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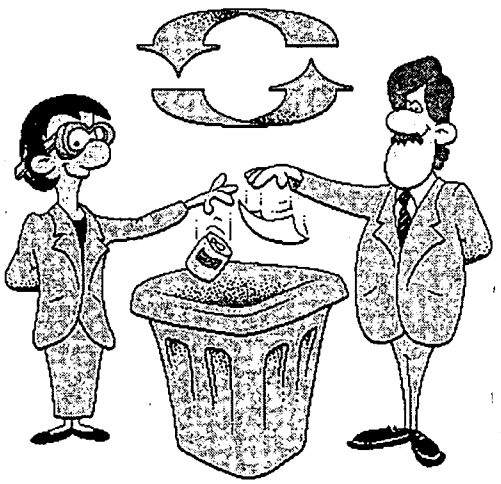
ABSTRACT

In June 1997, Tennessee Technological University's Center for Manufacturing Research conducted a one-week program on plastics recycling for science teachers. The purpose of the program was to increase the teachers' basic knowledge about the importance of recycling plastics and to better prepare the teachers for teaching recycling in the classroom. As part of the mini-course activities, teacher participants developed a series of lesson plans they felt were practical and would be of use in the classroom. Emphasis was placed on integrating recycling activities into the existing curriculum rather than producing a new curriculum. Activities were developed that could be coordinated with subjects found in the regular school curriculum including mathematics instruction, art education, and language arts. This manual is the compilation of these lessons. The activities in this manual have been classified into the following areas: (1) art; (2) consumer education; (3) language arts; (4) mathematics; (5) music; (6) physical education; (7) science; (8) social sciences; and (9) technology. Activities are arranged by grade level within each area. The classifications were arbitrary and some activities can be classified into more than one area. Recycling subjects such as litter, waste categories, composting, open- and closed-loop recycling, construction materials, renewable and nonrenewable natural resources, and polymers are also included. (PVD)

IDEAS AND ACTIVITIES FOR RECYCLING EDUCATION



FOR GRADES K-12

PREPARED BY STUDENTS
OF THE ENVIRONMENTAL PROTECTION AGENCY
SPONSORED PROGRAM ENTITLED
"PLASTICS RECYCLING MINI-COURSE:
A LEARNING EXPERIENCE FOR SCIENCE TEACHERS"

PREPARED AT
TENNESSEE TECHNOLOGICAL UNIVERSITY
COOKEVILLE, TENNESSEE 38505
SEPTEMBER 1997

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PREFACE

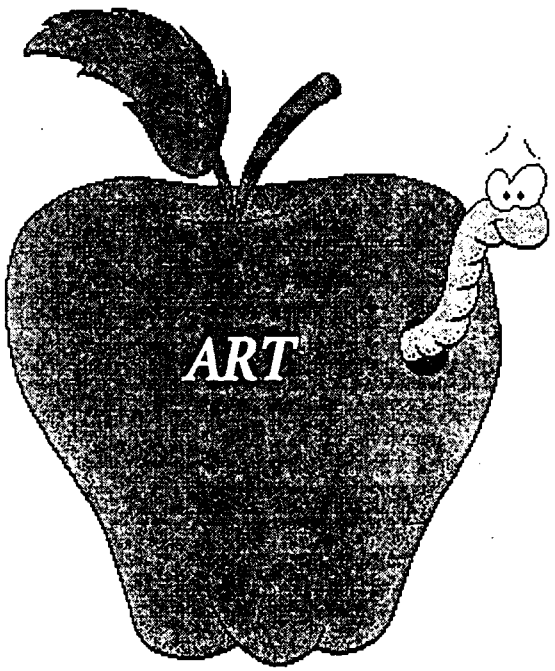
In June 1997, Tennessee Technological University's (TTU) Center for Manufacturing Research conducted, under the sponsorship of the Environmental Protection Agency (EPA), a one-week program entitled *Plastics Recycling Mini-Course: A Learning Experience for Science Teachers.* The purpose of the program was to provide 15 teachers from the university's service area the opportunity to increase their basic knowledge about the importance of recycling plastics. In turn, the teachers would be better prepared to teach recycling in their classrooms. The mini-course was designed so that its participants would be able to achieve the following objectives:

(1) describe the importance of recycling;
(2) demonstrate a knowledge of essential information related to the problems of recycling plastics and environmental problems;
(3) demonstrate practical ways that plastic materials can be recycled into useful products;
(4) demonstrate the use of TTU's recycling equipment to produce real plastic articles based on waste materials;
(5) develop an understanding of environmental issues and how they affect our quality of life;
(6) develop instructional materials on recycling for implementation in grades K-12; and
(7) teach and evaluate a unit on recycling in the fall of 1997.

As part of the activities of the mini-course, the participants developed a series of lesson plans they felt were practical and would be of use in the classroom. Emphasis was placed on integrating recycling activities into the existing curriculum, rather than on producing a new curriculum. Therefore, activities were developed that could be coordinated with subjects found in the regular school curriculum, including such diverse areas as mathematics instruction, art education, and language arts. The lessons were developed over a four day period, edited slightly to insure a uniform format, and compiled in this manual, which, it is hoped, will be of particular value to those who participated in the program.

In some cases, there is a good deal of overlap between activities and procedures of various lesson plans. This duplication was purposefully retained because, it was felt, one activity or procedure might work well with one group of students, while the overlapping material might work better with a different group.

The activities in this manual have been classified into the following nine areas: art, consumer education, language arts, mathematics, music, physical education, science, social sciences, and technology. The classifications were arbitrary and, in many cases, an activity could have been classified into more than one area. Within each area, the activities are arranged by grade level. The grade levels were assigned by the individual authors of the lesson plans, i.e., the teachers who participated in the mini-course.


ART

Title: Trash or Treasure

Subject Area: Art

Grade Levels: K-12

Objective: The student will become more aware of disposal problems by designing an original way to reuse some item that would otherwise be discarded.

Procedures:

1. Teacher will find and create examples of reusing thrown-away items. Using paint, glue, glitter, etc., making such things as a pencil holder out of a soft drink can, a vase out of a plastic bottle, a flower pot out of a 2-liter or a gallon milk jug and a jewelry box out of a plastic cottage cheese container.
2. Show examples to class and discuss how each has been reused.
3. Assign students to search their own trash and refuse to find suitable items for reuse; clean and bring to school.
4. Supply materials for students to create their treasure and allow time to finish projects.
5. Display finished products in classroom, library or other suitable place.

Resources:

Plastic, paint, glue, glitter, markers, felt, etc.

Title: Source Reduction: Priority

Subject Area: Art

Grade Levels: 4-6

Objective: The student will describe how source reduction means making less garbage.

Procedures:

1. Introduce the concept of source reduction and related vocabulary.

2. Did you know that Americans produce more garbage per person than any other industrialized country in the world? Ask students to think about why this is so. Look at lifestyles of other countries which may influence how a product is marketed and sold. For example, in France bakeries regularly sell loaves of unwrapped fresh bread to housewives, who carry them home in a reusable net shopping bag.

3. Solicit suggestions from the class on things they can do every day that will help in the area of source reduction. Have each student write and illustrate his suggestion and compile it into a source reduction booklet. Some possibilities: use both sides of your school paper; fix or repair a toy or clothing; donate items to charity rather than throw them away; bring your own bags to the grocery store; request that your name be removed from "junk" mail lists; when you buy a good book, share it with a friend; return extra hangers to the dry cleaners for reuse; leave grass clippings on the yard instead of bagging them up for the landfill.

4. Give Source Reduction Booklet to library for future source.

5. Have student conduct a source reduction audit in the school to see where the greatest amount of waste is occurring.

Resources:

1. Smithsonian Institution, "A Better World Starts at Home," Office of Environmental Awareness, Washington, D.C. 20560

2. Public Television Outreach Alliance, "Save It" Campaign, 2611 Shirlington Road, Arlington, VA 22206

3. U.S. Environmental Protection Agency, Washington, D.C. 202460

Title: Garbage Art

Subject Area: Art

Grade Levels: 6

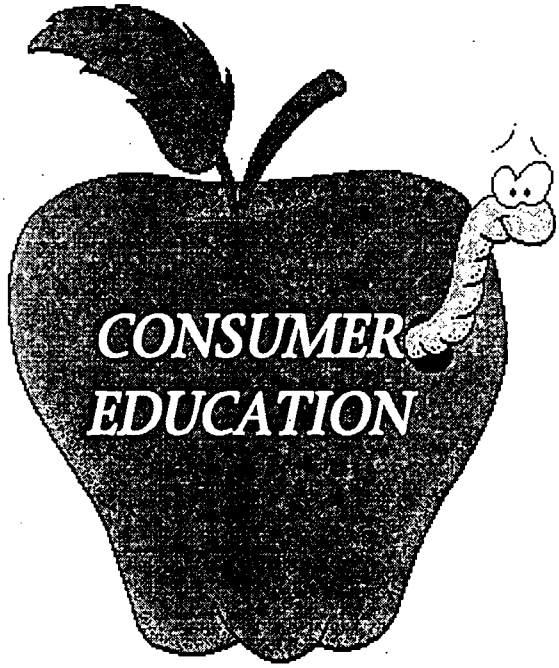
Objective: The student will create a "work of art" from plastic containers as a means of recycling. Assign students a specific type plastic (P.E.T., H.D.P.E., etc.) to collect and create with.

Procedures:

1. Teacher will introduce the term or phrase "throw-away society" and encourage reuse and creativity.
2. Students are assigned a "type" container to collect, clean and bring to class.
3. Students brainstorm for possible creative designs and images.
4. Provide examples of such art work, cutting tools, etc.
5. Have students name their creation using terminology acquired from previous plastics recycling lesson in science class.
6. Display in a gallery at school with a sign indicating type of plastic used (P.E.T., H.D.P.E., etc.) and name of creation.

Resources:

Observation of actual "gallery" exhibit in schools, etc.


CONSUMER
EDUCATION

Title: Reducing Packaging

Subject Area: Consumer Education

Grade Levels: 5-12

Objective: The student will describe packaging and the options for reducing packaging.

Procedures:

1. Discuss the purposes of packaging. Some of these are reduction in waste due to spoilage, prevention of contamination, increased efficiency in distribution, product attractiveness and portion control.

2. Demonstrate how lifestyle affects the amount and types of packaging used by letting students brainstorm on what is included in their favorite meal. Then list all product attractiveness and portion control.

3. Students survey their local food store for examples of natural packages, older and reusable packages and modern packages.

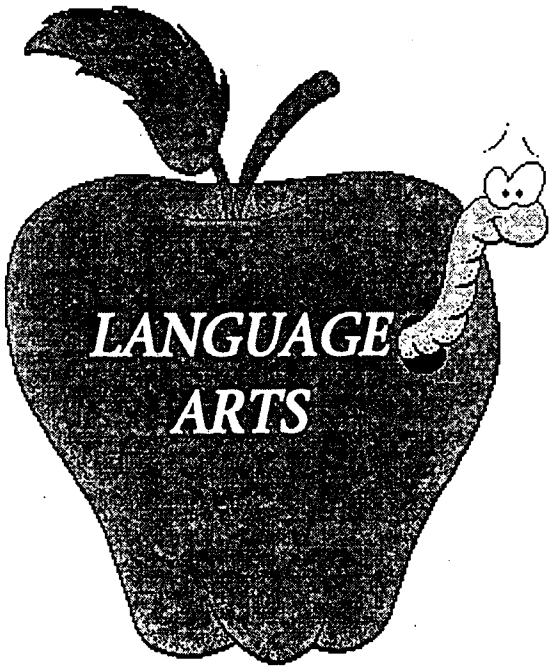
4. Students answer the following questions:
   A. Are any of these products overpackaged?
   B. What purposes do the packages serve?
   C. What kinds of packaging have changed?
   D. Which have remained the same over the last few years?
   E. Are there any examples of packaging actually being reduced? Why have they changed?
   F. Which of the packages chosen for your favorite meal could be recycled or could be made from recycled materials?

Resources:

1. Making A Difference, 1981, P.O. Box 10540, Portland, OR 97210

2. Polystyrene Packaging Council, Inc., 1025 Connecticut Avenue, Washington, D.C. 20036

3. Keep America Beautiful, 9 West Broad St., Stamford, CT 06902


LANGUAGE
ARTS

Title: Cartoons and Bumper Stickers

Subject Area: Language Arts

Grade Levels: 6-12

Objective: The student will (1) identify cartoons and bumper stickers that are designed to make a statement about some issue affecting natural resources and the environment, and (2) describe the influence of humor as a means of conveying information about such issues.

Procedures:

1. Ask students to spend some time in the library or at home looking for examples of cartoons or bumper stickers dealing with an environment-related issue in some way. Each student should find and bring in at least one cartoon or bumper sticker. *Note:* Newspapers can be accumulated in the classroom for one month preceding this activity, providing an opportunity to track the conditions leading to some of the cartoons.

2. Ask the students to put their cartoons or bumper stickers up in the classroom where everyone can look at them and read them. After giving time for everyone to examine them, ask questions such as these: What major topics are the focus? What people, if any, are involved? What elements of the environment? What natural resources, if any? What purpose does the cartoonist or author of the bumper sticker seem to have in mind? What kinds of emotions seem to be elicited? What feelings? What actions, if any, do the cartoons or bumper stickers seem to be designed to promote? What influence, if any, do you think these will have? Who will they influence? In what ways? Do the cartoons or bumper stickers seem designed to mislead, distort, or perpetuate negative stereotypes? If yes, in what ways? Do the cartoons or bumper stickers seem designed to inform, serve accuracy, or encourage constructive, responsible attitudes? If yes, in what ways?

3. Ask the students to summarize their views of the effectiveness and appropriateness of use of media such as bumper stickers and cartoons to attempt to influence people's attitudes.

4. Describe the significance and usefulness of humor as a way to convey information about environmental topics. Describe its effectiveness as a way to influence opinions about environmental topics.

Resources:

1. Project Wild Elementary Activity Guide, copyright 1983 by the Western Regional Environmental Education Council

Title: Recycled Plastics In Our Community and Beyond

Subject Area: Language Arts

Grade Levels: 6-9+

Objective: The student will participate in researching and reporting on products which are made from recycled materials.

Procedures:

1. Divide students into groups of two to four.

2. Students will be given several manufacturers in and around the community to call and/or interview to find out whether they make items using recycled plastics or whether they are recycling plastics.

3. Students will be given class time to work on the report and share information with other group members.

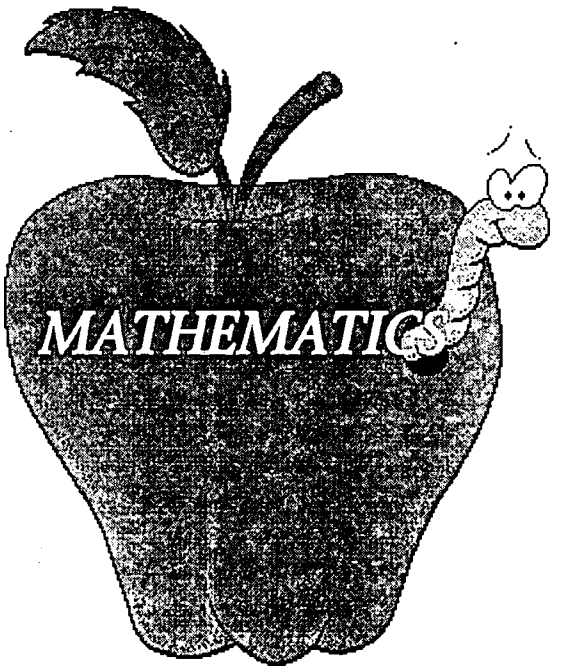
4. Students will present findings to class.

Resources:

1. Internet, Netscape, City Scape, Your City, Manufacturers

2. Local Telephone Book, Yellow Pages, Chamber of Commerce

3. Internet, American Plastics Council


MATHEMATICS

Title: Making Money The Recycled Way

Subject Area: Mathematics

Grade Levels: K-12

Objective: The student will learn the value of recycling by participating in a class project to collect and sell recyclable material.

Procedures:

1. Obtain large containers to hold collected material. Label these for plastic, paper, metal or any other material which may be marketed in your area.

2. Obtain accurate scales and set up a weigh station in the classroom.

3. Each student will collect, bring to class, separate, weigh, and deposit in appropriate containers all recyclable material they are able to obtain.

4. Each student will compile and keep a running total of his contribution to the class total.

5. As enough material is obtained, it will be sold or donated to a recycling program.

6. At the end of the collection period, each student will determine the percentage of their contribution to the class total.

7. Any money earned will be used for a class party or project.

Resources:

School Recycling Programs: A Handbook for Educators

Title: Does An Aluminum Can Weigh More When You Crush It?

Subject Area: Mathematics

Grade Levels: K-1

Objective: The student will participate in crushing cans for recycling. The student will weigh cans before and after crushing. The student will describe what happens to the weight of the can when crushed. Students will describe what happens to the shape of the can when crushed. Students will complete a small booklet.

Procedures:

1. Pass out pre-cut, pre-stapled booklets. Students will draw on the front page their favorite brand of soda contained in a can.

2. Divide students into groups of four or five. Students will go to the scale one at a time to weigh their can before crushing.

3. On the first page of their book they draw a plain, uncrushed can and write the weight.

4. The can is then taken to a helper to supervise and help with crushing.

5. On the second page of their book they draw the crushed can and write the weight.

6. On the third page of their book they write the conclusion — copied from the board after discussion.
   Challenge — Why would it be better to crush cans?

Resources:

Scales, cans, booklets, helper (upper grade student, parent or volunteer), crayons to color with while waiting their turn

Title: Predicting Types of Trash Found on Playground.

Subject Area: Mathematics

Grade Levels: K-1

Objective: The student will gather trash from the playground. The student will group trash according to the categories (plastic, paper, glass and metal). The student will count the items in each group and graph each item.

Procedures:

1. Predict types of trash to be found on playground.
2. Predict the most- and least-found type.
3. Go to the playground and gather trash.
4. Group items according to the categories (plastic, paper, glass and metal).
5. Count the number of items in each group.
6. Add each item to a class graph.
7. Look at graph and count total in each category.
8. Check predictions.

Resources:

Trash bags, gloves.

Title: How Expensive Is Recycling?

Subject Area: Mathematics

Grade Levels: 5-8

Objective: The student will determine the cost of recycling various types of products. The student will compare the cost of recycling to other types of disposal.

Procedures:

1. Divide the class into groups of three or four students.
2. Assign each group a different category — plastic, wood, paper, metal, etc.
3. Give each group an opportunity to research the category assigned. Using Internet, library resources and textbooks, find the costs involved in recycling, landfill, incineration, etc.
4. Compile a chart comparing the various categories and the expense involved with each.
5. Students compare and analyze all data to draw conclusions as to the expense of recycling various materials in comparison to other types of disposal.

Resources:

None

Title: Pros and Cons of Reusable and Disposable Diapers

Subject Area: Mathematics

Grade Levels: 5-8

Objective: The student will develop a list of the pros and cons of using cloth diapers and disposable diapers.

Procedures:

1. Ask some parents of children in diapers to come to class prepared to answer questions about diaper usage. Try to find parents who have children about the same age. Try to find parents who use only disposable, some who use only cloth and some who use both.

2. Have students brainstorm questions to ask the panel before they arrive. Prompt them to ask about cost, convenience, medical complications, child preference, etc.

3. Have students compile lists of pros and cons as questions are asked of the panel.

4. Students should be able to draw conclusions from the lists of pros and cons.

Resources:

Samples of both cloth and disposable diapers.

Title: Graphing Results of Scavenger Hunt

Subject Area: Mathematics (See "Plastics Scavenger Hunt" in Science Section)

Grade Levels: 6

Objective: The student will be able to observe and compare the different plastic type coded containers used by their family by making a bar graph. Total class graph results together to see the "big picture."

Procedure:

1. Each student separates and totals individual plastic types collected.
2. Student designs a bar graph for data (may use computer).
3. Students compare type and totals.
4. Class total all collected data for "big picture" of plastic use awareness.

Resources:

Science In Your World, MacMillan/McGraw-Hill

Title: Finding Densities

Subject Area: Mathematics

Grade Levels: 6-8

Objective: The student will determine the densities of various objects.

Procedures:

1. Students may be divided into groups or work individually if enough equipment is available.

2. Set up individual stations where students may weigh various samples of plastic, wood, metal, paper, etc.

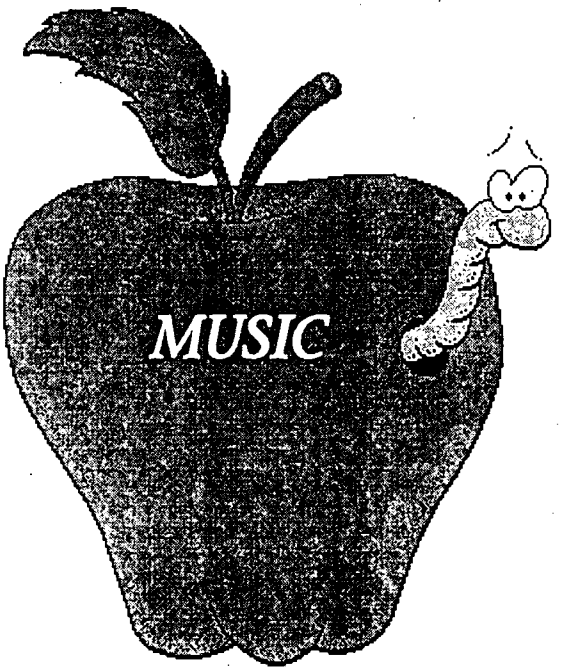
3. Set up individual stations where students may find the volume of the same samples as used in step 2. Use water submersion or multiply length X width X height as appropriate.

4. Have students determine the density of each object by dividing volume into mass. Arrange items in order of least to greatest density.

5. Point out to students that objects with a density of one are equal to water. Any object less than one will float; any object greater than one will sink in water.

Resources:

Assortment of objects, graduated cylinders, jars or beakers for use in making measurements and metric rulers


MUSIC

Title: What is Litter?

Subject Area: Music

Grade Levels: K-2

Objective: The student will identify litter in the world.

Procedures:

1. Take younger children on a "litter hunt" and record what is found.
2. Discuss "what is a litterbug?"
3. Ask children to be watchful for a day or two and to decide what is the most common type of litter and where the most litter is found.
4. "Clean up" an area and sort litter into categories (help the children to do this).
5. Help the children make up a song such as: can on the street is not too neat, ugly litter I kick with my feet, etc.

Resources:

1. Neighborhood or school playground
2. Recorder for song

Title: Sanitary Landfills: The Priority of Last Resort

Subject Area: Music

Grade Levels: 3-5

Objective: The student will describe a sanitary landfill.

Procedures:

1. Ask students if they have ever seen "open dumps" where people took unwanted items, or trash. Current methods for building sanitary landfills are safer and more protective of the environment. Ask the students if they can think of ways to build a more environmentally safe landfill.

2. Draw on the board a simplified diagram of a model landfill, explaining that this is an example of one of the more protective landfill designs. Layers of soil, clay, gravel with pipes, plastic liner and waste are highlighted. The new collected waste is covered daily by a layer of soil. Tell students that modern landfills also control the leachate so that it doesn't contaminate the environment.

3. Let students make a mini-sanitary landfill in a terrarium. Place a variety of wastes, such as food, paper, plastic and metal onto the gravel and cover with a light layer of soil. Sprinkle occasionally with water to stimulate rain. Observe changes in the waste materials over time and watch for "leachate" collecting at the bottom.

4. Introduce song "On Top of a Landfill" to the tune of "On Top of Old Smoky" to students.

Resources:

1. "Traces of Today" plastics recycling video, Dow Plastics, 1-800-258-2436

2. Council for Solid Waste Solutions, 1275 "K" St., N.W., Suite 400, Washington, D.C. 20005

3. Alliance of Environmental Educators, 2111 Wilson Boulevard, Suite 701 Arlington, VA 22201

4. Song, "On Top of a Landfill" (next page)

"On Top of a Landfill"
Song Tune: "On Top of Old Smoky"

On top of a landfill, I bought my new home
At first I didn't know it, but then I was phoned

The EPA called me, said the water was bad
And now I realized it, I had been had

And all of a sudden, I smelled something gross
It wasn't the oven, it wasn't burnt toast

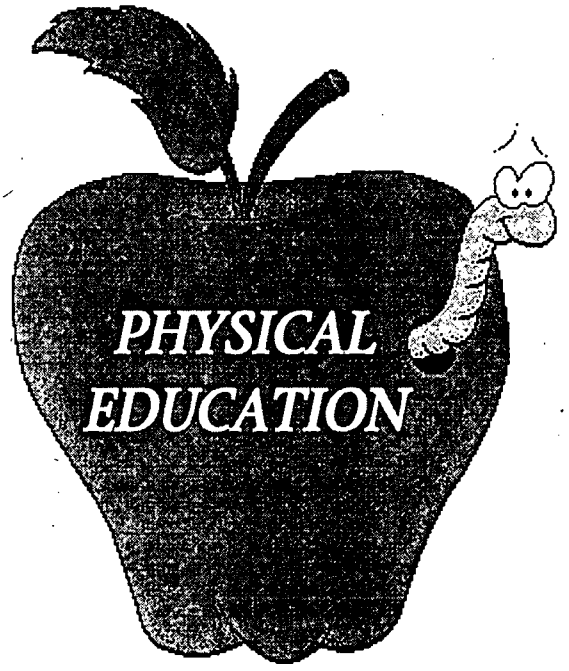
The fumes were arising right out of the ground
My head started spinning around and around

My stomach was aching, I started to cough
It must be those fumes that make breathing so tough

And the cause of this problem is a chemical dump
Those chemicals were toxic, and I fell with a thump

So now I've decided to buy a new home
But this time I'm wiser, EPA will not phone

Here's a way to prevent what happened to me
Education's essential — it must be the key


PHYSICAL
EDUCATION

Title: Don't Throw It Away — See If It Plays

Subject Area: Physical Education

Grade Levels: 6

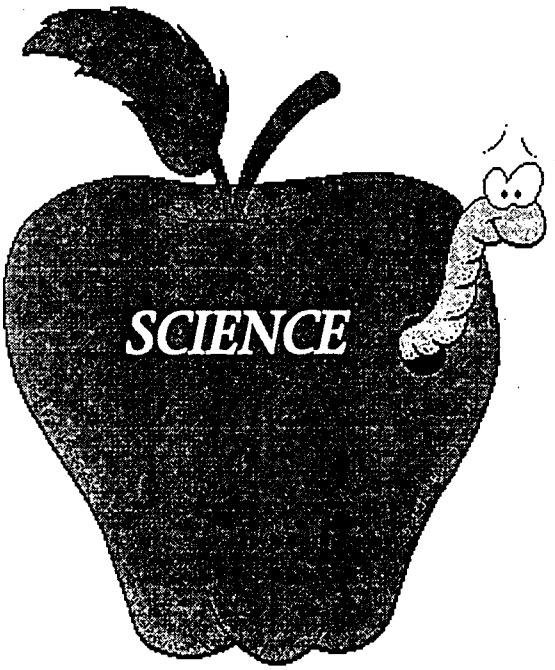
Objective: The student will work in a cooperative learning group to create a useful toy and/or game piece with plastic containers in a recycling strategy. The student will demonstrate how to create a useful function for throwaways.

Procedures:

1. Divide into cooperative learning groups.
2. Research and discuss possible inventions.
3. Collection of containers by students to meet their predetermined needs.
4. Allow class time for creation, invention, practice, etc. Supply guidance and supplementary materials.
5. Students will actually teach their game/activity, etc., to the other groups.
6. All groups evaluate each invented game/activity, etc., making suggestions for improvement.
7. Students will write a description of their creation and a set of game rules.
8. Invite other classes to play.
9. Video the activity.
10. Discuss production and marketing of creation.

Resources:

Assortment of physical education work-and-take, create-from-waste, type inservices


SCIENCE

Title: Classification of Trash for Recycling

Subject Area: Science

Grade Levels: K-1

Objective: The student will gather trash from the playground. The student will group trash according to these categories: plastic, paper, glass and metal. The student will learn what items can be recycled in our community and where.

Procedures:

1. Discuss the four categories of items to recycle. Find examples of each category in the classroom.
2. Go to the playground and gather trash.
3. Work in groups of two to classify the trash into four categories. Use classroom examples when needed.
4. Look at examples of recycled materials.

Resources:

1. Information found in "Plastics Recycling Mini-Course" Notebook
2. Examples of recycled pellets

Title: Recycling: Priority 2

Subject Area: Science

Grade Levels: K-6

Objectives: The student will demonstrate an awareness of recycling as a waste management method that conserves natural resources and saves energy.

Procedures:

1. Have a show-and-tell session where students bring in objects and discuss how they can be reused or recycled.

2. Set up recycling boxes for the classroom, if there is a recycling center in your community. Have a separate, clearly labeled box for each type of recyclable items.

3. Plan a field trip to the Recycling Center.

4. Have students start a school recycling program. Begin by setting up collection boxes for used writing paper in all of the classrooms. Aluminum cans can be collected and sold as a fund-raiser for a class trip.

Resources:

1. Twelve Facts About Waste Paper Recycling, 1988, American Paper Institute, 260 Madison Avenue, New York, NY 10016

2. Waste Management Recycling Topics, 1989, Florida Dept. of Education, Tallahassee, FL 32399

3. Recycling in Your School Makes Good Sense, 1989, Cornell Media Services, Ithaca, NY 14850

Title: Scavenger Hunt/Matching Game

Subject Area: Science

Grade Levels: K-6

Objective: The student will match cards with plastic items hidden around the room using the identification symbols.

Procedures:

1. Have students make cards with i.d. symbols, one card for each symbol per set. Make as many sets as needed. Divide students into teams.

2. Kids draw numbers out of hat to decide which team goes first. Each team has 30 seconds to search the room for items matching their cards (one item per card) and return to base.

3. The first team to find all the matches wins.

*Try to have several different examples of each type hidden so the students won't be looking for the same items.

Resources:

1. Internet, American Plastics Council

2. Hands On Plastics: A Scientific Investigation Kit; American Plastics Council, 1997

3. Upper Cumberland Development District, 1225 S. Willow Ave., Cookeville, TN 38506, Andy Mitchell

Title: Save! Sort! Recycle!

Subject Area: Science

Grade Levels: 2-3

Objective: The student will classify and sort some common recyclable items.

Procedures:

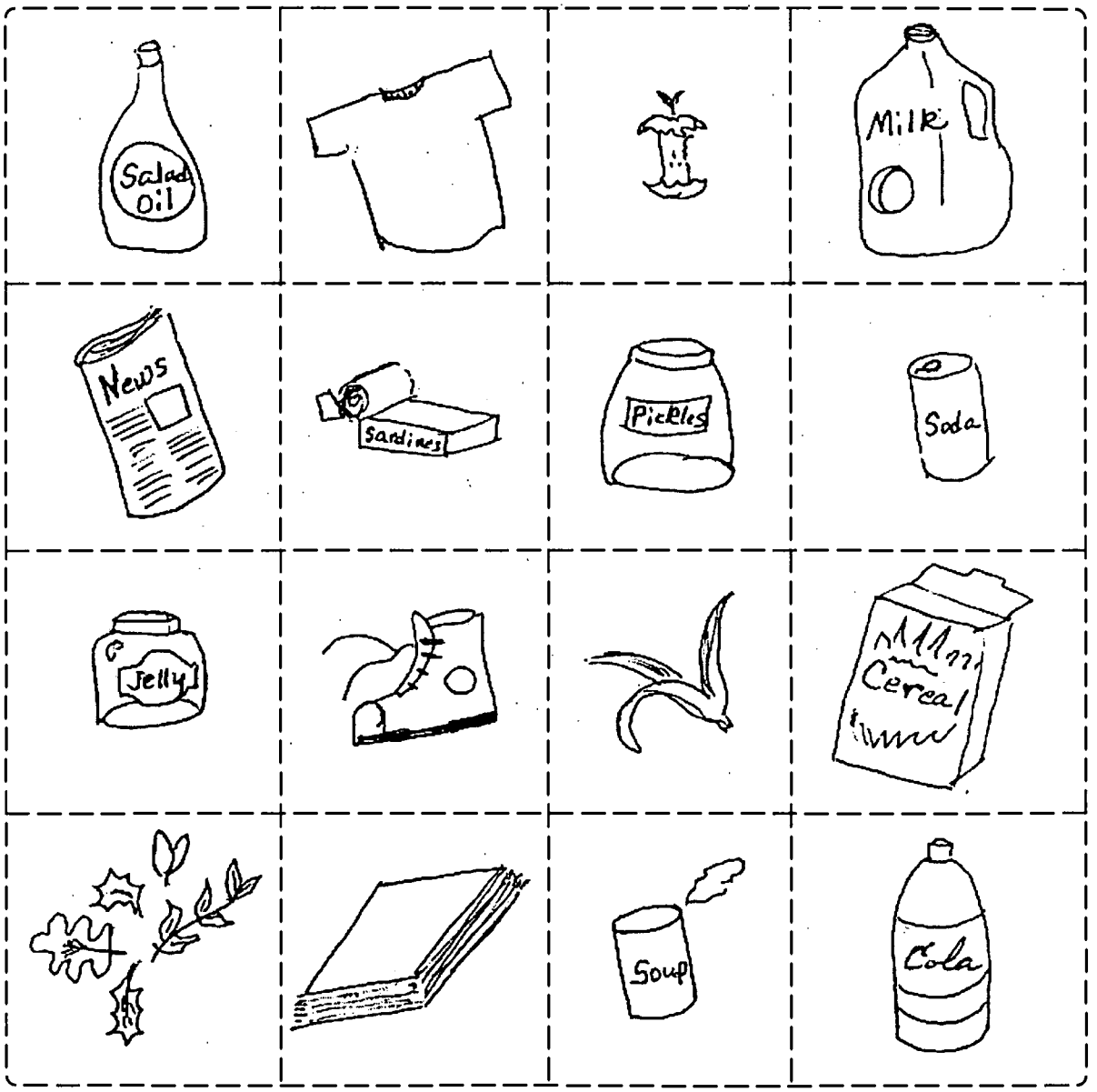
1. See the two pages which follow.

Resources:

1. Cut and paste sheets
2. Glue

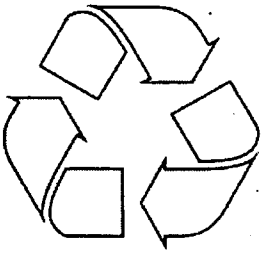
SAVE! SORT! RECYCLE!

Color the recyclables. Cut them out and paste them into the proper bin on the other page.

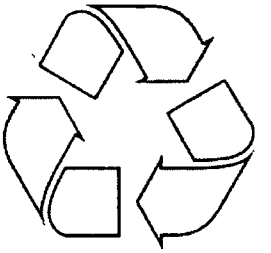


RECYCLING BINS

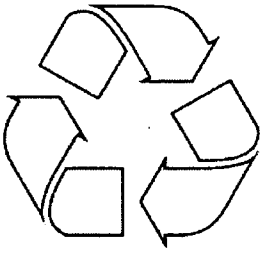
COMPOST



PLASTIC



METALS



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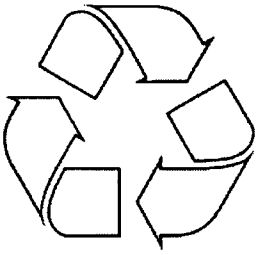
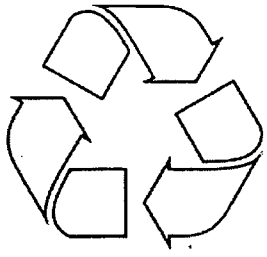


PAPER



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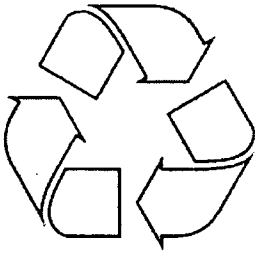


Title: Let's Recycle!

Subject Area: Science

Grade Levels: 2-5

Objective: The student will become aware of recycling in the community and become involved in school recycling efforts.

Procedures:

1. Set up boxes (appropriately labeled) for items which can be recycled in your community, i.e. aluminum, white paper, newspaper, plastic soda bottles, etc.

2. Find out what quality of items are accepted at the centers (i.e. must paper be high grade) and tell the students.

3. If possible, take the class to the center.

4. You might do a collection drive for an item such as aluminum to help fund a class trip.

Resources:

Yellow pages of telephone book — look for recycling programs, waste paper, scrap dealers, etc.

Title: What is Waste?

Subject Area: Science

Grade Levels: 2-5

Objective: The student will identify many different types of waste.

Procedures:

1. Have each child bring in one or two examples of waste from home (remind them to clean it first.) This should include plastic, paper, cardboard, cans and glass. (With younger children, you may need to bring the glass yourself.)

2. Label boxes and have the children sort their waste.

3. Have the children use a magnet to separate aluminum cans from tin and steel.

4. Younger children could trace some of the objects and color them. Older children could decorate cans for pencil holders or use plastic containers for planters.

Resources:

Waste products from home and school.

Title: Renewable and Nonrenewable Natural Resources

Subject Area: Science

Grade Levels: 3-5

Objective: The student will describe some of the differences between renewable and nonrenewable natural resources.

Procedures:

1. Divide students into groups to brainstorm what would normally be included in the waste stream.

2. Distribute a handout of samples of renewable and nonrenewable natural resources. Discuss which items are renewable and nonrenewable sources. Help students to realize that some materials are not renewable because they are the result of geological processes that take millions of years to complete. Nonrenewable resources are in limited supply and once they are used up, they are gone forever.

3. Evaluate students by letting them place any piece of solid waste into the categories of renewable and nonrenewable resources. Example: paper, from wood (renewable); plastic bags, from petroleum (nonrenewable).

Resources:

1. Keep America Beautiful, Mill River Plaza, 9 West Broad Street, Stamford, CT 06902

2. Houghton Mifflin Science Manual

3. U.S. Environmental Protection Agency, 401 "M" Street SW, Washington, D.C. 20460

Title: What Is "Recycle"?

Subject Area: Science

Grade Levels: 3-12

Objective: The student will define the word "recycle" and its symbol.

Procedures:

1. Write the word "recycle" on the board. Ask students to break it into parts. What does the prefix "re" mean? (Discuss other words such as repair, redo, return.) What does "cycle" mean? Discuss. Therefore: "Recycle" — to do or use over and over again. Ask students how the word "recycle" might apply to our use of resources.

2. Have students name some waste materials that can be recycled.

3. Show students the recycling symbols. Explain that the three arrows represent the three stages: collect, remake, reuse.

Resources:

Recycling symbols for those things made of recyclable materials and for those things made of recycled materials.

Title: Composting

Subject Area: Science

Grade Levels: 5-6

Objectives: The student will demonstrate composting.

Procedures:

1. Remove the bases from two 2-liter plastic bottles and the labels from three, by pouring about two cups of hot tap water into the bottles. Replace the cap, tilt the bottle so the water softens the heat-sensitive glue, peel off the label and twist off the base.

2. Pour out the water and draw cutting lines around the bottle. (The teacher will help students make incisions and cut bottles.)

3. Assemble by following illustration (next page).

4. Holes for ventilation can be poked into the plastic with a sharp needle or paper clip that has been heated in the candle flame under teacher's supervision. Larger holes can be cut into the sides with the knife and covered with fine mesh fabric held in place with tape.

5. A piece of mesh fabric over the lower end allows for drainage.

6. Add ingredients for composting through the top of the column.

7. Observe changes in compost. Compost columns can be used to generate liquid fertilizer called "compost tea." Use liquid to water and fertilize identical sets of seedlings to see how different brands of "tea" affect growth.

Resources:

1. Three 2-liter beverage bottles

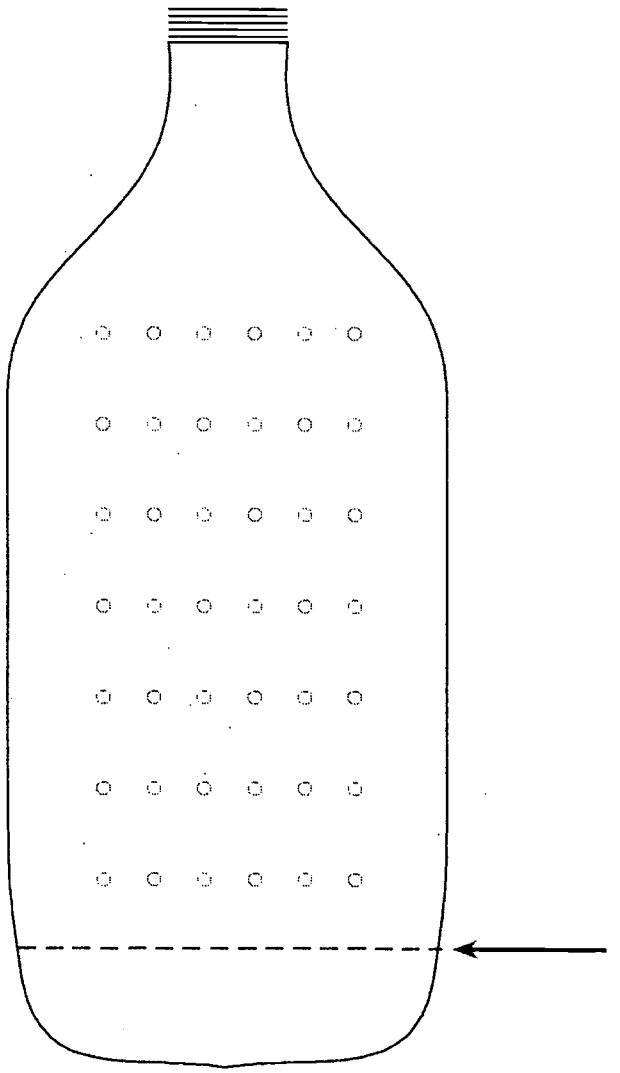
2. Hot tap water, knife, scissors, marking pen, needles or paper clips for poking holes, candle, clear tape, netting, rubber bands

3. Organic materials for composting, such as vegetable or fruit kitchen scraps, leaves, newspapers and grass clippings

4. Bottle Biology Resources Network, University of Wisconsin-Madison, 1630 Linden Drive, Madison, WI 53706

5. National Association for Plastic Container Recovery, 4828 Parkway Plaza Blvd., Charlotte, NC 28217

ASSEMBLY OF COMPOSTER



CUT HERE. Attach fine mesh fabric to bottom of bottle with rubber bands and/or tape.

Title: Introduction to Solid Waste Management: Why Recycle?

Subject Area: Science

Grade Levels: 5-7

Objective: The student will demonstrate a basic understanding of recycling principles.

Procedures:

1. Divide students into groups of three. Have students list items that can be recycled. In–class discussion of these items. Inform students that items we use everyday can also be recycled — cars, seats, auto parts, etc.

2. Have students list reasons why all items are not recycled in their communities. Answers may include: (1) facilities don't exist, (2) too costly, (3) not enough interest, (4) transportation, etc.

3. Assign students to monitor items that they throw away for 24 hours. Could the items be recycled? Can they be recycled in our area? Do they recycle these items?

Resources:

1. The Consumer's Handbook for Reducing Solid Waste, EPA

2. EPA Mini Course Binder: General Solid Waste Problems and Management (Monday)

Title: Introduction to Solid Waste Management: Why Reuse?

Subject Area: Science

Grade Levels: 5-7

Objective: The student will demonstrate a knowledge of basic recycling principles. Reduce, reuse, recycle.

Procedures:

1. Ask the students to list in writing litter items often seen on the side of the road.

2. Remind the students that objects have varying decomposition times. Ask the students if they were to drive down the same road in one year which items would still be there; in 5 years; in 10 years; in 30 years; in 100,000 years?

3. Ask the students to take one item from their list and devise five alternate uses for the item.

4. Allow each student to present their ideas to the class.

Resources:

1. The Consumer's Handbook for Reducing Solid Waste, EPA

2. The Book of Lists 2, Wallace, et al. 1980

Title: Recycling of Household Waste

Subject Area: Science

Grade Levels: 5-8

Objective: The student will determine the percentage, by volume, of his household's waste that it is practical to recycle.

Procedures:

1. Each student will be responsible for collecting and measuring household waste for one month.
2. Each student will separate the waste into disposable and recyclable material.
3. Each student will determine the percentage of recyclable material by volume. (For example: one bag of recyclable material to three bags of disposable would yield 25%.)
4. After one month, students will report their results to class.
5. Students will determine the average amount of material recycled by the entire class.

Resources:

None

Title: Which Items Are Biodegradable?

Subject Area: Science

Grade Levels: 6

Objective: The student will demonstrate or describe which items in a simulated landfill will biodegrade and which items will not.

Procedures:

1. Stake off one square meter in school yard per cooperative learning group. Remove the soil to a depth of 30 cm.
2. Place aluminum cans, glass jar, plastic bag, paper napkin, orange peel, milk carton, ink pen, foam cup and apple slices in area. Don't allow items to touch.
3. Make a top view map of the pit showing location of each item.
4. Replace soil in pit over items. Wait 30 days.
5. Open pit. Observe and record data.
6. Recover pit. Wait 30 more days.
7. Open pit. Observe and record data.
8. Note and discuss changes that occurred after 30 days and after 60 days.

Resources:

1. Science In Your World, MacMillan/McGraw-Hill
2. Discover the Wonder, Scott/Foresman

Title: Plastics Scavenger Hunt

Subject Area: Science

Grade Levels: 6

Objective: The student will demonstrate how to recognize the SPI codes by collecting material from residential waste streams. The student will list which recycling firms are available in the area and how these firms require plastics to be sorted.

Procedures:

1. Explain SPI codes and show examples.
2. Assign students to collect and identify the SPI–coded containers their family uses in a week or a month.
3. Confirm the location of a recycling firm that will accept each SPI coded container, etc., and obtain sorting and bailing directions they require.
4. Arrange for students to deliver their collected material to one recycling firm and tour the plant.
5. Evaluate student knowledge and understanding.

Resources:

1. Science In Your World by MacMillan/McGraw-Hill
2. This Watchable Wildlife Environmental Educ. Activities by Mary V. Ball, Carson-Newman College

Title: Investigation of Two Views of Conservation & Recycling
1. "Walk in Moccasins" or "The Conservation Ethic"
2. "Run in Nikes" or "The Pioneer Mentality"

Subject Area: Science

Grade Levels: 6

Objective: The student will be able to identify correctly on a written instrument the phrases and terms which illustrate and define the Native American view ("Walk in Moccasins") and the white pioneer view ("Run in Nikes") of conservation and recycling.

Procedures:

1. Teacher leads students to an understanding of conservation and recycling as terms. Teacher presents recycling as a "must" for our society today.

2. Discuss that different societies and cultures may have very different views on family, religion, education, gender roles, as well as values placed on nature and its protection and care.

3. Divide students into cooperative learning groups to research the two views. (Teacher to supply needed research material.)

4. Students may share research knowledge in the form of a short play or teacher or "guest" could dress the part and role play these two very different views on conservation and recycling.

5. Use evaluation tool to measure student understanding of the two views. Encourage an honest answer as to which shoes they wore before this lesson and which shoes they plan on wearing tomorrow. Have students list changes they are willing to make.

Resources:

1. Keepers of the Earth by Michael Caduto and Joseph Bruchac

2. Keepers of the Animals by Michael Caduto and Joseph Bruchac

3. Brother Eagle, Sister Sky by Susan Jeffers

4. This Indian Peoples by Ronald N. Satz

Title: Renewable Versus Nonrenewable Resources

Subject Area: Science

Grade Levels: 7

Objective: The student will describe renewable and nonrenewable resources that we encounter on a daily basis.

Procedures:

1. Have students bring to class small samples of renewable and nonrenewable items:

   A. Nonrenewable — aluminum cans, steel cans, glass bottles, fossil fuels, minerals, etc.

   B. Renewable — plants, fruits, vegetables, paper products, etc.

2. Have students identify the raw materials used to make the resources brought to class.

3. Explain that some materials are not renewable because they are the result of geological processes that take millions of years to complete.

Resources:

1. Related articles from public library.

2. Sources from school library

3. Plastics Recycling Education, Andy Mitchell

Title: Environmental Pollution by Plastics

Subject: Science

Grade Levels: 7

Objective: The student will demonstrate an awareness of the amount of plastics thrown away and what can be done to reduce the volume of material.

Procedures:

1. Have students survey their local surroundings and note all types (kinds) of plastics lying around.

2. Compose a series of diary entries on this topic: "Plastic Waste in my Surroundings."

3. Complete the following statement and give details to support your response:
   What can I do to help this environmental problem?

Resources:

Local area

Title: "Ride the Wave of the Future" — Recycle Today

Subject Area: Science

Grade Levels: 7-8

Objective: The student will investigate the origins and vocabulary of waste. The student will identify the categories of plastics. The student will illustrate the chemical structures of plastics — polymers. The student will identify applications/uses of common plastics.

Procedures:

1. Pre-test environmental quiz, including (1) the 4 R's, (2) consumption amounts and (3) recycle possibilities.
2. Attention getter: each student to list plastic waste they generated in the previous 24 hours.
3. Introduce origins and vocabulary for recycling plastics.
4. Have students separate/categorize types of plastics that fit into the common packaging codes.
5. Illustrate polymers with beads, paper clips, students, etc.
6. Teach the chemical structures of plastics.
7. Allow students to get in groups and list items that are in each plastics group. Identify those that are "virgin" materials and those that are recycled.
8. Ask each student to write a brief statement on their beliefs concerning recycling in general and specifically plastics.

Assignment: Each student should bring five items made of plastic to be categorized by the class on day two.

Resources:

1. EPA Curriculum for Solid Waste Awareness, "Let's Reduce and Recycle", 1990
2. Plastics Recycling Education, Andy Mitchell
3. Hands On Plastics, American Plastics Council
4. Recycle America

Title: The Planet and the Law

Subject Area: Science

Grade Levels: 7-8

Objective: The student will identify government agencies and laws concerning recycling. The student will establish the economic benefits of recycled plastics. The student will address the negatives involved with recycling.

Procedures:

1. Have students watch video "The Busy, Busy Planet."
2. Allow students to brainstorm individually, on paper, their ideas of laws and regulations concerning recycled plastics.
3. Place students in groups of four to combine their lists.
4. Present to the class from each group.
5. Instructor to present basic regulations and laws governing plastic recycles.
6. Debate those laws/regulations that students would add to or delete from government regulations.
7. Assign students (in some groups) Fact Sheet Activity (p. 98-99, Curriculum for Solid Waste Awareness).
8. Be prepared to present their view on town/community activity.

Resources:

1. EPA Curriculum for Solid Waste Awareness, "Let's Reduce and Recycle," 1990
2. Plastics Recycling Education, Andy Mitchell, Environmental Planner 4100
3. The Busy, Busy Planet, American Plastics Council
4. Hands On Plastics, American Plastics Council

Title: "4 R's" + 1

Subject Area: Science

Grade Levels: 7-8

Objective: The student will identify specific ways to Reduce, Reuse, Recycle, Recover and Refuse

Procedures:

1. Share "plastic creations" from Day 4 class.
2. Allow students to get in groups and create their own rules for the 4 R's.
3. Share rules. Determine which are feasible and those that would pose economic or logistical problems. List the easy ones to accomplish.
4. Create a Refuse list — things not to do or consume.
5. Make posters/signs using the students ideas for 4 R's + 1.
6. Organize plan for recycling at Your School.
7. Write proposal to be presented to principal for approval.

Resources:

1. Hands On Plastics, American Plastics Council
2. EPA Curriculum for Solid Waste Awareness
3. Recycle America
4. Plastics Recycling Education, Andy Mitchell
5. EPA Consumer Handbook for Reducing Solid Waste

Title: A Plastic Planet

Subject Area: Science

Grade Levels: 7-8

Objective: The student will describe the place plastics have in our communities and our lives — to establish a safe community for all.

Procedures:

1. Allow students from each group to "group" with students assigned to specific "jobs" within the town and community of Farmington (p. 97, Curriculum for Solid Waste Awareness), discuss their pros and cons and be prepared to argue their point.

2. Allow students to draw (illustrate) best "map" for community progress and safest location of all community components.

3. As each community group presents their stand, allow the map to be a part of the presentation.

4. Allow students to put all ideas together to collectively arrive at the best solutions for all individuals and the community.

Resources:

1. Curriculum for Solid Waste Awareness, EPA

2. Plastics Recycling Education, Andy Mitchell

3. Hands On Plastics, American Plastics Council

4. Recycle America

Title: Recycling is Garbage?

Subject Area: Science

Grade Levels: 7-8

Objective: The student will sort/separate various plastic items by chemical properties and to determine future use. The student will identify recycling methods for plastics. The student will illustrate new products from recycled plastics.

Procedures:

1. Present recycling pyramid.
2. Day 1 assignment (all students should have items)
3. Group students in fours and allow to identify and sort plastic items brought to class.
4. Present plastic groups to class — let class members evaluate each group's success in classification (did they sort correctly?).
5. Address properties of thermoplastics, thermoset plastics and elastomers.
6. Allow students individually to design a functional product from items brought to class — thus the ultimate of recycled plastics.
6. Be prepared to share with class.

Resources:

1. EPA Curriculum for Solid Waste Awareness, "Let's Reduce and Recycle," 1990
2. Plastics Recycling Education, Andy Mitchell
3. Hands On Plastics, American Plastics Council
4. Recycle America
5. Dr. Fyodor Shutov — lectures

Title: Polymer Propaganda

Subject Area: Science

Grade Levels: 7-8

Objective: The student will identify properties of a polymer. The student will illustrate polymer structure. The student will review and identify plastic polymer structures in our daily lives.

Procedures:

1. Build polymers with marshmallow and toothpicks, clay and sticks, Legos and tinker toys.
2. Disassemble and make new structures.
3. Repeat several times.
4. Evaluate each level of production — how do new items compare with first creation? What happens as each new item is created? Strength? Appearance? Can all items be mixed — put together.
5. Make Slime — just for fun!!
6. Look at polymers in disposable diapers (properties that identify polymers)
7. Epoxies — examine types, properties

Resources:

1. Hands On Plastics
2. EPA Curriculum for Solid Waste Awareness
3. Recycle America

Title: Introduction to Trash

Subject Area: Science

Grade Levels: 8

Objective: The student will examine litter (both natural and man made) found on school campus and suggest ways in which it could be controlled.

Procedures:

1. Pair the students up and equip each student with a pair of gloves and each pair of students with a bag.

2. Go onto the school grounds and assign each pair of students to an area. Each assigned area should be of about equal size and "trashiness".

3. The students should be instructed to collect ALL types of loose debris. This includes leaves, twigs, paper etc. They should only pick up debris while wearing the gloves.

4. When each pair has completed their collection, they should return to the lab and separate their trash into natural litter and people litter at their lab stations.

5. Separate the people–produced trash into metal, paper, plastic and glass. Get a rough estimate of the percentage of each type of debris found by each pair.

6. Discuss the following: Does the trash harm anything except the appearance of the area? What effect, if any, does the natural litter have on the area? What effect, if any, does the people litter have on the area? Which types of litter are biodegradable? What could be done to reduce the amount of litter on campus? What differences in the percentage of trash found in each area were observed? What could account for the observed differences?

7. Clean up the lab by disposing of each type of debris in an appropriate manner.

Resources:

1. Plastic gloves

2. Paper bags or small garbage bags

3. Notebook from "Plastics Recycling Mini-Course: A Learning Experience for Teachers"

Title: Plastic is Plastic, Right?

Subject Area: Science

Grade Levels: 8

Objective: The student will demonstrate or describe the differences in the chemistry of the more commonly recycled types of plastics. The student will participate in a discussion on how these differences can be a problem during the recycling process.

Procedures:

As this is a lecture/discussion type of lesson, each teacher should devise their own "hook" to begin. After getting the interest of the class, give them the chemical reasons for the incompatibility of many plastics. Explain how this can cause problems in the recycling process. Generate a class discussion by getting the students to recommend simple ways of dealing with this at the household level.

Resources:

1. Handouts on subject
2. Chalkboard or white board
3. Sample plastics for students to examine
4. Notebook from "Plastics Recycling Mini-Course: A Learning Experience for Teachers"

Title: Sorting Plastics

Subject Area: Science

Grade Levels: 8

Objective: The student will demonstrate the sorting process usually necessary at the recycling plant. The student will also compact the sorted recycled material and form bundles.

Procedures:

1. Divide the students into groups (according to how many students you have and the amount of plastic waste available to sort).

2. Having already discussed types of plastics, review the number system. Give out bags of unsorted plastics.

3. Have the students sort their bag of plastics.

4. After the sorting process is finished, discuss again the reasons sorting is necessary.

5. Ask each group to compact and tie each type of plastic into as space saving a package as they can manage.

6. Discuss the problem of storage caused by the bulk of loose plastics and the student's difficulties in compacting and packaging their plastics.

7. Have the class brainstorm on solutions to the problems of sorting and compacting.

Resources:

1. Bags of assorted plastic waste, gloves, bailing twine cut to lengths of appropriate size

2. Notebook from "Plastics Recycling Mini-Course: A Learning Experience for Science Teachers"

Title: The Types of Plastic Forming Processes

Subject Area: Science

Grade Levels: 9-12

Objective: The student will list and define the ways that plastics can be formed.

Procedures:

1. Lecture
   A. Extrusion — act of processing or shaping by forcing polymers through a die.
   B. Expansion — act of increasing the dimensions of a polymer by forcing air into polymers.
   C. Lamination — act of processing by beating or compressing into a thin plate or sheet.
   D. Molding — act of using a mold to shape a fluid or plastic substance. Examples include compression, transfer, injection, blow rotomolding.

Resources:

1. General Approaches to Plastic

2. Formation (Class Notebook)

Title: The Big Three

Subject Area: Science

Grade Levels: 9-12

Objective: The student will sort polymers by using the three approaches.

Procedures:

1. Lecture on the three types of separation:
   A. Macro — separation at the container level. Show an example.
   B. Micro — separation after the container has been put into chips.
   C. Molecular — sorting on this level involves dissolving polymers into an organic solvent. This has demonstrated that five or more polymers can be separated for packaging from each other in a solvent system.

2. Give the students samples of polymers.

3. Have the students sort the polymers using the macro, micro and molecular properties of these samples.

Resources:

Sorting/Separation (Class Notebook)

Title: The Two Types of Loops

Subject Area: Science

Grade Levels: 9-12

Objective: The student will recognize the two types of loop recycling means, then give examples of what will be recycled in each loop with 90% accuracy.

Procedures:

Lecture:

1 Closed Loop Recycling — defined as recycling where the material of the discarded product is processed to enable it to provide the *same function in the same product.*
2. Open Loop Recycling — defined as recycled material that is utilized in another product.

Examples:

Closed — an aluminum can can be recycled and turned into another aluminum can.
Open — milk jugs have to be processed into something else.

Resources:

Section Solid Waste Problem and Management (Class Notebook)

Title: Is Recycling Enough?

Subject Area: Science

Grade Levels: 9-12

Objective: The student will list five ways that a person can minimize his/ her solid waste output with 100% accuracy.

Procedures:

1. Lecture on the EPA Hierarchy for managing solid wastes.
   A. The first is reducing one's output of solid waste.. One way of doing this is to borrow (rent) equipment that a person does not use often.
   B. The second is to reuse materials. This can be done with grocery bags. A person can take them back to the store for packaging.
   C. The third is to recycle. This can be done by taking recyclables to designated areas.
   D. The fourth is incineration. This can be done by taking trash to an incinerator.
   E. The fifth is to take non-recyclables to a designated spot.

Resources:

Some Environmental Aspects (Class Notebook)

Title: Is it a Polymer or is it not a Polymer?

Subject Area: Science

Grade Levels: 9-12

Objective: The student will identify an unknown sample of polyethylene by using a melt flow index.

Procedures:

1. Divide students into groups (four per group).
2. Give each group a different unknown sample of polyethylene.
3. Have the students melt the polyethylene and time its viscosity.
4. Have the students use this equation: Melt Flow Index=M(melt)/10s.
5. Have each group find the name of their sample by using a predetermined chart.

Resources:

Class Notebook

Title: Major Types of Polymers

Subject Area: Science

Grade Levels: 9-12

Objective: The student will compare and contrast thermoplastic polymers with thermoset polymers.

Procedures:

Lecture: Thermoplastic and thermosetting nature is based on the heat response of polymers.

1. How are they alike? They both contain C and H and they are both made from monomers.

2. How are they different?
   A. Thermoplastic polymers when heated to a certain temperature can be recycled into another structure.
   B. Thermoset polymers when heated form a crystalline structure and can not be broken down easily.

Resources:

Class Notebook

Title: One Way of Polymerization

Subject Area: Science

Grade Levels: 9-12

Objective: The student will define the three basic steps of addition polymerization.

Procedures:

Lecture on polymerization by addition.

1. Initiation — this step is where the double bonds in ethylene "mers" break and begin to bond together.
2. Propagation — this involves the continued addition of monomers together into chains.
3. Termination — this is where all monomers are used up and the reaction will cease.

Resources:

Class Notebook

Title: Introduction to Plastics

Subject Area: Science

Grade Levels: 10-12

Objective: The student will define what a polymer is and give a brief history of polymers. The student will list three common polymers and their properties (physical). The student will separate several types of polymeric materials in at least 2 ways (density, color or perhaps just reading the recycling codes on the bottoms of containers).

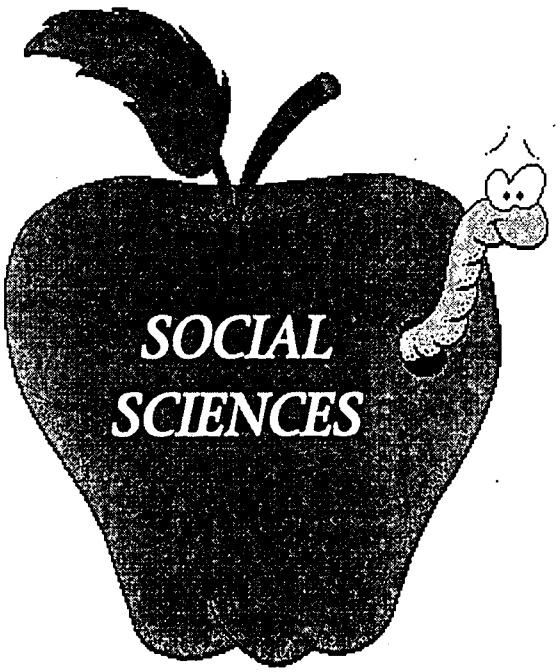
Procedures:

Introduction: Hold up examples and non-examples of plastic articles and ask students to decide on what basis they are different.

1. Short overview of polymer history — lecture with overheads, film.
2. Short student assignment — students will be asked to list physical properties by which any substance might be separated.
3. Students will sort and separate plastic containers which they have brought into class previously. They will have to figure out for themselves on what basis these might be separated.
4. Students will visit recycling center.

Resources:

1. Visit to recycling center and to manufacturing operator of recycled plastics.
2. Possible incentive program for recycling for students ($?) — reuse possibilities.
3. Visit to landfill to increase awareness of amount of waste produced by consumers.


SOCIAL
SCIENCES

Title: Litter We Know

Subject Area: Social Sciences

Grade Levels: 4-6

Objective: The student will (1) identify and evaluate ways that litter pollution can endanger wildlife and (2) propose ways they can help eliminate these dangers.

Procedures:

1. Divide the class into three or four teams.

2. Ask each team to bring a collection of litter to class in a paper bag. Suggest they look in parks, camping areas or school grounds. NOTE: They should not take things out of garbage cans.

3. Have the teams make and display collages of these items.

4. Discuss the effects of litter. Optional: ask a wildlife expert to join the class for the discussion. If available, show a film or read brochures on the subject.

5. Ask the students to assign a numerical value to each kind of litter. The item potentially most harmful to wildlife has the highest score, least harmful has the lowest score.

6. Have each team figure a total score for their collage based on the numerical values of each piece of litter.

7. Propose and evaluate ways that people can eliminate litter pollution. Can manufacturers make cans with openings other than pop tops? Could they devise another method of packaging six packs? How could people fishing have more control over losing their fishing line? How can individuals be instructed about the dangers, as well as the unsightliness, of littering? What can the students do personally — as individuals, as groups, or as family units — to eliminate or reduce their own litter?

Evaluation:

1. Name four ways that litter can harm wildlife.

Continued....

2. List three things you can do to eliminate these dangers.

3. Propose what you consider to be one of the most effective ways to eliminate or reduce litter.

Resources:
Project Wild Elementary Activity Guide, copyright 1983 by the Western Regional Environmental Education Council

Title: Historical Changes Contributing to Increased Waste

Subject Area: Social Sciences

Grade Levels: 4-8

Objective: The student will describe historical changes that have contributed to increased waste.

Procedures:

1. Call on volunteers to name examples of disposable items they have used. List them on the board. Ask why they chose these over more durable items (cost, availability, convenience, effectiveness, etc.).

2. Tell students that in 1989, people in the U.S. threw away approx. 1.6 billion pens, 2 billion razors and blades and 16 billion diapers.

3. Ask why people in the past did not buy disposable products (people bought what they could find and made it "last").

4. Mention advances in technology and mass production — new products less expensive than repairs.

Resources:

1. Local library

2. Historical Society

Title: Enviro-Ethics

Subject Area: Social Sciences

Grade Levels: 6-12

Objective: The student will (1) distinguish between actions that are harmful and beneficial to the environment and (2) evaluate the appropriateness and feasibility of making changes in their own behaviors related to the environment.

Procedures:

1. Involve the students in discussion about the impact each of us has every day on aspects of the environment, from using electricity, to making breakfast, to putting on clothes that were derived from some natural resources and transported to us by some means, to use of the varied products we choose and employ each day, to our choices of recreation and entertainment. We are consumers and our impact is formidable.

2. Ask each student to work alone to devise a "Personal Code of Environmental Ethics." This code may be written or not. Emphasize the importance of the code being for the person who creates it. The code should take into consideration daily actions that are harmful to the environment and those which are beneficial; the students should consciously create their code based on actions they believe are beneficial, or at least not harmful, to elements of the environment. We will always have some impact; we can make choices about the kinds of impacts we make, their extensiveness, etc.

3. Ask for any volunteers to share their "Personal Code of Environmental Ethics." They might share the entire code or a segment of it. They might describe the thinking that went into the decisions they made in constructing their code. Students might illustrate a part of their code — if they chose not to write it — to convey a major idea. Encourage the students to ask each other questions about the codes, in the spirit of learning more about each person's priorities, but not in a judgemental approach. The purpose is for each student to evaluate his or her own priorities, in a responsible consideration of day to day actions that affect the environment, but not to be actively critical of another student's approach to the same problem. In this way, each student is simply encouraged to take responsibility for his or her own actions.

4. Encourage the students to try using their codes, keeping track of how easy or difficult it is for them to live by them. "Progress reports" are appropriate and again in the spirit of each person paying attention to his or her own actions and bearing responsibility for them.

Evaluation:

1. List five environmental issues.

2. List one way that you directly or indirectly contribute to an environmental problem.

3. Identify, describe and evaluate one way you could lessen your role in contributing to an environmental problem.

4. Make at least one change in your lifestyle that will reduce your role in contributing to an environmental problem.

Resources:

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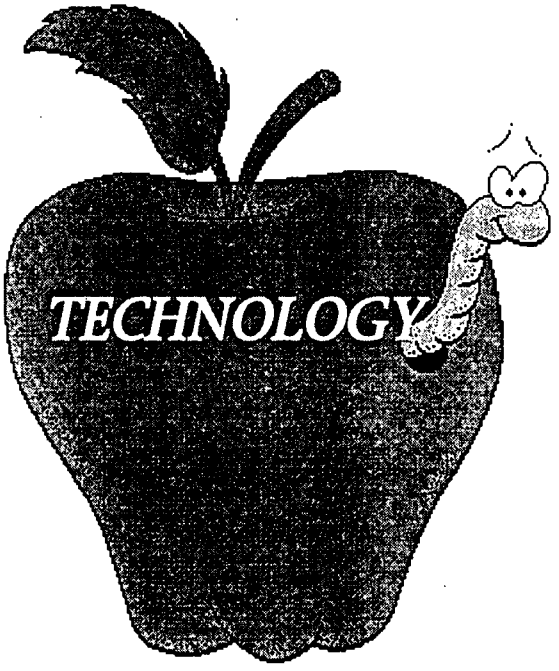

TECHNOLOGY

Title: Building Materials of Today and Tomorrow

Subject Area: Technology

Grade Levels: 9-12

Objective: The student will describe the value of integrating plastic components properly into the construction industry.

Procedures:

1. Teacher-led discussion of various types of construction materials, what they are made from and why.

2. Compare samples of lumber with emphasis on both structural and non-structural usages.

3. *Lab:* Each student in groups of four will test and take written notes of their findings on comparisons between sanding, hand-sawing, power sawing, routing and fastening of these new, nontraditional materials and traditional products.

Resources:

Wood, metal and plastic material samples of construction materials.

Title: Materials for Machine Tool Technology

Subject Area: Technology

Grade Levels: 9-12

Objective: The student will compare and contrast plastics and metals on a simple level.

Procedures:

Given samples of different plastic objects and metal objects, students will:

1. Cut each with a chop saw.
   A. Note time to cut.
   B. Note pressure required to cut.

2. Melt each with oxygen fuel torch.
   A. Note time to melt.
   B. Note gauge settings on gasses.

3. Cut each with band saw.
   A. Note time to cut.
   B. Note finish of cut.
   C. Note pressure applied to saw.

In-class discussion: Each student will compare and contrast the merits of plastics versus metals as applied to (1) ease of machining and (2) surface finish.

Resources:

1. Machine tools in metals lab

2. Plastic and metal scrap

Title: Resin Identification

Subject Area: Technology

Grade Levels: 9-12

Objective: The student will identify resins using the resin identification code and list some uses for each type of resin.

Procedures:

1. The students and teacher will bring in scrap plastic.
2. Using a resin identification chart and working in small groups, the students will sort the plastic according to type and color.
3. Each student will list four types of products made with each resin.
4. Based on observations of products made with each resin, each student will recommend a resin type for us to use in our compression forming process.

Resources:

Hands On Plastics: Scientific Investigation Kit

Title: Use of Composite Materials in Construction

Subject Area: Technology

Grade Levels: 11-12

Objective: The student will describe and/or demonstrate the use of composite materials.

Procedures:

1. Have students watch video tape of submarine races in which Tennessee Technological University has participated.

2. Discuss the use of composite materials in the construction of various items, such as in the body of the submarine described in number one.

3. Conduct a field trip to Tennessee Technological University to view the use of composite materials in various types of construction.

4. Have students prepare a written paper of 500 words on a particular type of composite material.

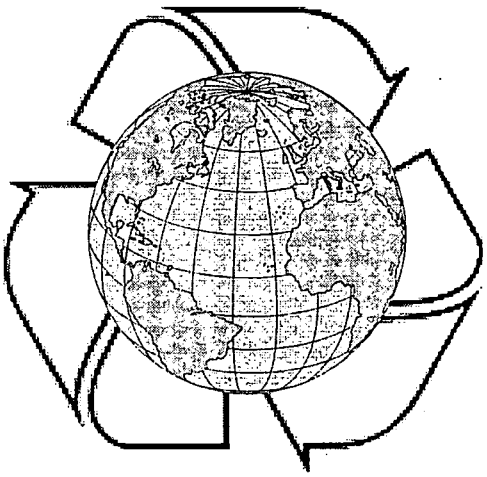
5. Using samples of composite materials obtained from industries, construct some original items.

Resources:

1. Video tapes available from the Manufacturing Research Center at Tennessee Technological University

2. Dr. Joseph Scardinia

3. Samples of composite materials from various industries



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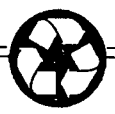

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