R	A	L	G	A	S
K	D	P	L	H	N	S	L	O	E	E	Z	C	C	H	X	Q	A	F
G	W	K	T	J	D	J	C	R	T	Y	W	S	X	T	V	Q	G	V
K	N	C	A	G	F	O	B	G	B	J	L	L	O	Q	H	O	P	X
O	R	G	A	N	I	C	A	H	Z	H	V	U	Q	K	L	M	F	X
H	X	N	Y	B	L	J	G	Z	K	W	W	G	S	X	J	P	V	V
J	C	J	U	L	L	V	O	T	C	Q	M	N	E	K	X	Q	I	L

Word Define

Match the words in the list above with their definitions listed below.
Write each word on the line next to its definition.

1. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _: relating to living or once-living material

2. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _: an odorless, flammable gas from manure

3. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _: gas from the Earth's crust

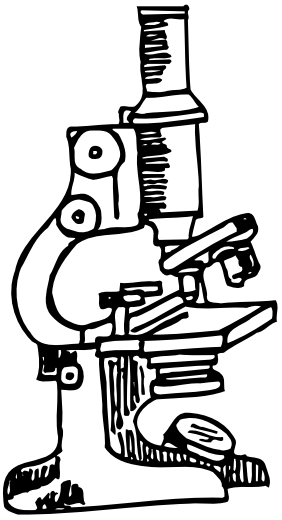
4. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _: a mixture of decayed organic matter

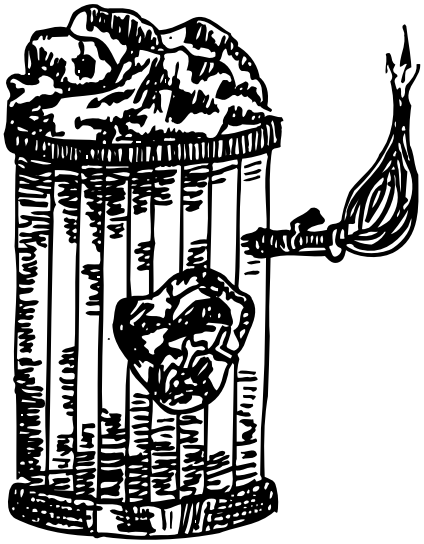
5. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _: an area set aside for burying waste

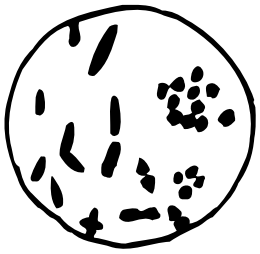
6. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _: rot

7. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _: changing once-living matter into methane

Images And Explorations





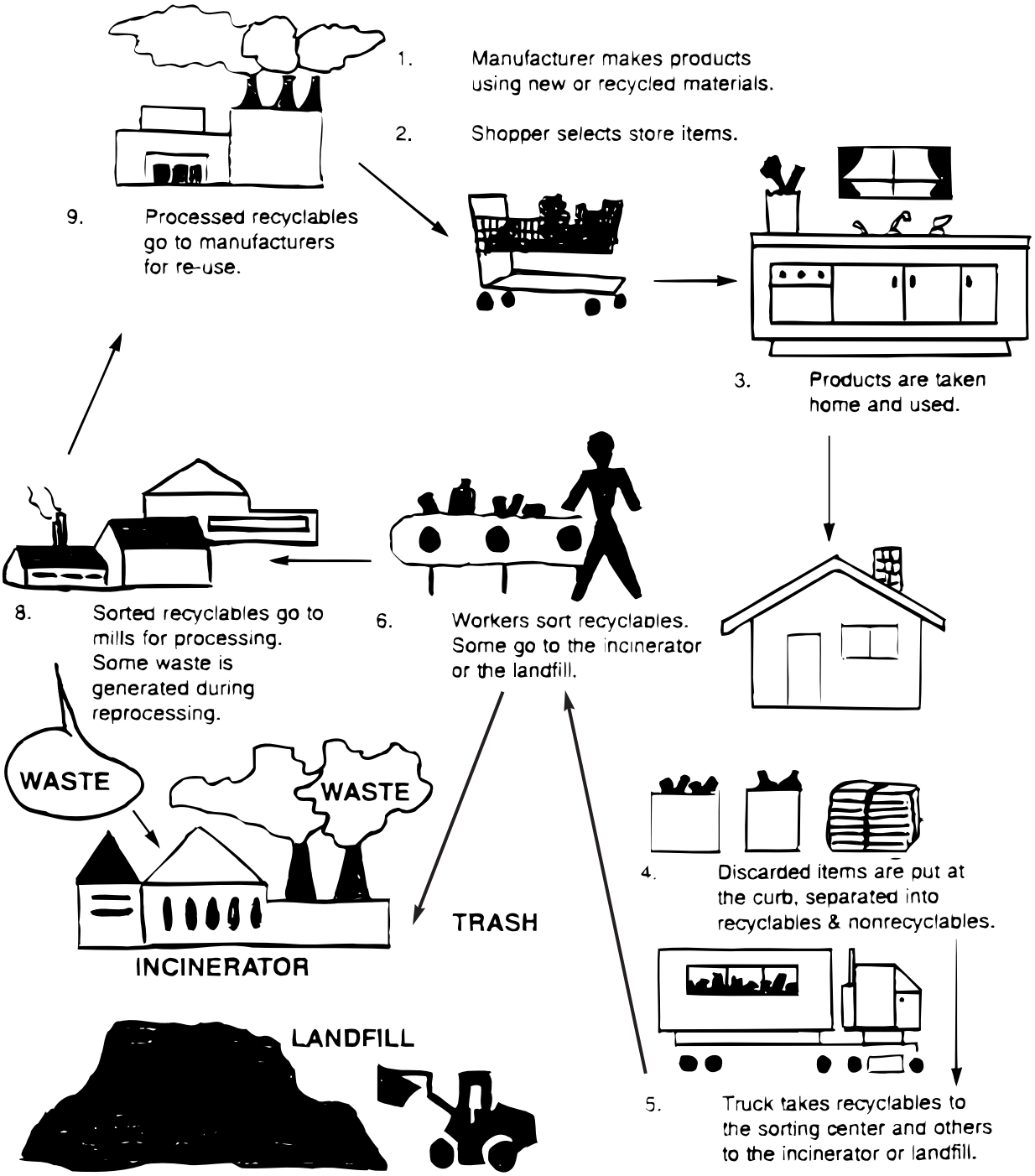


When manure, vegetation, or any organic materials decay, a gas is given off. This gas is called methane. Methane can be produced from decaying matter in home garbage (if it sits long enough) or in a compost heap. It also takes place in the landfills where we bury our trash and garbage. Methane produced in landfills can be carried through pipes to places where the gas will be used.

Today, some companies are producing methane from waste. They change city sewage, garbage, and animal manure to energy sources. The process of changing matter from once-living things into methane is called bioconversion.

This same process takes place in nature, producing natural gas. Methane is the main element of natural gas. The organic part of our trash and garbage is an important energy resource !

The Recycling Process



Notes

What Goes Around Comes Around

OBJECTIVES:

The student will be able to:
1. Describe recycling.
2. Illustrate the recycling logo.
3. Identify recyclable materials.
4. Present information.

BACKGROUND:

Recycling is the collection of waste materials to process them into new, usable products. The recycling logo represents the three steps of the recycling process: separating materials to be recycled; processing the materials by sorting, washing, drying, grinding, or heating, and re-manufacturing products to be purchased.

People must sort their household trash and either take recyclables to a collection site, place their recyclables on the curbside, or deliver them to buy-back recycling programs.

To make sorting easier, different plastics are identified by codes (SPI-Society of Plastics Industries-Codes.) These codes are usually located on the bottom of plastic containers.

Grades:
3-5

Subject:
Science

Time Needed:
Two class periods

Materials:
examples of recyclable items:
- aluminum cans
- plastic milk jugs
- newspapers
- jars
- plastic containers (several)

art paper
markers
small jar of M&M candy for rewards

VOCABULARY:

recyclable - a material that can be recycled
recycling - the collection and reprocessing of manufactured materials for reuse either in the same form or as part of a different product

ADVANCE PREPARATION:

1. Gather materials.
2 Copy information cards and glue to index cards for durability and uniformity.
3. Copy student activity page.

PROCEDURE:

Setting the stage
1. Display recyclable materials.
   - Discuss the steps of the recycling process using the background information and the attached sheet, “The Recycling Process”.
   - Have students look for the recycling logo on the plastic materials.
2. Inform students of the three ways items are collected (or deposited) for recycling.

Activities
1. Create a presentation about a recyclable material.
   - Divide the class into four groups.
   - Distribute the information cards.
   - Use other sources to create songs based on a familiar tune.

- Choose a song that everyone knows.
  Rewrite the words using facts about the assigned recyclable material.
  Name your group.
  Optional - design a CD cover, dress in a costume, make a backdrop for the presentation.

Example - (Sing to the tune of "Row, Row, Row Your Boat.")
Crush, crush, crush the cans
As many as you may
Put them on the curb outside
To be used another way

2. Allow the students to vote on their favorite presentation or give each group an award for The Best Workers, The Best Research, etc. Present them with an award, for example, a jar of M&Ms.

Follow-Up
1. Complete the student activity page.
2. Review the diagram of "The Recycling Process" in the previous activity.

EXTENSIONS:
1. Visit a recycling center.
2. Survey school officials to determine the school's recycling policies.
3. Read *Recycle !* by Gail Gibbons.
4. Read *Cartons, Cans, And Orange Peels - Where Does Your Garbage Go?* by Joanna Foster.
   Read Series - *How On Earth Do we Recycle Metal? Paper? Plastic? Glass?* published by Millbrook Press.

ORIGINAL DEVELOPMENT RESOURCES:
Kraft General Foods. (June, 1993). *Solid thinking about solid waste*.

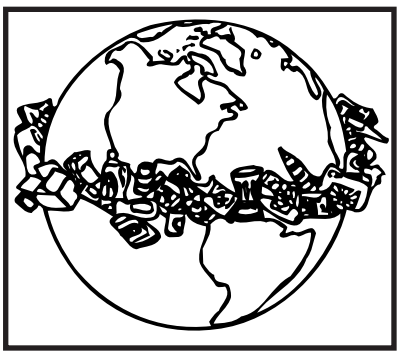
United States Environmental Protection Agency. (October, 1988). *Recycle*. (EPA/530-SW-88-050)

Alabama Department of Economic and Community Affairs. *Kids can help recycle* (coloring sheet); *Be part of the solution...recycle Alabama* (brochure); *Handling and disposal of home medical waste* (brochure); *Household hazardous waste* (booklet); *Managing Alabama's municipal solid waste* (poster); *Get down to business...reduce, reuse, recycle* (booklet).

Name: _____

What Goes Around Comes Around

1. Describe the process of recycling.



2. Draw the recycling logo.

3. Create a plan for your family to implement a recycling program.

- How will you sort the garbage?

- How will your recyclable materials get to the recycling center?

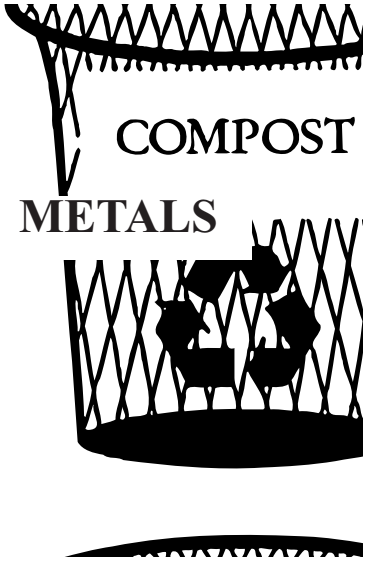
- How will you change your purchasing habits in order to support products that have been recycled?

Save! Sort! Recycle!

Color the recyclables in the boxes on this page. Then cut them out and paste them into the proper recycling bins.


COMPOST
COMPOST


COMPOST
PLASTIC


COMPOST
METALS


COMPOST
SECOND
HAND
SHOP


COMPOST
PAPER


COMPOST
GLASS

Notes

A City "Can"

OBJECTIVES:

The student will be able to:
1. Evaluate the importance of recycling.
2. Simulate a city recycling program.
3. Tally exchanges in the recycling simulation.

Grades:
3-5

Subjects:
Science, Math

Time Needed:
One class period

Materials:
48 aluminum cans
48 pebbles

BACKGROUND:

Aluminum comes from bauxite. Most of the new aluminum used in the United States is imported. By reusing aluminum, we reduce air pollution, water pollution, and damage to the land.

- Making aluminum from recycled cans uses 90-95 percent less energy than making it from raw materials and reduces related air pollution by 95 percent.
- Enough aluminum is thrown away every three months to rebuild the entire United States commercial air fleet.
- Approximately 50-60 percent of aluminum cans used in the United States are recycled.
- Recycling reduces litter and slows the filling of landfills.

VOCABULARY:

aluminum - a silvery, lightweight, metallic, chemical element
bauxite - a claylike ore, the source of aluminum
ore - a natural combination of minerals from which metals or other valuable substances can be mined

ADVANCE PREPARATION:

1. Gather materials.
2. Make a set of signs for each city stating landfill, bank, recycling center, and grocery store.
3. Prepare copies of student activity page.
4. Make 24 recycling certificates from the teacher handout.

PROCEDURE:

Setting the stage
1. Give the journal prompt: Why is recycling important?
2. Discuss the benefits of recycling using the background information.

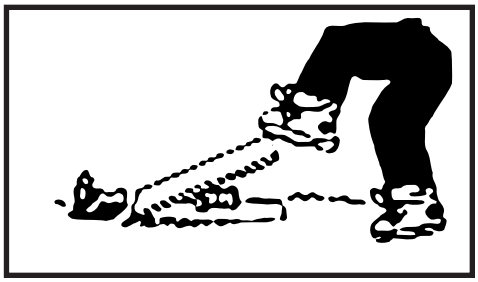
Activities
1. Conduct a simulation that shows the benefit of recycling.
   - Divide the class into two groups. They will act as the citizens of two cities. One Cycle City will recycle. The other Waste City will not recycle. Each city will contain a grocery store, landfill site, a bank, and a recycling center (Cycle City only). Assign each student a post.
   - Give each grocery store 24 aluminum cans and 24 pebbles (represent bauxite).
   - Allow one citizen at a time to go to the grocery store to buy four canned drinks. Trade one piece of bauxite for each can.
   - Allow Cycle City to take its cans to the recycling center. They are given a certificate for every four cans. Waste City throws away its cans in the landfill.

- Return to the grocery store to buy four more drinks. Cycle City uses its certificates to buy one drink and three pieces of bauxite to buy three drinks. Waste City uses four pieces of bauxite to buy four drinks.
- Continue the activity until one city runs out of bauxite.

2. Compare the student activity page.

Follow-Up

1. Discuss the activity reviewing the benefits of recycling for a community.
2. Present the results of each city's simulation.



EXTENSIONS:

1. Build a can crusher using lumber and a heavy duty door hinge.
2. Compile a list of recyclable items used during the school day and at home.

ORIGINAL DEVELOPMENT RESOURCES:

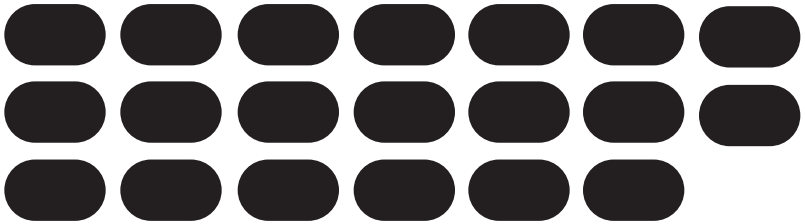
Roa, M. *Environmental science activities kit.* The Center for Applied Research in Education.

Schultz, R (1982). *Environmental experiments..from Edison*. Michigan: Thomas Alva Edison Foundation.

A City "Can"

Cross off a can each time your city delivers one to the landfill or recycling center.

Cross off a pebble each time your city purchases a can.



Cross off a rectangle each time your city collects a certificate.

I am a citizen of City _____ .

Grocery Store workers are _____,

_____, and _____ .

Landfill workers are _____ and

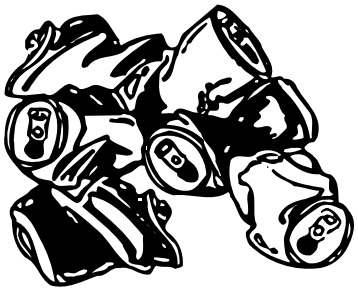
_____ .

Recycling Center workers are _____,

_____, and _____ .

What did you learn from this activity?

A City "Can"



Certificate of Receipt. Redeem at grocery store for one canned drink.

A City "Can"

Certificate of Receipt. Redeem at grocery store for one canned drink.

A City "Can"

Certificate of Receipt. Redeem at grocery store for one canned drink.

Heavy Metal

OBJECTIVES:

The student will be able to:
1. Illustrate how steel mills use steel cans, cars, and appliances.
2. Describe a material recovery facility and how steel is separated.
3. Locate the major steel mills in Alabama on an Alabama map.

Grades:
3-5

Subjects:
Science, Geography

Time Needed:
One class period

Materials:
Alabama map
art paper or half sheets of poster board
crayons or markers
magazines
aluminum cans
steel cans
various items made of steel
magnets
scales

BACKGROUND:

For many years, Alabama was one of the leading producers of steel. Steel-can recycling is made easier because steel is magnetic. Steel cans may be magnetically removed from other recyclables in the solid waste stream. Empty steel cans may be collected for recycling through any recycling collection program that accepts them. For curbside collection, steel cans should be emptied and rinsed. Steel cans are also collected through voluntary drop-off programs and material recycling centers.

After collection, steel cans and other steel products, such as appliances, are sent to steel mills to be made into new products. There are two types of furnaces used to make steel, depending on the product into which the steel will be made. One type is the basic oxygen furnace, which consumes about 25 percent scrap. The electric arc furnace consumes about 100 percent of scrap to make new products. In either case, some of the scrap is still left over from steel making and product manufacturing, but none is wasted. Even if molten steel overflows, it can be used again.

Today in America, no steel is new. Virtually all steel contains old steel. It always maintains its integrity by keeping the same quality after recycling as before.

VOCABULARY:

scrap - the old steel that will be recycled into new steel
solid waste stream - the variety of solid materials that are discarded or rejected from homes and businesses

ADVANCE PREPARATION:

1. Gather materials.
2. Copy group directions cards.
3. Copy the Alabama map for each student group.

PROCEDURE:

Setting the Stage
1. Display items made from steel such as utensils, pots, soup cans, paint cans, nails, aerosol cans, bandage boxes, and cookie tins.
2. Discuss the difference between recycled steel and other products.

3. Remind students of the importance steel has played in the state of Alabama. Use an Alabama history book to locate specific details about the importance of steel production in Alabama. Steel was produced in areas where iron ore, coal, and limestone were found in the soil. Since steel is now being made from recycled steel, it is no longer necessary to have steel mills located close to these natural resources.

Activity

1. Locate these major steel mills that are in operation in Alabama.
   - Write the name and location of the steel mills on the board. They are:
     Nucor Steel Birmingham, Birmingham, AL
     Nucor Steel Decatur, Decatur, AL
     USX-US Steel, Birmingham, AL
     Nucor Steel Tuscaloosa, Tuscaloosa, AL
   - Divide the students into six groups. Give each group of an outline map of Alabama (included).
   - Have groups work together to locate these steel mills on their maps.
2. Work in groups to illustrate the steel recycling process.
   - Provide each group with one direction from the Teacher Handout.
   - Allow students to work for about 15 minutes on their assignment.
   - Ask a representative from each group to bring the poster to the front of the classroom.
   - Assist the students in putting the posters in order: (1) store; (2) home; (3) empty cans; (4)sorted garbage; (5) trucks; (6) magnet; (7) area of various steel products.
   - Place posters in a circular order on a bulletin board or the chalkboard.
3. Use magnets to experiment separating steel cans from aluminum cans. Compare the weight of steel containers to aluminum cans.

Follow-Up

Discuss each step of the recycling process.

- Steel products come in many shapes and sizes, from food cans to aerosol cans or bandage boxes to cookie tins.
- Consumers use many steel products in their daily life. Some examples include vehicles, appliances, containers and nails.
- Steel products can be sorted for recycling along with other materials.
- Steel materials can be placed in bins along the curb for collection, or residents take recyclables to collection sites.
- Steel products are recycled at the Materials Recovery Facility (MRF). Steel products are magnetically separated from other recycles.
- Recycled steel (scrap) is made into new products.

EXTENSIONS:

1. Sculpt a replica of the Vulcan statue (located in Birmingham) using soap or clay. In Roman mythology, he is the God of Iron.
2. Have students create a flow chart depicting a steel product going through the recycling process.

ORIGINAL DEVELOPMENT RESOURCES:

Steel Can Recycling Association, Inc., Two Gateway Center, Suite 720, Pittsburgh, PA 15222, (412) 281-5655.

Group Directions

Use art supplies to illustrate a neighborhood of homes.	**Use art supplies to illustrate empty steel cans.**
Use art supplies to illustrate sorted garbage cans (a box of steel) at the end of the driveway or basement.	**Use art supplies to illustrate large trucks such as garbage trucks.**
Use art supplies to illustrate a large magnet.	**Use art supplies to illustrate a large area filled with various steel materials (appliances, cans, cars.**
Use art supplies to illustrate paint cans or food cans on the shelves in the stores.	**Teacher Directions - Cut apart and give each group one assignment.**


LAUDERDALE
LIMESTONE
MADISON
JACKSON
Bridgeport
Florence
Sheffield
Muscle Shoals
Tuscumbia
COLBERT
Athens
Huntsville
Scottsboro
Decatur
Russellville
FRANKLIN
Moulton
LAWRENCE
MORGAN
MARSHALL
DE KALB
Ft. Payne
Arab
Guntersville
Albertville
Haleyville
MARION
WINSTON
CULLMAN
Cullman
CHEROKEE
Centre
Hamilton
Double Springs
ETOWAH
BLOUNT
Gadsden
Winfield
WALKER
Oneonta
LAMAR
FAYETTE
Jasper
Ashville
CALHOUN
ST CLAIR
Anniston
Heflin
Vernon
Fayette
JEFFERSON
CLEBURNE
Birmingham
Pell City
Talladega
Bessemer
TALLADEGA
RANDOLPH
PICKENS
TUSCALOOSA
SHELBY
Ashland
Wedowee
Northport
Tuscaloosa
Columbiana
Childersburg
CLAY
Carrollton
Sylacauga
Roanoke
BIBB
CHAMBERS
GREENE
Centreville
COOSA
TALLAPOOSA
Alexander City
Lafayette
Lanett
Eutaw
HALE
Clanton
Rockford
SUMTER
CHILTON
Dadeville
Greensboro
PERRY
Opelika
ELMORE
Auburn
Marion
AUTAUGA
LEE
Livingston
Demopolis
Wetumpka
Phenix City
York
Selma
Prattville
Tuskegee
Linden
DALLAS
Montgomery
MACON
RUSSELL
MONTGOMERY
CHOCTAW
MARENGO
Union Springs
Hayneville
Butler
WILCOX
LOWNDES
BULLOCK
Camden
BARBOUR
Thomasville
Eufaula
Greenville
PIKE
Clayton
Troy
Grove Hill
Brundidge
MONROE
BUTLER
Luverne
Abbeville
CLARKE
CRENSHAW
WASHINGTON
Monroeville
CONECUH
DALE
HENRY
Jackson
Chatom
COFFEE
Ozark
Elba
Evergreen
Headland
Daleville
Andalusia
Opp
Enterprise
Dothan
ESCAMBIA
COVINGTON
GENEVA
Brewton
Citronelle
Atmore
Florala
Geneva
HOUSTON
MOBILE
Bay Minette
Prichard
BALDWIN
Mobile
Fairhope
County Seat
Other Cities

Seeing Is Believing

OBJECTIVES:

The student will be able to:
1. Observe the neutralization process of toxic wastes.
2. Identify common toxic wastes.
3. Identify safe ways to dispose of hazardous materials.
4. Construct "ugly jars" - containers that stored toxic wastes during Colonial times.

BACKGROUND:

Toxic wastes consist of wastes that contain poisons and, when improperly managed, can pose a great threat to human health or the environment. Toxic wastes include inorganic toxic metals, acids, salts, or bases. They include synthetic organic chemicals such as the insecticides DDT and DDE as well as herbicides.

One method for dealing with toxic wastes is to neutralize them. Their effectiveness is counteracted by the application of chemicals that change their toxic state.

In the present day, toxic materials are labeled with a specific sign. Poisonous materials existed in Colonial times as well. During that historical period, hazardous materials were stored in "ugly jars". These "ugly jars" were constructed with clay and had hideous faces.

Grades:

3-5

Subjects:

Science, History

Time Needed:

One class period

Materials:

cornstarch
water
several drops of tincture of iodine
500 mg of ascorbic acid (vitamin C), crushed
a large clear jar
baby food jars or pimento jars (one per student)
materials to decorate "ugly jars"
poisonous symbols sheet
Legacy Hazardous Household Materials Wheel

VOCABULARY:

acid - any compound that reacts with a base to form a salt
base - a chemical compound, like ammonia, that reacts with an acid to form a salt
chemical reaction - chemicals are changed into different substances
herbicide - a plant killer
insecticide - an insect killer
neutralization - the process in which toxic wastes react with another chemical to produce a harmless substance
toxic waste - poisonous waste
ugly jars - containers that stored toxic wastes during Colonial times

ADVANCE PREPARATION:

1. The day before:
   - Stir a teaspoon of cornstarch into one quart of water.
   - Bring the cornstarch to a boil.
   - Allow the mixture to cool.
   - Add a few drops of iodine until the liquid is a dark, blue-black color.
   - Crush 500 mg of ascorbic acid (Vitamin C) tablets into a powder.
   - In a separate container, dissolve the powder in several ounces of water

   NOTE: Try the demonstration yourself using some of the solutions. If the color does not disappear from the iodine/starch solution, add more Vitamin C.

2. Gather materials for the “ugly jars”.

3. Construct an “ugly jar” to display as an example.
4. Copy student activity page.

PROCEDURE:

Setting the Stage

1. Display containers that hold toxic wastes. Include the example of the “ugly jar” you crafted.
2. Discuss the importance of properly identifying containers of dangerous materials.
3. Brainstorm ways to deal with the disposal of toxic wastes.
4. Use Legacy Wheel to learn appropriate methods of disposing of toxic wastes.

Activities

1. Demonstrate the neutralization process.
   - Show the starch/iodine solution (made in advance).
   - Explain that the dark color represents a toxic chemical.
   - Remind the students what a chemical reaction is.
   - Add the Vitamin C solution to the starch/iodine solution.
2. Discuss what happened, focusing on the process of neutralization.
3. Create “ugly jars” by decorating baby food jars, or pimento jars, with craft materials.
   - Discuss the purpose of “ugly jars” using the Background information.
   - Show the class an example.
4. Share modern day symbols (see sheet included) used to indicate hazardous substances including toxic ones.

Follow-Up

1. Have the students survey their homes for hazardous wastes using the checklist included. (Include a waste wheel or related publication for proper handling and disposal).
2. Display the “ugly jars”.
3. Have students describe the neutralization process.

EXTENSIONS:

1. Research other methods of waste disposal throughout history.
2. Brainstorm ways that the “safe” waste produced by the neutralization process can be safely disposed.

ORIGINAL DEVELOPMENT RESOURCES:

Tennessee Valley Authority. *A world of resources*. TVA/ONRED/L & ER/86/52.

The Education Center, Inc. (Feb/Mar 1993). Wising up about waste. *The intermediate mailbox*, (Vol. 15, p. 43).

Hazardous Household Materials Wheel, Legacy, Inc., P.O. Box 3813, Montgomery, AL 36107, www.legacyenved.org, 1-800-240-5115.

NAME: _____

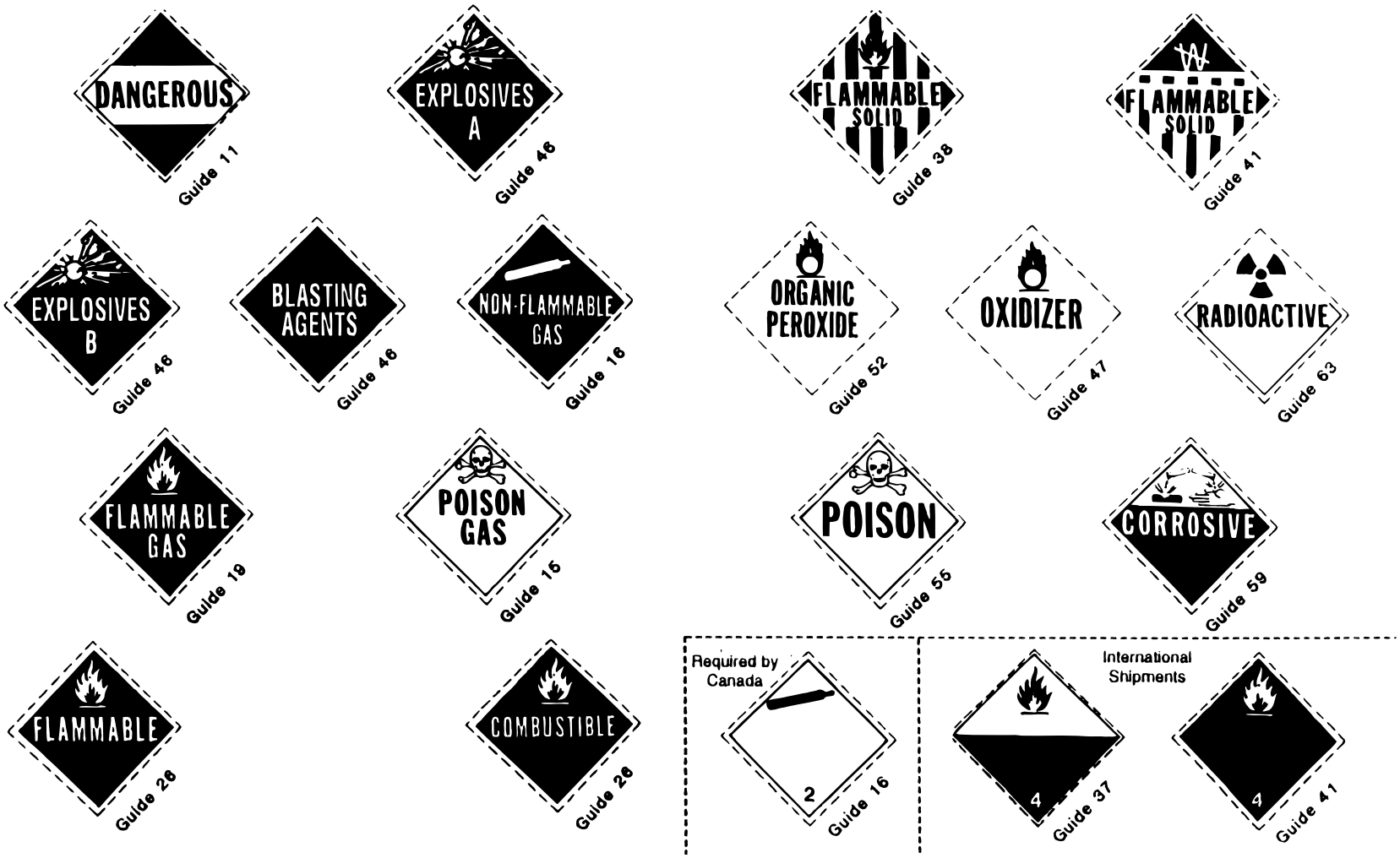
Is Your Home a Hazardous Waste Site?

Some substances in your home should not be poured down the drain or toilet, placed in the trash, dumped out on the ground, or poured in the water because they are toxic. Look for the following substances in your home. Check whether they will be used up or thrown away.

Location	Substance	Found in Home	To be used up	To be thrown away
Garage	anti freeze			
	auto wax			
	car battery			
	gasoline			
	motor oil			
Workshop	paint			
	paint thinner/remover			
Lawn	insecticide			
	weed killer			
Household	ammunition			
	artist's painting supplies			
	bathroom cleaner			
	batteries			
	fire extinguisher			
	floor care products			
	fluorescent lights			
	furniture polish			
	lighter fluid			
	moth balls			
	nail polish remover			
	oven cleaner			
	rat poison			
Others				

Table Of Placards And The Initial Response Guides To Use On Scene

Use this table only if materials cannot be identified by using shipping papers, numbered placard, or orange panel number.



Roll Out The Barrels

OBJECTIVES:

The student will be able to:

1. Discover containers that are safe for storing corrosive materials.
2. Observe the corrosive effects of salt and vinegar.

BACKGROUND:

Toxic wastes are often stored over a period of time to await safe disposal. However, corrosive toxic waste is sometimes put in containers that can be dissolved or eaten away. Then the toxic waste can leak out. Strong and corrosive toxic materials must be stored in the correct kind of container.

VOCABULARY:

corrosive toxic waste - waste that can eat away or chemically react to corrode and dissolve other substances

ADVANCE PREPARATION:

1. Gather materials.
2. Use the screwdriver to make several deep scratches on the inside of the steel can and the aluminum can.
3. Copy the students activity page for each student.

PROCEDURE:

Setting the Stage

1. Discuss the effect of storing corrosive materials over a long period of time.
2. Display the different containers and ask students to predict which containers would best store a corrosive chemical.
3. Use the student activity page to answer questions l and 2. Save pages.

Activity

1. Show how corrosive substances can be safely stored.
   - Dissolve two tablespoons of salt in a quart of vinegar.
   - Place all six containers in the plastic tray.
   - Pour some of the vinegar/salt solution into each container.
   - Cover each container with plastic wrap and secure it with a rubber band to prevent evaporation.
   - Place the containers in a safe place where they will not be disturbed.
2. Inspect the containers periodically for any signs of corrosion. (This could take as long as two weeks.)
3. Explain that the solution of vinegar and salt is an acid. Acids react with metals causing them to corrode. Corrosive chemicals often leak through the steel drums used for storage.
4. Complete the student activity page.

Grades:

3-5

Subject:

Science

Time Needed:

One class period (with a one to two week time lapse)

Materials:

steel can (soup)
aluminum can (soda)
plastic jar
glass jar
screwdriver
paper cup
Styrofoam cup
plastic wrap
plastic tray
vinegar
rubber bands
tablespoon
measuring cup
activity page
beads
tag board

Follow-Up

1. Collect and review for understanding.
2. Discuss the results of this activity.

EXTENSIONS:

1. Demonstrate the corrosive effects of soaking copper wire in vinegar for a couple of days.
2. Investigate the rates of corrosion depending upon the climate. (Salt causes corrosion at the beach.)

ORIGINAL DEVELOPMENT RESOURCES:

Tennessee Valley Authority. *Waste: A hidden resource*. TVA/ONRED/L&ER/87/14.

The Education Center, Inc. (Feb/Mar 1993). Wising up about waste. *The intermediate mailbox*, (Vol. 15, p. 45).

Cash, T. Parker, S. & Taylor, B. (1989). *175 More science experiments to amuse and amaze your friends*. New York: Random House.

Roll Out The Barrels

	Steel Can (Soup)	Aluminum Can	Plastic Jar	Glass Jar	Paper Cup	Styrofoam Cup
Draw a picture.						
Prediction (Check which containers will safely store corrosive waste.)						
Label each as corrosive waste or non-corrosive waste.						

Roll Out The Barrels

1. Draw a picture of the six containers.

2. Circle the containers that you predict will safely store corrosive waste.

3. What changes occurred over a period of time?

4. What did you learn from this experiment?

5. Use the chart below to compare and contrast vinegar/salt solution with corrosive waste.

Salt or Vinegar Solution	**Both**	**Corrosive Waste**

Fetch A Pail Of Water

OBJECTIVES:

The student will be able to:
1. Discover how groundwater can become contaminated.
2. Record observations and data.

BACKGROUND:

Groundwater can be contaminated by chemicals poured on the ground, landfill seepage, and leaking underground tanks. Since groundwater is used for drinking water, it is important to keep it clean.

VOCABULARY:

groundwater - water found in the porous spaces of soil and rock
well - a hole sunk into the Earth to get water

ADVANCE PREPARATION:

1. Gather materials.
2. Soak the sponge in dark food coloring (at least 30 drops) and let it dry overnight.
3. Fill the dishpan half full of sand.
4. Use the nail to punch holes in the bottom of the large paper cup.

Grades:

3-5

Subject:

Science

Time Needed:

One class period

Materials:

large dishpan
sand: enough to fill half of a dishpan
clear plastic tube about 6” long
large paper cup
two identical clear jars
1” x 1” sponge
food coloring
turkey baster or small paint brush
nail

PROCEDURE:

Setting the Stage
Discuss groundwater using the background information.

Activity
1. Demonstrate how groundwater can be contaminated.
   - Place the tube upright in one corner of the dishpan so that it is partially buried.
   - Use the cup to sprinkle water on the sand until it is visible in the tube.
   - Explain to students that this is groundwater.
   - Tell them the tube represents a well.
   - Demonstrate how water can be removed from the well using the baster or paint brush and put some of it in one of the clear jars (control).
   - Bury the sponge in a shallow spot at the opposite end of the tray. It represents toxic waste that is to buried in a landfill.
   - Pour water onto the landfill site (the sponge) one cup at a time.
   - Draw water from the well periodically and examine it in the other clear jar. Compare it to the control jar. Compare the following school day. (The well should appear more saturated than first observed.)
2. Complete the student activity page during the demonstration.

Follow-Up
1. Discuss how the water might be restored to a clean condition.
2. List ways groundwater can be contaminated.

EXTENSIONS:

1. Conduct an experiment using different types of soil in the dishpan.
2. Research different types of wells.
3. Write a story centered around a well.
4. Invite a County Extension Agent to speak to the class.

ORIGINAL DEVELOPMENT RESOURCES:

The Education Center, Inc. (Feb/Mar 1993). Wising up about waste. *The intermediate mailbox*, (Vol. 15, p. 45).

Watt, F. (1991). *Planet Earth: Usborne science and experiments: A practical introduction with projects and activities.* London: Usborne Publishing Ltd.

Down The Drain
Fetch A Pail Of Water

1. What do each of the materials in the experiment represent?

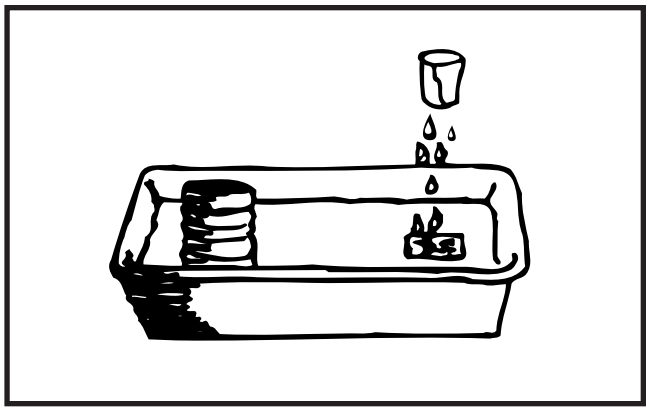
List the material.	Draw a Picture.	Tell what it represents.
Tube		
Sand		
Sponge		

2. Predict what will happen if it "rains" and the well continues to be used.

3. How many cups of "rain" will it take the contaminated groundwater to reach the well?

	# of cups
Prediction	
Actual	

4. Describe how the well might be restored to a clean condition. Create a practical plan.



Notes

Filtration Sensation

OBJECTIVES:

The student will be able to:
1. Predict the filtration process of contaminated water.
2. Observe a simulation of sedimentation and filtration.

BACKGROUND:

Toxic chemicals can get into public water supplies. Polluted water appears cloudy when it contains suspended solids. These particles can be removed by sedimentation. If the water still contains tiny solid matter, another treatment method called sand filtration can be used.

VOCABULARY:

contaminated - impure and corrupt
sand filtration - the process of straining out solid particles through sand
sedimentation - when wastewater is allowed to stand in pools so that particles will settle
suspended solids - particles floating in a liquid

ADVANCE PREPARATION:

1. Gather materials.
2. Copy student activity sheet.
3. Collect pictures of water sources.

Grades:

3-5

Subject:

Science

Time Needed:

One or two class periods (this is an activity with a one-hour time lapse)

Materials:

two glass pint jars (for teacher demonstration)
one jar lid or two baby food jars per student
funnel
paper towel or coffee filter
clean white sand
soil
water
teaspoon

PROCEDURE:

Setting the Stage

1. Display pictures of bodies of water. Try to include examples of rivers, puddles, lakes, and a variety of sources.
   - Discuss the unhealthy habit of drinking from these water sources.
   - Ask students to predict how the water goes from unclean to drinkable when it comes out of a house's faucets.
   - Share answers.
2. Tell students that they will learn how to remove solid matter from water.

Activity

1. Demonstrate the sedimentation process. (This may be done as a teacher demonstration or as individual activities.)
   - Fill a jar(s) half full with water.
   - Add two teaspoons of soil to the jar(s).
   - Secure the lid on the jar(s).
   - Shake the jar(s) vigorously.
   - Allow the jar(s) to stand undisturbed for one hour.
   - Help students notice that the large particles have sunk to the bottom.
   - Remind students that the process of sedimentation allows wastewater to stand in pools so that particles will settle.

2. Using the jars of settled sediment, demonstrate the process of filtration.
   • Remind students that the water in the jar(s) may still be cloudy because very fine particles have not settled on the bottom. These particles are removed by filtration.
   • Line a funnel with a paper towel or coffee filter. A construction paper funnel may be made instead of obtaining a class set of funnels if each student is participating.
   • Fill funnels about 2/3 full of sand.
   • Stand the funnel in the empty glass jar.
   • Pour the water slowly from the first jar through the funnel. As the water passes into the empty jar, it should be mostly clear.

Follow-Up
1. Complete the student activity page.
2. Remind students that even though water may look clean, it can contain harmful substances.

EXTENSIONS:
1. Take photos of the dirty water and then the filtered water for a visual reminder of the success of this treatment process.
2. Take a field trip to a water treatment facility.

ORIGINAL DEVELOPMENT RESOURCES:
Cole, J. *The magic school bus waterworks.*

The Education Center, Inc. (Feb/Mar 1993). Wising up about waste. *The intermediate mailbox,* (Vol. 15, p. 45).

Savan, B. (1991). *Earthcycles and ecosystems*. Toronto Kids: Can Press Ltd.

Filtration Sensation

1. Write a hypothesis for this experiment. What do you think will happen to the soil in the water?

2. Record the data observed and collected during your experiment on the chart.

What was done	What I observed

3. Look at your data and draw a conclusion about sedimentation and sand filtration.

4. How would you rate the success of the experiment? Check one below.

Very successful	Somewhat successful	Successful	Not very successful	Not at all successful

5. Draw a picture of another experiment you might like to try concerning the treatment of contaminated water.

Notes

Crystallizing The Problem

OBJECTIVES:

The student will be able to:

1. Observe the method used for removing dissolved chemicals from waste.
2. Predict ways to dispose of harmful solid wastes safely.

BACKGROUND:

Many harmful chemicals cannot be filtered out of the water supply because they are dissolved. If poisonous chemicals are dumped into the streams and rivers, living things could be harmed. The chemicals must be separated from the water.

VOCABULARY:

chemical - a substance used in factories, farms, and homes for a variety of purposes such as cleaning, painting, killing pests, and helping maintain vehicles

dissolve - to break down and become a liquid

ADVANCE PREPARATION:

1. Collect supplies.
2. Fill a clear glass with water.

Grades:

3-5

Subject:

Science

Time Needed:

One class period; daily maintenance and observation for three or more days

Materials:

water
salt
pint jar
shallow nonmetal dish
blue food coloring
small sealed container
tablespoon
drawing paper
clear glass with water

PROCEDURE:

Setting the Stage

1. Hold up the clear container containing water.
2. Ask the students if it is possible that invisible poisons could exist in the water without our knowledge.
3. Using the background information, discuss dissolved chemicals in water.
4. Inform students that they will observe a simulation of how dissolved substances are removed from water.

Activity

Demonstrate the removal of dissolved chemicals from water.

- Dissolve three tablespoons of salt in a pint glass container of water to represent poisonous chemicals.
- Add about ten drops of blue food coloring to the water to represent poisonous chemicals.
- Pour 1/4 cup of the water solution into a shallow dish.
- Allow the water to stand undisturbed in a warm spot for several days. As the water evaporates, blue salt crystals will be left behind.
- Explain to students that the remaining chemicals (the blue salt crystals) are still dangerous. They now must be disposed of in solid form.
- Demonstrate this by carefully placing the crystals in the sealed container.
- Brainstorm ways that this chemical can now be disposed of safely.

Follow-Up

1. Create a picture depicting hazardous waste disposal solutions.
2. Share the pictures.

EXTENSIONS:

1. Investigate ways local companies safely dispose of chemicals that easily dissolve in water.
2. Visit a water treatment plant.
3. Ask an Extension Agent to test the school's water for chemicals.

ORIGINAL DEVELOPMENT RESOURCES:

The Education Center, Inc. (Feb/Mar 1993). Wising up about waste. *The intermediate mailbox,* (Vol. 15, p. 43).

Mandell, M. (1989). *Simple science experiments with everyday materials*. New York: Sterling Publishing Co., Inc.

Savan, B. (1991). *Earthcycles and ecosystems*. Toronto Kids: Can Press Ltd.

Playing With Rubbish

OBJECTIVES:

The student will be able to:
1. Understand that many items can have more than one use.
2. Create toys from common household trash.
3. Construct a bird feeder from common household trash.

BACKGROUND:

Many people discard products and materials in the trash that could be reused. Common household trash can be reduced by extending the life of some products. Finding creative ways to use discarded containers can be an enjoyable challenge and provide useful items. Encourage students to be creative as they learn to reuse waste and save money!

ADVANCE PREPARATION:

1. Gather supplies.
2. Copy student handout.
3. Ask students to bring in a commercially produced ring toss game and a scoop ball set.
4. Construct an example of each toy.

PROCEDURE:

Setting the Stage 1
1. Display the commercially produced toys and the toys you made from household trash.
2. Discuss the cost effectiveness of making your own toys.

Setting the Stage 2
1. Discuss the importance of reusing materials.
2. Develop a list of common items that can be reused and the new use(s) for each.

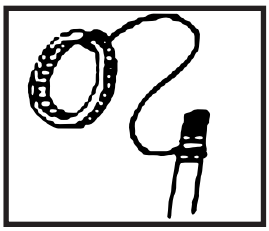
Grades:
3-5

Subject:
Art

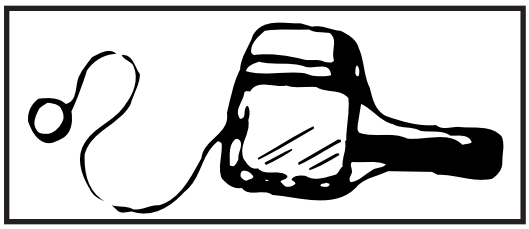
Time Needed:
One or two class periods

Materials:
ring catch (per person)
one pencil
one lid from any plastic container
scissors
string
scoop ball (per person)
plastic detergent scoop
ball (ping pong or one made from foil)
clean household containers (milk cartons, bleach bottles, coffee cans)
jar lids
sticks, dowels, or the cases from old plastic markers (for perches)
wire
string
wire cutters
bird seed

Activity 1
1. Make a ring catch according to the picture.



2. Make a scoop ball game according to the picture.



Activity 2
Construct bird feeders using the drawing for models. Remember to punch small drain holes in the bottom of the containers for drainage.

Follow-Up

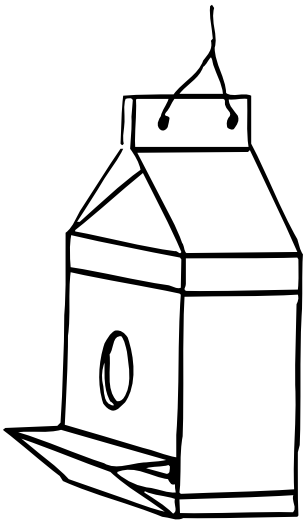
1. Brainstorm other toys that could be made from trash.
2. Discuss the proper locations for hanging a bird feeder.
3. Inform students of their responsibility for:
   - Maintaining a continuous supply of food once feeding is initiated.
   - Keeping the feeders clean.

ORIGINAL DEVELOPMENT RESOURCES:

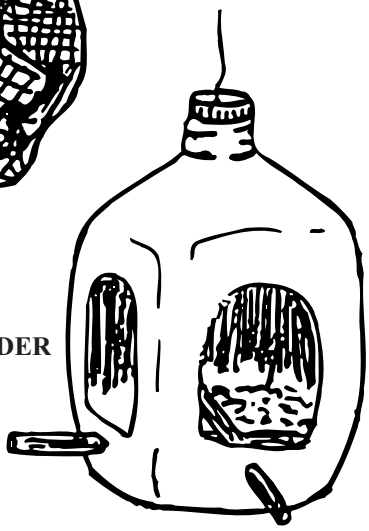
The University of North Alabama Environmental/Energy Education Center. (April, 1991). *The environmental awareness activities guide for grades K-6.*

Home, Tweet Home

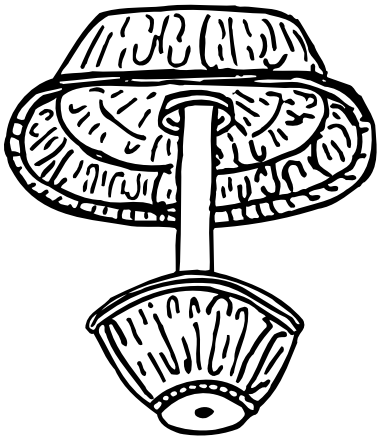
ONION SACK SUET FEEDER



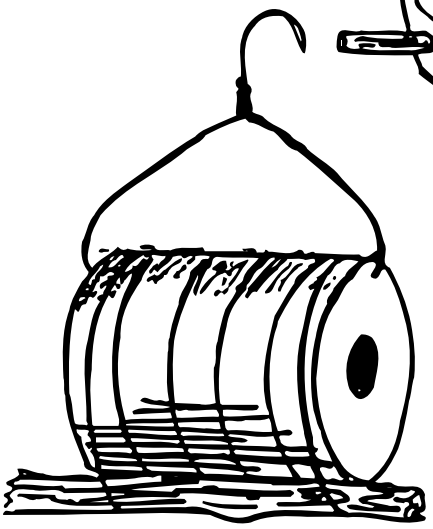
MILK CARTON FEEDER



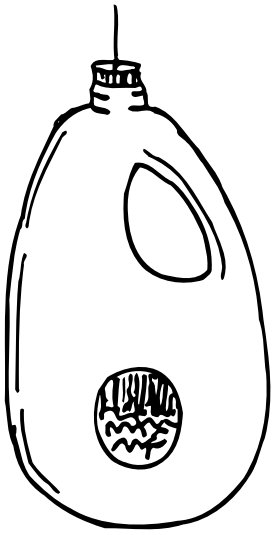
MILK JUG FEEDER



PIE PLATE FEEDER



COFFEE CAN FEEDER



DETERGENT BOTTLE FEEDER

Notes