Trash Goes To School

Produced by

Cornell Waste Management Institute

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Rhode Island Department of Environmental Management
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Washington Department of Ecology
Wisconsin Department of Natural Resources
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Sample Teacher Letter

Dear Educator:

In New York State and the nation, managing our solid waste has become an overwhelming task. The costs of disposal are rising, related environmental degradation is occurring, and controversies are arising over siting of new landfills and incinerators. Laws are being implemented to ensure sound solid waste planning and minimize problems such as these. There seems to be a lot of work for everyone to do, and you can help!

As educators, we have an important task ahead. The next generation of decision-makers is being educated in your classroom. So, how can you help? By starting this generation off with information and habits that emphasize reducing the amount of waste we produce, reusing, recycling, and composting whatever we can, and incinerating, landfilling, and finding other technologies to dispose of the rest.

Trash Goes to School provides you with:

- solid waste background information,
- activities for K-12 to present a well balanced picture,
- ideas on how to use solid waste issues in teaching many subjects, including math, science, English, social studies, and home economics, and
- glossaries appropriate to the grade levels.

There are many more resources available, so if you have a specific need, ask your local recycling coordinator for more help.

{Add some local program history here if appropriate.}

Solid Waste Management

Background Information

Whatever we decide to label it -- rubbish, trash, waste, refuse, or garbage -- the piles keep growing. It comes from homes, schools, businesses, factories, and other places; it is generated by people of all ages. As hard as we try to reduce and recycle large amounts of waste, we will still have some left to be disposed of. In the United States, we generate over 160 million tons of municipal waste each year -- 3 to 5 pounds per person per day. Approximately 10

percent of that amount is recycled, 10 percent is burned, and the remaining 80 percent is landfilled.

Why is there suddenly a problem? Everything appeared to be taken care of: garbage was put out for haulers and was taken away. That is only a partial view of the picture, however. Our problem has been accumulating for a long time. The U.S. Environmental Protection Agency (EPA) predicts that 80% of the existing permitted landfills will close within 20 years. There are many reasons we are losing our landfill space. Older landfills are filling up, federal, state, and local restrictions are becoming stricter, and there is greater public opposition to siting any new facilities.

We must re-educate ourselves to realize that waste is a resource that should be managed. Across the nation, waste management laws are being enacted and communities are developing plans for better management of their garbage. Management of waste requires a comprehensive plan. It will take the right combination of options to meet each community's needs. These options include waste reduction, recycling and composting, incineration, and landfilling.

Reduction

Waste reduction is one of the most important aspects and one in which everyone can participate. In the most basic form, we need to think about what we are buying. When making purchases, buy only what you need, use substitutes for toxic substances when possible, buy durable rather than disposable products, and consider packaging and recyclability. *One out of every eleven dollars spent for groceries in the U.S. pays for packaging. Schools can reduce wastes in many ways, including using paper on both sides, sharing resources when possible, using durable items, reducing disposables and excess packaging wastes in lunches, and setting a good example for others.

Recycling

The current level of recycling in the U.S. is about 10 percent. Our garbage must be looked at as a resource instead of something to throw away. The benefits of recycling include not only saving of landfill space, but also conservation of energy, decrease of pollution, conservation of resources, and reduction of expenses due to avoided costs (the tipping fees at landfills and incinerators generally are higher than the costs of recycling).

Composting

Over half of our waste stream is organic material that could be composted. Compost is a valuable resource for lawns and gardens. By composting, we save space in landfills and turn waste into a product that can improve soil and increase its water-holding capacity.

Composting is a natural process that occurs with or without our help. In nature the process continues independently, but since we generate so much organic waste, in densely populated areas we need to speed up the process. Many people have compost piles in their own backyards Where that is not possible, community composting areas provide a good alternative.

Incineration

The role of incineration is one of the most controversial issues that communities are facing in solid waste management. Among the concerns are presence of undesired metals and organic chemicals, the quality of the ash (which must be landfilled), the financial risks, and the worry of becoming a target area for garbage imported from other places.

Arguments for incineration include the possibility of recovering energy, the decreased amount of material needing to be sent to a landfill, and the destruction of pathogens.

Incineration has made many technological strides over the years. Originating as burners transported by horse and wagon, incinerators now are modern facilities equipped with pollution-control devices, up-to-date operating procedures, and in some cases front-end separation of material that should not be burned.

Landfills

Landfills will always be needed to manage our noncombustible, nonrecyclable materials, as well as ash from incineration and residues from recycling. Since 80 percent of U.S. landfills are closing, we must insure that landfill space will continue to be available for our communities' garbage. In some places, landfills will remain the primary management option when other options become infeasible because of size and population density.

In recent years, many improvements have been made in landfill technology. New types of liners inhibit groundwater contamination, and methods have been developed for collection of methane gas and for collection and treatment of leachate.

Risk

With all solid waste options, there are risks, even with something as natural as composting of organic wastes. Decisions about the acceptable level of risk must be made by each community. This will depend on size of the area, population density, costs of the various options, possiblities for cooperation with other areas, and consideration of the whole picture.

Sources

Facing America's Trash -- What Next for Municipal Solid Waste? Congress of the United States, Office of Technology Assessment. October, 1989.

*Waste: Choices for Communities. Concern, Inc. September, 1988

Reduce, Reuse, and Recycle: Suggestions for Children

Reduce

* When you go shopping, take along a bag and tell the cashier that you won't need a new one.

* Avoid buying fast food unless it is served in recyclable packages.

* Boycott products that are overpackaged. Choose items packaged in containers that are recyclable or made of recycled materials. Write to companies and tell them why you are making these choices.

* Don't buy or use disposable products. Switch to cloth napkins, carry drinks in refillable thermos bottles, and carry your lunch in washable, reusable containers. Instead of paper towels, use a cloth or sponge to clean up.

* Don't buy aerosol cans. They can't be recycled, and they contain ingredients which cause air pollution. Instead look for spray bottles or other alternatives.

* Try to avoid creating hazardous wastes. Many household cleaning products can be replaced with simpler, less hazardous materials.

* Reduce your use of batteries. They contain heavy metals that are toxic. Try to use mechanical objects, ones that plug in, or rechargeable batteries.

Reuse

* Donate outgrown toys and clothing to a worthy cause, rather than throwing them away. Even worn-out clothing can be used as rags for cleaning, car polishing, etc., rather than using disposable paper towels.

* Create a compost pile. With very little effort, yard wastes and food scraps can be made into compost, which will help your garden or yard to grow.

* Learn to fix things rather than throwing them away. When buying new objects, look for sturdy ones that will last for

a long time.

* If you or your family have old magazines or books you want to get rid of, donate them to a hospital, nursing home, or waiting room rather than throwing them away. Share a subscription with a friend.

Recycle

* Find out what is recyclable in your community, and help your family to make whatever changes are necessary to recycle everything possible.

* Ask your parents to buy drinks in glass or aluminum containers instead of plastic, since glass and aluminum are easier to recycle. Avoid buying drinks in unrecyclable containers.

* Whenever possible, choose products made from recycled materials. Unless people want to buy recycled products, companies will not produce them.

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Precycling

It is easy to blame others for abusing the environment, but in just one year we New Yorkers created more than 21 million tons of solid waste. Americans are more wasteful than people in any other country. Recycling is one solution, but not the only one.

PRECYCLING and WASTE REDUCTION mean making less garbage. Precycling is the easiest and cheapest way to deal with the garbage glut and help our environment. See how many of the following ideas you can try:

1. Choose reusable alternatives to disposable products:

    a. A sponge instead of a paper towel
    b. A reusable razor blade instead of disposable shavers
    c. A mug instead of disposable (plastic or paper) cups
    d. Washable plates or china instead of paper plates
    e. Cloth napkins instead of paper ones
    f. Cloth diapers or diaper service instead of disposable diapers

2. Be an environmental shopper:

a. Don't buy things that are overpackaged. Ask yourself, "Is this packaging really necessary?"
b. Avoid single serving packages
c. Use a soap bar instead of liquid soap dispensers
d. Buy toothpaste in large tubes instead of other, more wasteful containers.

3. Buy in bulk to reduce packaging waste that is thrown away:

a. Buy concentrates of products like detergents, cleaners, and juices
b. Buy large sizes of products
c. Buy fruits and snacks loose instead of in packages

4. Bring your own bags to the grocery store. When you're asked "paper or plastic," say "No thanks, I have my own bag." If you buy only one or two items, don't use a bag.

5. Use both sides of a sheet of paper when making copies or writing. Reuse glass, plastic and metal containers to hold small items such as bulk purchases, sewing supplies, crayons, hardware, etc. Cardboard boxes can also be used again.

6. Invest in a battery charger and use rechargeable batteries, or better yet, avoid using batteries whenever possible.

7. Share your magazines and newspapers with your friends. Bring recent magazines to hospitals, nursing homes, doctors and dentist offices.

8. Cut down on junk mail by writing to:

Direct Marketing Association
6 East 43rd Street
New York, NY 10017-4601

Ask them to take your name off unwanted mailing lists.

9. Donate reusable clothes, toys and other items to charity. Make old clothing into new by painting or decorating or remodelling in some way. Make rags out of unusable clothes.

10. Get your nickel back. Return used soda and beer containers to the store to redeem your deposits. Yes, the big plastic bottles too.

11. Repair appliances and furniture instead of throwing them out. It's usually less expensive.

12. Write to manufacturers about excessive packaging. They'll listen.

13. Compost grass, leaves and other yard waste in your backyard.

14. Tell your friends, family and neighbors that precycling is here!

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Trash Goes To School

Solid Waste Activities
Grades K-3

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Just Throw It Away!
My Reduce/Reuse Story
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Recycling
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Trash Goes To School
Solid Waste Activities

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Solid Waste Activities
Grades 7-8

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Trash Goes To School
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Glossary - Grades K-6

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ALUMINUM: A lightweight, nonrustable metal, commonly used to make soda cans, airplane bodies, and frames for lawn chairs.

BIODEGRADABLE: Able to be broken down by microorganisms into simpler forms.

BRAINSTORMING: Attempting to solve a problem by having members of a group spontaneously propose ideas and solutions.

COMMUNITY: A group of people living in the same place and sharing the same government.

COMPOST: A rich, soil-like mixture that is produced when organic materials, such as yard, garden, and kitchen wastes, break down.

COMPOSTABLE: Able to biodegrade, or break down when exposed to microorganisms under the right environmental conditions.

CONSERVATION: The wise use of natural resources, to minimize their loss and waste.

CORRUGATED: Cardboard made up of several layers, including a middle layer that is bent into a series of ridges and grooves with air spaces in between.

DECOMPOSE: To rot, or break down.

DEGRADE: To break down into simpler chemical forms.

DISPOSABLE: Meant to be thrown away after a single use or a few uses, rather than to be saved and reused many times.

DURABLE: Made to last for a long time.

ECOSYSTEM: A system made up of a community of living things together with their environment.

ESSENTIAL: Necessary.

GARBAGE: Solid waste or trash (anything that we throw away).

GLASS: A material made by melting silica.

INCINERATOR: A furnace or other unit used for burning waste.

INDUSTRIALIST: A person who owns or manages an industry.

LANDFILL: A place where unwanted materials are dumped, compacted, and covered with dirt.

LEACHATE: Water that percolates through a dump or landfill, picking up pollutants along the way.

LITTER: Waste materials carelessly discarded in an inappropriate place. Littering is against the law.

MICROORGANISMS: Tiny living things that can be seen through a microscope.

NATURAL RESOURCES: Things in the world around you, such as trees, water, animals, and soil, which are used to

make products.

NUTRIENTS: Chemicals used as food.

OIL: A substance made by prehistoric decay of organic matter, and currently used to produce many products, including fuels and plastics.

PACKAGING: Ways of wrapping products to protect, advertise, or make them convenient for sale.

PAPER: A thin material made from pulp from wood, old paper, or rags.

PHOTODEGRADATION: The process of breaking down through exposure to sunlight.

POLLUTION: In our environment, the condition of being dirty, especially as a result of wastes.

PRECYCLING: Reducing the amount of waste generated by avoiding disposables and overpackaged articles.

PRODUCT: Something that is sold.

PROPAGATION: Producing new plants from seeds, leaves, spores, or other plant parts.

PROPERTIES: Characteristics.

RECYCLABLE: Able to be used instead of raw materials to make a new product.

RECYCLE: To make materials such as glass, aluminum, paper, steel, and plastic into new products.

REDUCE: To decrease the amount of trash we produce by buying only what we need, avoiding disposables, and buying products that are not overpackaged.

REFUSE: Trash, rubbish, anything thrown away.

RENEWABLE Resources: Something we use from nature that can be replenished. For example, trees are a renewable resource; a tree can be planted to take the place of one that has been cut down. Oil is not a renewable resource; it takes millions of years for oil to form.

REUSE: To extend the life of an item by using it again, repairing it, or creating new uses for it.

SANITARY LANDFILL: A place for disposing of garbage where it is covered each day with soil in order to reduce odors and pest problems. Modern sanitary landfills also have systems for collecting and treating leachate, the polluted water that drains out from the landfill.

SOLID WASTE: The things we throw away: household trash, yard and kitchen wastes, old machinery and equipment, and many agricultural and industrial wastes.

TOXIC: Able to cause injury or illness through chemical means.

UNINHABITABLE: Unable to support life.

WASTELAND: Desolate land, unable to support life.

WATER: A clear, colorless, odorless, and tasteless liquid, made of hydrogen and oxygen, that is essential for most plant and animal life.

WATER CYCLE: The process by which water circulates on earth, through precipitation (rain or snowfall), runoff, use by plants and animals, percolation to groundwater, and evaporation.

GLOSSARY GRADES 7-12

Trash Goes To School

Cornell Waste Management Institute

AEROBIC: Occurring or living in the presence of oxygen.

ANAEROBIC: Occurring or living without oxygen.

AQUIFER: A geologic formation from which groundwater can be obtained.

BAUXITE ORE: Mineral from which aluminum is made.

BIODEGRADABLE: The ability of a substance to be changed into simpler, usually harmless, substances by the action of microorganisms.

BOTTOM ASH: Solid residual which remains after burning. Found in the bottom of an incinerator.

CARCINOGEN: A chemical or substance capable of causing cancer.

COMPOSTING: The process of collecting organic materials such as lawn clippings, leaves, kitchen scraps and manure to be layered so as to decompose into fertile humus. When organic matter is broken down in an airtight container (without air), it is called anaerobic composting. When the organic matter is exposed to air, it is called aerobic composting.

CONSERVATION: The preservation of natural resources from loss or waste.

CONTAMINANTS: Materials that pollute and harm our environment.

COST AVOIDANCE: Finding the least expensive option for accomplishing a task. In the case of waste disposal, recycling can be a cost avoidance measure if it saves tipping fees at the landfill.

CULLET: Ground or crushed glass.

DECOMPOSITION: To process of breaking down or rotting.

DIOXIN: A toxic chemical which may be formed from processes such as bleaching paper or burning certain materials.

DUMP: Now illegal, dumps were open unsanitary disposal sites used prior to sanitary landfills. (Verb) To throw away garbage or solid waste in a place set apart for the purpose.

ECOLOGY: The scientific study of the relation of living things to one another and to their environment. A scientist who studies these relationships is called an "ecologist".

ECOSYSTEM: A system made up of a community of living things and the physical and chemical environment with which they interact.

EFFLUENT: Liquid discharged as waste, such as water used in an industrial process, or treated sewage.

EMISSIONS: Effluents such as those resulting from the combustion of a fuel.

ENERGY RECOVERY FACLITY: A resource recovery plant which generates energy by burning solid waste.

ENVIRONMENTAL MANAGEMENT COUNCIL (EMC): A group of citizens that advises and raises concerns for decision-makers about environmental issues.

FEASIBILITY STUDY: An assessment of whether a project is capable of being completed, both physically and financially.

FINITE RESOURCE: A resource that exists in a measurable amount and is nonrenewable (once it is used up, it is gone forever).

FERROUS METAL: Iron-based metal. You can tell if a metal is iron by using a magnet.

FIXED COSTS: Costs that are unrelated to the volume of business conducted.

FLY ASH: Small solid particles of ash and soot generated when coal, oil, or waste materials are burned.
GARBAGE: Solid waste, anything that we no longer want or use.

GROUNDWATER: Water which is in the spaces between soil particles or cracks in rocks under the ground.

HARDNESS: A characteristic of water, caused by salts of calcium, magnesium, and iron.

HAZARDOUS CHEMICAL: A chemical that is dangerous to handle or dispose of.

HAZARDOUS WASTE: A waste material that is dangerous to handle or dispose of, including toxic chemicals, radioactive wastes, old explosives, and some biological wastes.

HUMUS: Decayed organic materials (grass, leaves, etc.); rich soil.

ILLEGAL DUMPING: To unlawfully throw away garbage or waste in any place not authorized to accept waste material.

INCINERATOR: A thermal device in which solid waste is burned for the purpose of volume reduction. An incinerator used to obtain energy is classified as an energy recovery facility.

INORGANIC: Composed of matter that is not animal or vegetable; not having the organized structure of living things. Most inorganic compounds do not contain carbon and are derived from mineral sources.

LANDFILL: A place where unwanted materials are dumped. They are then compacted with large machines and covered with soil. Modern landfills have a liner under the garbage and a cover on top.

LEACH: To remove dissolved substances by the action of percolating water or other liquids.

LEACHATE: Liquid that has percolated through solid waste and/or been generated by solid waste decomposition and has extracted, dissolved or suspended materials in it. The liquid may contaminate ground or surface water if not properly managed.

LITTER: Waste materials carelessly discarded in an inappropriate place. Littering is against the law.

MATERIAL MANAGEMENT: Management of resources that we used to dispose of in landfills. Examples include source separation and recycling.

METHANE: An odorless and colorless gas that is produced by anaerobic decomposition of solid waste. Its chemical formula is CH4. Methane can cause asphyxiation and is explosive.

MUNICIPAL SOLID WASTE: Solid waste produced within a community by residential, commercial and institutional generators.

NATURAL RESOURCES: Valuable, naturally occurring materials such as wood, minerals, air, or water.

NONRENEWABLE RESOURCES: Natural materials, which because of their scarcity, the great length of time required for their formation, or their rapid depletion are considered finite, i.e., exhaustible.

ORGANIC: Derived from living organisms. Also, designating any chemical compound containing carbon.

PACKAGING: A covering used to protect and promote a product.

PERMEABILITY: A measure of the rate at which water can percolate through soil.

PETROCHEMICAL: Chemical made from petroleum; used in making plastic.

PLANNED OBSOLESCENCE: Designed to last for a limited period of time; not durable.

PLANNING DEPARTMENT: A government body that plans for a community's future with regard to space, land use, water supplies, etc.

POLLUTION: Harmful substances deposited in the air, water, or land, leading to a state of dirtiness, impurity or unhealthiness.

PRECYCLING: Activities that reduce the amount of waste produced.

PULP: Fiber material from which paper and cardboard is made.

RECYCLING: The act of removing from the overall waste stream those materials that can be reconstituted into new products.

REDUCTION: Decreasing the amount of trash produced by buying only what is needed, avoiding disposables, and choosing products that are not overpackaged.

REFUSE-DERIVED FUEL: A solid fuel derived from municipal solid waste that has been processed to improve its combustion characteristics.

RENEWABLE RESOURCE: A resource derived from an endless or cyclical source, such as the sun, wind, falling water (hydroelectric), biofuels, fish, and trees. With proper management and wise use, the consumption of these resources can be approximately equal to replacement by natural or human-assisted systems.

RESERVE BASE: The amount of a nonrenewable natural resource that still remains to be used.

RESOURCE RECOVERY: Use of high technology to burn mixed solid waste and produce energy and, in some cases, industrial fuel. Resource recovery may involve mechanical separation of recyclables before or after burning.

SANITARY LANDFILL: A specially engineered site for disposing of solid waste on land constructed so as to reduce hazards to public safety and health.

SCRUBBER: Machines used to remove particulate matters and pollutant gases from exhaust gas streams.

SEWAGE: Liquid/solid waste from our sewage systems.

SLUDGE: Solid muddy materials left after sewage has settled.

SOLID WASTE MANAGEMENT: The controlling, handling, and disposal of all trash.

SOLVENTS: Liquid that are able to dissolve other substances; often have detrimental effects to health.

SOURCE REDUCTION: Reducing waste at the source, producing less waste or decreasing its toxicity.

SOURCE SEPARATION: The separation of recyclable materials from trash at home, in school, or by businesses.

STATIC USE: Rate of use of a natural resource remaining level (not increasing or declining).

SUPERFUND: A fund the U.S. Government has formed to handle hazardous waste problem.

TIPPING FEE: Charge at a disposal site to dump garbage. Usually expressed in $/ton.

TOXIC SUBSTANCES: Materials that can cause death or disease, mutations, deformities, or malfunctions in organisms or their offspring.

TRANSFER STATION: An intermediate collection facility temporarily holding solid waste en route to another facility.

TRASH: Material considered worthless, unnecessary or offensive that is usually thrown away. Generally defined as dry waste material and not including food waste and ashes. The term is often used interchangeably with the word garbage.

TURBIDITY: A cloudy condition caused by particles suspended in a liquid.

VARIABLE COSTS: Costs which rise or fall as the volume of business increases or decreases.

WASTE MANAGEMENT: The managment of garbage through a variety of methods including reduction, recycling, composting, incineration, landfilling, etc.

WASTE STREAM: The solid waste produced by people or industries within a given area, location, or facility.

WASTE-TO-ENERGY: Process of burning waste to produce energy/electricity.

WATER TABLE: The top of the groundwater layer.

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Just Throw It Away!

(Adapted from material created for National Science & Technology Week, April 22-28, 1990)

GRADE LEVELS: K-3

SUBJECT AREAS: art & science

CONCEPT: If we reuse objects rather than buying new ones, we generate less garbage.

OBJECTIVE: To use waste to benefit wildlife. (**NOTE:** Though we can make things from some waste products, we will still need to consider whether we need it in the first place.)

MATERIALS:
-trash from home (plastic bottle, milk carton, aluminum pie plate, paper towel roll)
-craft items (glue, scissors, tape, paint, string, wire or coat hangers)

KEYWORDS: reuse

BACKGROUND: There is no place on earth called "away". Things we think we throw away have to go somewhere, and these things end up in the soil, air, streams, and oceans. When people reuse or recycle paper, aluminum cans, glass jars, and other trash, they cut down on the amount of solid waste they throw away.

PROCEDURE:
1. Ask the students to bring a piece of trash from home: a plastic bottle, a milk carton, an aluminum pie plate, a margarine container, or other reusable containers.

2. Set up a table to use as a project center. On it place: scissors, tape, glue, paper, string, paint, markers, nails, hammers, and other useful items for building with trash. Make sure to supply extra trash items for those students who need them.

3. Display a bird feeder that you have made from a piece of trash. For example, you can make a simple bird feeder by cutting large holes into the sides of a plastic milk jug, two inches up from the bottom. Glue a rock into the bottom of the jug to add weight, and attach a wire or string around the neck.

Instruct the students to design and build a bird feeder using their trash and items from the project center. Explain that the bird feeder needs to be hung from a branch, and that they must have both an opening big enough for a bird and a perch for the birds to sit on while eating.

4. Let the students display their completed feeders on a tree outside. Fill the feeder with food for the birds, and enjoy watching them use the feeder. NOTE: Once you begin feeding birds in the winter, you should continue to keep the feeder filled because the birds may become dependent on your food supply.

5. Remind the students that they have just done something important for the environment as well as for the birds. Instead of throwing their trash away, and adding it to the piles of garbage that trucks haul away, they have reused the trash. Just imagine, if every piece of trash was used a second time, we could cut the amount of solid waste we throw away in half!

FOLLOW-UP: Discuss what other items that could be reused (i.e. use of egg cartons, milk cartons, or other containers for starting seeds or building things like birdhouses, hummingbird feeders, or terrariums.

My Reduce/Reuse Story

(Adapted from Reycling Alaska Activities Handbook, Dept of Env Conservation, Juneau, AK)

GRADE LEVELS: K-3

SUBJECT AREAS: language skills, art and English

CONCEPT: How can we reuse items that we might normally throw away?

OBJECTIVE: To reduce the amount of garbage we produce.

MATERIALS: old magazines and used paper

KEYWORDS: reduce, reuse

PROCEDURE: Have children go through old magazines and select pictures of things which will ultimately become a waste product (cereal boxes, other types of packaging, for example). Have the children paste these pictures into a small "recycling" book (paste picture on used paper).

Have one student dictate into a tape recorder a story about reuse and/or recycling of these materials, or how their use could be avoided altogether. Play this tape back and listen to it.

This could be a group project for K levels and either a group or individual project for level 1-3.

FOLLOW-UP: Discuss other ways of doing without wasteful things and of reusing things rather than throwing them away, such as donating outgrown clothing, saving egg cartons and plastic containers for art classes, or passing magazines along to a hospital or a friend.

Necessary Wrappers?

GRADE LEVELS: K-3

SUBJECT AREAS: math and social studies

CONCEPT: Some packaging is needed to protect the product, but how much is enough?

OBJECTIVE: Student will realize that large amounts of packaging may be used to wrap products they buy.

MATERIALS: packaged items or empty packaging, such as drink boxes, styrofoam containers, packaging for convenience foods.

KEYWORDS: product, packaging, durable

BACKGROUND: One out of every $11 is spent on product packaging in the United States. In our disposable lifestyles, we have gotten into the habit of buying items for convenience. We don't think about how much or what we throw away. In this exercise, find out how much waste is from packaging.

PROCEDURE:
1. Divide students into small groups.
2. Ask each child to carefully unwrap the product, saving all packaging.
3. Weigh the pile of packaging and pile of product. Which weighs more, the product or the packaging?
4. Ask the children why there are so many wrappers. Identify the possible purpose of each. Ask: If you were going to package an item, how would you do it?
5. Ask the children to identify the source of raw materials for packaging, i.e., the plastic, the aluminum, the paper.
6. Ask the children to think of other things that their families buy that come in packages.
7. Ask: If we reduce the amount of packaging, will we reduce the amount of garbage?
8. How can we help?
- Buy items in bulk and divide into durable containers for lunches.
- Buy easily recyclable packaging - glass and metal.
- Let stores know when there are over-packaged items such as vegetables, lunch meats, or convenience foods.
- Write letters to companies that are over packaging.
- Think before you buy.

FOLLOW-UP:
Where does packaging go if you throw it away?
How can you reduce the amount of packaging in your garbage can?
Name two types of packaging that are difficult to recycle and two that are easy to recycle.
How are products packaged in other countries (e.g., Mexico, China, Europe)?

Aluminum Recycling

(Adapted from Team Up for a Clean New York, by Curriculum Editorial Unit, Brooklyn, NY)

GRADE LEVELS: K-3

SUBJECT AREAS: social studies

CONCEPT: Aluminum can be recycled, resulting in savings of energy and resources.

OBJECTIVE: Students will be able to describe how aluminum is recycled.

MATERIALS: handout: **How is Aluminum Recycled?**

KEYWORDS: aluminum, recycling

BACKGROUND: Aluminum is a metal with many uses in our daily lives. Recycling aluminum is an easy and practical way to insure that we will always have enough to meet our needs. Recycling aluminum actually saves energy; 75 - 95% less energy is required to process aluminum from scrap than from its source in nature, bauxite ore. The following learning activity introduces aluminum recycling.

PROCEDURE:
1. Have students study the diagram illustrating the recycling path of an aluminum can.
2. After reviewing the diagram, have the students explain their answers to the following questions:
a. What do you and your family buy in aluminum cans? (Include not only soda cans, but also containers for foods, pet foods, etc.).
b. What does your family do with them when they are empty?
c. Why is it important to recycle aluminum?
d. Have you ever seen aluminum cans on the ground along a road?
3. Complete the writing exercise which follows the diagram. Ask students to complete it, explaining what happened to the soda can.

FOLLOW-UP: Ask students to write letters to recycling firms for information on starting a recycling project.

How is Aluminum Recycled?

Aluminum is a metal used to make cans, foil, appliances, auto parts and thousands of other things we use every day. But like every other resource in nature, aluminum is in limited supply. How can we make sure that we will always have enough? Some state governments have passed the Beverage Container Return Law to promote the recycling of aluminum. Under the law, a five cent deposit is added to the price of drinks in aluminum cans or bottles. For every can or bottle you return, you receive a five cent refund.

The diagram below shows how an aluminum can could be recycled from trash into another usable container. Study the diagram, then list in the space below what happens in each step of the cycle.

1) Food Market _ _ _ 2) Child with Soda Can _ _ _ 3) Food Market

4) Recycling Center _ _ _ 5) Can Maker _ _ _ 6) Bottling Company

1:

2:

3:

4:

5:

6:

How does recycling help each one of us?

How does recycling help the community?

Making Paper From Paper

(Adapted from Woodsy's Wastwise, by Cornell Cooperative Extension, Broome County, NY)

GRADE LEVELS: K-3

SUBJECT AREAS: art & science

CONCEPT: How can new paper be made from old?

OBJECTIVE: Making paper.

MATERIALS: for every 2-3 students:
_ a piece of window screen 5" square
_ a pan big enough for the screen to lie flat
_ a large spoon
_ 2 Tbls. of liquid starch
_ a large jar, can or rolling pin
_ 2 pieces of blotting paper (ordinary paper) the same size as the screen
_ 2 blank 8-1/2 x 11 pieces of paper
_ 2 sections of newspaper
_ 2 cups of hot water
_ blender

KEYWORDS: paper, reuse

PROCEDURE:
1. Tear paper into very small pieces in the pan (do not cut). Add 2 cups of hot water and stir for 3-5 minutes. Use a blender for best results in making pulp.
2. Add Tbls. of starch and stir 3 more minutes. Slide screen under the paper pulp and move pulp around until screen is completely covered.
3. Lift screen out, let it drain a few seconds, then place it on a piece of blotting paper on a section of newspaper. Place another sheet of blotting paper on top, and then the second section of newspaper.
4. Press the excess water out by rolling the jar, can or rolling pin over the newspaper. Take off the top newspaper, turn the blotting paper sandwich over and take off the top piece of blotting paper and the screen.
5. Let the recycled paper dry for 2 hours, then loosen it from the blotting paper and gently peel it off. Let the recycled paper dry overnight before writing on it.

FOLLOW UP: Discussion questions:
1. How does your new paper look?
(thick, lumpy, ragged)
2. Would you like to recycle all your own paper yourself?
3. Do you get the same amount of new paper out as you put old paper in?
(no, you get less because there is some waste)

Let's Get Organized

(Adapted from Recycling: Mining Resources From Trash, Cornell Waste Management Institute)

GRADE LEVELS: K-3

SUBJECT AREAS: social studies, technology, and home economics

CONCEPT: What needs to be done to organize a collection system for recyclables?

OBJECTIVE: To teach organizational skills and involve youth in the planning of their school and home recycling project (if children participate they will have a vested interest in the program's success). To design a set-up for recyclables.

MATERIALS: paper, pencils, and ruler

KEYWORDS: recycling, brainstorming, disposal

BACKGROUND: Teaching youth to be organized and efficient is important. In the following activity, they will help set up a collection system that is efficient for students, teachers, and custodians.

PROCEDURE: Check with the recycling coordinator to see what items are being recycled in your area, then decide which one you want to collect. Have a brainstorming session to find the most efficient way to set up a recycling collection system. This discussion may center on the classroom, cafeteria, or other offices. You can sketch out your own designs and tell why your design will work well.

Further exploration: As a homework assignment or project have them design a system for their own homes.

FOLLOW-UP: Sketch a design of the recycling program in school or home. Include:
1. Which material will be collected?
2. What types and sizes of containers will be used? What will they cost?
3. Where will the containers be placed?
4. Who will collect the recyclables?
5. How often will they be collected? If collection occurs one time per week, you will need larger containers than if it occurs every day.
6. Where will the recyclables go after they are collected in school?
7. What kinds of products can they be made into?
8. Does your family buy those products?

Discover Composting Organisms

(Adapted from Composting: Waste to Resources, Cornell Waste Management Institute)

GRADE LEVELS: K-3

SUBJECT AREAS: science

CONCEPT: What makes composting work?

OBJECTIVE: To expose students to some of the organisms that carry out decomposition.

MATERIALS: fresh sample of compost, glass slide or petri dish, hand lens or microscope, paper, pencil

KEYWORDS: bacteria, fungi, decompose

BACKGROUND: The insects, worms, bacteria, and fungi found in your compost pile do the work of making compost. You can see some soil animals with the naked eye, and for some you will need a hand lens or microscope. These organisms are some of the decomposers that fit into the cycle of life.

Cycle of Life

Producers (Grass)
Primary Consumers (Sheep)
Secondary Consumers (Wolf)
Decomposers (Insects, Fungi)

PROCEDURE: Put a small compost sample on a glass slide with a drop of water. Observe the sample under a hand lens or microscope. If you don't see live organisms, take a fresh sample from the compost. Draw pictures of what you see.

Option: Try to identify organisms with a field guide.

FOLLOW-UP: Take a field trip to see a compost pile, and bring a hand lens to do on-site investigations.

Discuss what would happen in the world if there were no decomposers. What would happen to leaves in the fall, or to dead trees in the forest? *(Decomposers are the recyclers of the natural world. They break down organic matter and turn it into materials that can once again be used to support life. That is why compost contains many nutrients that help plants to grow. Without decomposers, we would all be buried in wastes!*

A Mini Landfill

(Adapted from Nutrition Comes Alive, Level 6, A Case of Waste, by the Division of Nutritional Sciences, Cornell University)

GRADE LEVELS: K-3

SUBJECT AREAS: science

CONCEPT: Which materials will decompose, and which will not?

OBJECTIVE: To observe the difference between degradable and non-degradable wastes.

MATERIALS:
_ large glass or plastic jars, or aquarium
_ various pieces of garbage to bury (small food scraps, bones, metals, cardboard, paper, plastic)
_ soil from garden or other outdoor area (not sterilized potting soil)
_ water
_ plastic wrap
_ worksheet: Where Does This Trash Belong?

KEYWORDS: degrade, landfill, decompose, compost

BACKGROUND: Landfills have changed a lot over time. In the 1700's people threw their garbage in the street and pigs and other animals ate it. We make much more garbage today than they did then. If we threw our garbage in the streets today, we would be buried in it!

Today most of our garbage goes to a landfill; some is burned and some recycled. Sending most of our garbage to a landfill is becoming a problem because we are running out of spaces. Where would a city put a landfill?

We have to start looking at our garbage in a different way. In our garbage, there are many resources that should not end up in a landfill. We need to:
1) Reduce the amount of waste we produce,
2) Recycle all that we can,
3) Compost all organic material,
4) Incinerate what is left if that option is feasible and/or available, and
5) Landfill the leftover material.

PROCEDURE: Follow the directions below to make your own mini-landfill.

1. Fill the jar about half full of soil. Add 4 or 5 different pieces of garbage. Keep a list of all the things you put in.
2. Cover the garbage with more soil. Sprinkle the soil with water and cover the top of the jar with plastic wrap.
3. Place the jar in a warm place for about ten days.
4. Then empty the contents of the jar onto a newspaper and examine the bits of garbage. Record and date any changes that you see. Repeat several times to record changes.

Type of Garbage - Changes Observed - What Else Could Be Done With This Item?
1. _____
2. _____
3. _____
4. _____
5. _____

FOLLOW-UP: Based on your observations, which materials do you think would naturally decompose? Should they be sent to a landfill, or should they be composted?

What Is Trash?

(Adapted from Reycling Alaska Activities Handbook, Dept of Env Conservation, Juneau, AK)

GRADE LEVELS: K-3

SUBJECT AREAS: science, social studies

CONCEPT: Our class generates a great deal of trash daily. Trash can be divided into three categories.

OBJECTIVE: Students will be able to state the difference between recyclables, biodegradables, and the leftover that must be disposed of.

MATERIALS: classroom trash (one day's worth), Sesame Street song "I Love Trash"
KEYWORDS: reusable, recyclable, biodegradable, disposable
PROCEDURE: Collect the trash which accumulates in the classroom after one day. Help the students separate it into three categories:
_ recyclables
_ biodegradables, and
_ the leftover that must be disposed of.

Reusables, Recyclables
Discuss some ways in which these materials can be reused or recycled. Sandwich containers can be used many times; papers of various types can be reprocessed and recycled. Find out how Oscar on Sesame Street is using what other people throw away. Learn his song, "I Love Trash."

Biodegradables
These are materials that will rot over a short period of time. In a plot on a school yard, bury some samples of biodegradable trash; unearth the trash periodically to see what is happening. Record what you see. You might also bury some paper, glass, or metal trash at the same time for comparison.

The leftover that must be disposed of
This is trash that will not decay and cannot be recycled. Are there some reusable or recyclable materials that could have been substituted for disposable materials? Discuss what happens to trash in your community.

Where Should It Go?
Recycle? Compost? Incinerate? Landfill?

GRADE LEVELS: K-3

SUBJECT AREAS: math, science

CONCEPT: Where should our garbage go?

OBJECTIVE: To understand that solutions to garbage disposal problems are varied and complex.

MATERIALS:
- 5 cardboard boxes or small garbage cans
- markers
- a bag of clean garbage (choose items that will fit into all categories below)
- handout: Where Does This Trash Belong?

KEYWORDS: incinerate, compost, landfill, recycle

BACKGROUND: Our solid waste problem is very complex. To solve this problem, each community must look at all the possible solutions and make a comprehensive solid waste plan. These plans may include reduction, recycling, composting, incineration, and landfilling. No single method will solve the problem, so each community has to decide which alternatives best meet the local needs.

We are all garbage producers and therefore part of the problem. We must also all be part of the solution.

PROCEDURE: In this activity, we want to make students think about where garbage can go. At present it may all go to a landfill or incinerator, or some may be recycled or composted.

1. Take 5 boxes and place them at on end of the room and ask the students to label them:

reduce (or avoid)	recycle	compost	incinerate	landfill

2. Take a bag of clean garbage and dump it out on the floor at the opposite end of the room.

3. Set up two teams and let them sort the garbage by taking one item at a time and placing it in a container.

4. After the students have sorted the garbage, go through the bins and ask why items were placed in certain boxes. Some items may appropriately fit into more than one box. The answers are not always clear, depending on options available in your community.

5. This can be done on paper also by drawing lines between the item and the container on the handout called Where Does This Trash Belong?

6. Discuss the following questions:
- Can all items be recycled? *No, some items are made from many different materials that are hard to separate.*
- Can everything be burned if we have an incinerator? *No, some items will not burn, and some are valuable resources that could be fixed, reused, or recycled.*
-If we have an incinerator, will we still need a landfill? *Yes, the ash from incinerators must be sent to a landfill, and there are also some hazardous items (like batteries) that should be landfilled rather than burned.*

FOLLOW-UP: Discuss the idea of waste reduction. (What items are not needed in the first place? Could we have used durable products rather than disposable ones? Could we have purchased products with less packaging?)

The Waste Paper Basket

(Adapted from Team Team Up for a Clean New York, by Curriculum Editorial Unit, Brooklyn, NY)

GRADE LEVELS: K-3

SUBJECT AREAS: social studies

CONCEPT: What are the consequences of our actions with litter and garbage?

OBJECTIVE: To get students to think about what happens with their litter or garbage.

MATERIALS: worksheet: *The Waste Paper Basket

KEYWORDS: litter, solid waste

PROCEDURE: Have the students complete the following questions, either individually or as a class project. Then discuss the results, emphasizing the idea that individual actions are significant. How we all treat our environment determines how good an environment we will have.

FOLLOW-UP: Discuss the following questions:
1. Extend the waste paper basket situation to the world outside the classroom. If you were walking down a street and there were no litter baskets around, and you wanted to throw some candy wrappers away, what would you do?
2. If you threw one piece of paper on the ground, would that make a big difference? Explain.
3. Suppose 100 people threw papers on the ground, what would it look like then? Why?

*(*Waste Papaer Basket worksheet)*

What would you do? Suppose the waste paper basket in the classroom is full?

Answer the questions A. B. C. D. E. with these choices:
Yes - No - Maybe - How will this affect you? - How will this affect others?
Would you ...
A. Would you put your garbage in your desk?
B. Would you throw your garbage on the floor?
C. Would you try to put your garbage in the waste paper basket anyway?
D. Would you put your garbage in your bookbag until you find another waste paper basket to put it in?
E. Would you ask your teacher for another waste paper basket to put your garbage into?

Candid Camera

(adapted from Here Today Here Tomorrow...Revisited: A Teacher's Guide to Solid Waste Management. NJ Dept of Environmental Protection, Div. of Solid Waste Management)

GRADE LEVELS: K-3

SUBJECT AREAS: language arts, art, photography

CONCEPT: Why is litter a problem? What can we do about it?

OBJECTIVE: Students will appreciate the negative effects litter has on their community.

MATERIALS: camera - photographic film - community map

KEYWORDS: litter, community

PROCEDURE:
1. Assign students to investigate areas of unsightly litter in their community for a week. At the end of the week, discuss the various areas and mark them on a community map. Discuss why there is a litter problem there.
2. Divide the class into groups and have them take photographs of the areas.
3. Display the pictures and have the children write reactions to them.

FOLLOW-UP:
1. Students can monitor the litter problem in a given area by taking pictures over a period of time.
2. Students can write captions for each photo identifying the area for use at Town Hall or community groups.
3. What are the laws in your area regarding littering?

When It Is "Wrong To Belong" - Scavenger Hunt

(adapted from Here Today Here Tomorrow...Revisited: A Teacher's Guide to Solid Waste Management. NJ Dept of Environmental Protection, Div. of Solid Waste Management)

GRADE LEVELS: K-3

SUBJECT AREAS: science, social studies

CONCEPT: What is litter? Why do we litter?

OBJECTIVE: Students will become aware of the various forms of litter found in different environments. Students will be able to distinguish between man-made litter and natural materials that people dispose of improperly.

MATERIALS: Paper bags (one per group)
KEYWORDS: litter

PROCEDURE:
1. Select an area for study and divide students into groups. Tell students they will be participating in a scavenger hunt.
2. Each group receives a list of the items expected to be found in this "unfamiliar" environment and a bag to collect the items.
3. Determine the length of time for this activity and have the students find as many items as possible.
4. Wash hands!
5. Discuss the items found, having the students comment on how they got there. While this activity can be done almost anywhere, it might be more effective in an environment that is new to the students. It is recommended that the teacher visit these areas first to better prepare the "scavenger" sheet.

Sample list: Use this same activity in different environments and compare the results.
Examples might be:

A trip to the city park something lost by a person a coin something glass evidence of people aluminum can fast-food wrappers	**A trip to the beach** a crab's claw sea glass driftwood something metal something aluminum a shell a battery
A trip to the woods an oak leaf or evergreen needles evidence of an animal evidence of a person	**Around the school yard** paper leaf something left by a person something aluminum grass
Common to all Something blue something plastic something bigger than your nose	

FOLLOW-UP:
Take a litter walk to clean up an area, e.g., playground, park, roadside.

What Is This Toy Truck Made Of?

(Adapted from Recycling: Mining Resources From Trash, Cornell Waste Management Institute)

GRADE LEVELS: K-3

SUBJECT AREAS: social studies, science

CONCEPT: Many natural resources may be needed to make one object.

OBJECTIVE: To identify how many resources are used to produce an item and why each resource is so important.

MATERIALS:
- handout: "What Is This Made Of" Record Sheet (below)
- pencil
- ask students to bring in a toy truck or other item to be discussed

KEYWORDS: natural resources

BACKGROUND: Use an object that youth are familiar with to explore how many resources are used to make it. Youth should realize that everything is made from a natural resource. Example: pencil, house, bicycle, car, softball.

PROCEDURE: Take an item that you are familiar with and list all the raw materials needed to produce it.

Example: A toy truck is made of: wood, paint, plastic, steel, rubber

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"What Is This Made Of" Record Sheet

Item being examined:

_____

Parts that make up the object	Raw Materials Needed	Renewable in 100 years?
i.e. - rubber tires	*latex from trees*	*yes*

_____

Plants From Trash

(Adapted from Recycling: Mining Resources From Trash, Cornell Waste Management Institute)

GRADE LEVELS: K-3

SUBJECT AREAS: science

CONCEPT: What can we do with seeds, other than throw them away?

OBJECTIVE: To observe how plants recycle themselves.

MATERIALS:
_ water
_ potting soil
_ containers for plants
_ seeds, pits, fruit, or vegetable parts
_ newspaper

KEYWORDS: propagation, exotic

BACKGROUND: Did you know that some of the things you throw away can be grown into attractive houseplants? All you need are a sunny window, some water or potting soil, flower pots or containers, and a little tender loving care.

PROCEDURE:

1. If possible take a trip to the grocery store or fruit market (if you want exotic fruits or vegetables go to the larger grocery stores). If the trip is not possible, the instructor will need to shop for produce.

2. Discuss the different types of propagation. See **Plants from Plant Parts**, **Plants from Seeds**, and **Plants from Exotic Fruits**, which follow:

Plants from Plant Parts:

- White Potato in Soil:
Take a white potato that is showing "eyes" and cut a section that includes an eye (about 1 square inch). Place it in a pot of moist soil, about 2" deep. Keep the plant moist but do not "drown" it. Field potatoes are planted this way.

- Sweet Potato in Water:
In the middle of a sweet potato, stick 3 to 4 toothpicks evenly spaced. Place the potato in a glass of water and put it in a sunny window. Either end can be rooted. Keep the water level high, and after a week or more the potato will usually sprout roots and vine-like stems and leaves.

- Carrot Top in Water:
Cut about 1" - 1 1/2" off the top of 4 to 6 carrots. Fill a shallow bowl 2/3 full of washed pebbles (pebbles help support the tops.) Place the carrot tops over the pebbles. Add water to the level of the pebbles and maintain this level at all times. Soon the tops will sprout pretty foliage.

- Pineapple in Water:
To separate the top from the fruit, hold the fruit firmly with one hand and twist the leafy head with the other. The top should come right off. Remove the lower leaves until the stump is about 1 1/2" long. Put the top in a glass of water and change the water weekly. When roots are 3" to 4" long, transplant to a pot.

Plants from Seeds:

- Avocado Pits:

Remove the pit from an avocado and allow it to dry for 2-3 days. Peel away as much of the onion-like skin as possible. One-third of the way down, inset four toothpicks at regular intervals. The flat end is the bottom and the pointed end is the top.

Put the pit in a glass of water so that 1/2" of water covers the base of the pit. When the roots are 4" long, transplant the pit to a pot and keep it in a bright, warm window. Keep the soil evenly moist at all times.

- Mini-Fruit Trees:
Citrus plants can be grown from seeds removed from oranges, grapefruits, lemons, and tangerines. Soak the seeds overnight in water. Plant 1/2" in moist potting soil. Cover the pot with a plastic bag or a piece of plastic wrap, and put in a warm spot. When the seeds start to grow (in a few weeks), remove the plastic. Keep the plant in a warm, sunny window.

- Beans, Peas, and Lentils:
Soak dried beans, peas, or lentils overnight in warm water. Fill a pot 2/3 full with potting soil. Place three seeds on the top of the soil and cover with 1/2" of soil. Cover the pot with plastic wrap. After the seeds start to grow, remove the plastic. Put the plant in a warm, sunny window, and keep the soil evenly moist. It may be necessary to tie the plants to a small stake as they grow.

- Herbs:
Use anise, caraway, coriander, celery, dill, or fennel seed. Fill a 6" pot 2/3 full with moist potting soil. Place six seeds on top of the soil and cover with 1/2" of soil. Cover the pot with plastic wrap and place in a warm spot. After the seeds begin to grow (3-8 days), remove the plastic and place the plant in a sunny window. After a few weeks, you will have a lovely feathery foliage that can be snipped and used in cooking.

- Peanuts:
Make sure you use fresh, unroasted peanuts. Fill a large, 4" deep plastic bowl 2/3 full with moist potting soil. Shell four peanuts and place them on top of the soil, covering them with 1" of soil. The plant will sprout quickly. In a couple of months small, yellow, pealike flowers will develop along the lower part of the stem. After the flower fades, the ovary swells and starts to grow toward the ground and pushes into the soil. Peanuts will be ready to harvest in about six months.

Plants from Exotic Fruits:

- Mango:
In the center of the mango, there is a large hairy husk with a pit in it. Scrape off all the excess flesh from the husk and gently pry open with a dull knife. The pit is best started in a sphagnum bag. Fill a Ziploc bag with dampened peat moss or sphagnum. Place the pit in the bag and make sure it is completely surrounded by moss. Check every day to make sure the pit is not dried out or rotted from too much moisture. When the roots are 4" long, transplant to a pot that is at least 1" larger than the pit.

- Papaya:
Papayas are not easy to grow because the plants have a tendency to dampen off (die) at about 6" tall. When you cut the papaya open, you will find hundreds of black seeds surrounded by a gelatinous aril (seed covering). To remove the aril, spread some seeds on a paper towel and roll them with your fingers until the aril squashes off. Plant the seeds immediately in a container with sterile potting soil. Give them bottom heat and high humidity until they pass the critical stage of 6" high. Papayas are rapid growers, and once they are established, they will not need a lot of water and fertilizer.

- Tamarind
Tamarind pods look like brown lima beans. The outer shell is brittle and easily peels back, revealing a sticky, brown, pulp. Within this pulp there are five or six shiny black pits. Nick the pits (with a nail file) and soak them until they swell, usually in a few hours. Plant the pits in a container with potting soil and place in a sunny window. Tamarinds are water-loving plants and should never be allowed to dry out. As they grow, pinch them back to make the plant fuller.

(Source: "The Pits", Rare Pit & Plant Council)

Celery Stalkers

(Adapted from The Recyculum: A Resource Conservation Curriculum for Grades K6, by Eco Alliance, Inc.)

GRADE LEVELS: K-3

SUBJECT AREAS: science

CONCEPT: How do plants use water?

OBJECTIVE: To see how plants take up water and any dissolved pollutants.

MATERIALS:
_ jar or other container
_ celery stalk (or white flower)
_ food coloring

KEYWORDS: water, pollution

PROCEDURE:

1. Fill a container 3/4 full of water.
2. Add 3 drops of food dye.
3. Put a stalk of celery into the water.
4. Check often to see what happens.

FOLLOW-UP:

Discuss what this experiment tells us about how pollutants could get from water into plants.

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Throw-Away Society

(Adapted from Wrap Sessions: Town of Islip Recycling Curriculum, by Departmental of Environmental Control, Town of Islip, NY)

GRADE LEVELS: 4-6

SUBJECT AREAS: social studies

CONCEPT: To think about garbage disposal and the amount that we produce.

OBJECTIVE: To increase awareness about solid waste and how it relates to each of us.

MATERIALS: handout: **Throw-Away-Society**

KEYWORDS: recycle, biodegrade, reduce, refuse

PROCEDURE: Ask students to fill out the questionnaire on the next pages. Discuss answers and the effects on the environment.

Answers: 1-C, 2-B, 3-B, 4-C, 5-B, 6-C, 7-C, 8-C, 9-A, 10-D, 11-B

FOLLOW-UP:

1. Produce a bulletin board or display the results of the information on the questionnaire.

2. Write a report or fact sheet using this information.

3. Take it home and share with the family.

Throw-Away-Society

Do you know what the term "THROW-AWAY-SOCIETY" means? The questions below will help you realize just how much we are throwing away. See how much you know about our "throw-away-society."

1) How much garbage do you think a typical American family of four is responsible for in one week? (This includes our individual share of commercial waste.)

a. about 20 pounds
b. 50 pounds
c. 80-150 pounds
d. 250 pounds

2) How much garbage is that for each person for one day?

a. 1 pound
b. 3-4 pounds
c. over 10 pounds
d. 22 pounds

3) What fraction of our garbage is paper?

a. 1/10
b. 1/3
c. 1/2
d. 3/4

4) How many pounds of glass do you think you use in one year?

a. 50 pounds
b. 50 pounds
c. 500 pounds
d. 1000 pounds

5) What does RECYCLE mean?

a. to burn
b. to make into
c. to break down
d. to throw away new product

6) What does BIODEGRADABLE mean?

a. burn
b. use again
c. break down or rot
d. throw away

7) How much paper does a family of four throw away in a week?

a. 20 pounds
b. 6 pounds
c. 10 pounds
d. 60 pounds

8) How much food (scraps) does a family of four throw away in a week?

a. 50-60 pounds
b. 5-10 pounds
c. 10-15 pounds
d. 25-30 pounds

9) Look carefully at this list:

7 million cars
7 million TV sets
62 billion cans
43 billion bottles
65 billion tops (to cans and bottles)
70 million tons of paper

The list is probably...

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

10) Which of the following materials found in your garbage, can be recycled or composted?

a. paper
b. food
c. metal
d. all of these

11) Which of these is NOT toxic (poisonous)?

a. nail polish remover
b. vinegar
c. furniture polish
d. weed killer
e. insect spray

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Updated June 2003

School Food Waste

(Adapted from Nutrition Comes Alive, Level 6,
Division of Nutritional Sciencs, Cornell University)

GRADE LEVELS: 4-6

SUBJECT AREAS: social studies, math

CONCEPT: What foods do students throw away? How much? For what reasons? What are some of the ways to decrease food waste?

OBJECTIVE: Students will see how much food is thrown away at their school each day.

MATERIALS:

- plastic disposable gloves for handling food
- data sheets: **School Food Waste Data** **and** **Foods Thrown Away**
- optional:
  - 2 trash containers, one for food and the other for other materials;
  - several 1/2-gallon or gallon milk containers to collect leftover milk;
  - tape recorder, camera, and video tape recorder.

KEYWORDS: waste

PROCEDURE: To find the total amount of milk and food thrown away:

- Ask people to give you their leftover milk when they clear their trays.

Pour the milk into half-gallon or gallon containers. On the data sheet, record the number of containers filled and the sizes of the containers.

-If you can use a large scale, ask people to separate all the leftover food from other trash and to place it in a separate trash container after lunch. Subtract the weight of the empty container from the weight of the full container to determine how many pounds of food were thrown away. Record the information.

To determine what foods are thrown away, look at the day's menu and fill out a data sheet with names of foods on the menu. Use extra spaces to record the contents of bag lunches. Then stand by the trash containers and observe which foods are thrown away. Estimate the amounts of foods thrown away and record the information using check marks.

To learn why people don't eat their food, interview students and tape-record or write down their comments.

To learn about another side of the problem, interview cafeteria workers. Ask whether any foods are throw away in the kitchen and what happens to leftovers. Find out what government guidelines and requirements the cafeteria must follow when planning and preparing meals.

Also talk to the custodial staff. They can tell you whether the results on the day of your survey were typical.

Results

You should now be able to answer your questions about food waste. Use the information gathered to make some suggestions about how to decrease food waste at school. You may present the results of your study in some of the following ways:

drawings, photographs	newspaper articles

movies, videotapes	letters
posters	oral reports
graphs and charts	class discussions
taped interviews	

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Name:_____ Date:_____

School Food Waste Data

Total Pounds of Food Thrown Away:

Weight of food trash container **after** lunch _____ pounds

Weight of food trash container **before** lunch -_____ pounds

Total weight of food thrown away =_____ pounds

Total Amount of Milk Thrown Away:

Number of 1/2-gallon cartons filled with milk =_____ 1/2-gal.

OR

Number of gallon cartons filled with milk =_____ gallons

Questions:

1. How many pounds of food were thrown away at lunch? _____

2. How many kilograms of food were thrown away at lunch? _____
(1 kilogram = 2.2 pounds)

3. How many half-gallons of milk were thrown away at lunch? _____

4. How many gallons of milk were thrown away at lunch? _____

5. How many half-pints of milk were thrown away at lunch? _____
(1 half-gallon = 2 quarts = 4 pints = 8 half-pints)

6. Figuring on 180 days of school per year, and using your findings as a typical day, how many pounds of food are thrown away at your school in one year? _____

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Name:_____ Date:_____

Foods Thrown Away

School Lunch Food	Whole Serving	More than 1/2-serving	1/2 serving or less

_____

_____

_____

_____

_____

_____

_____

Bag Lunch Food

_____

_____

_____

Classroom Conservation

GRADE LEVELS: 4-6

SUBJECT AREAS: social studies, art, math

CONCEPT: We can all help to reduce the amount of waste generated in the classroom and lunch room.

OBJECTIVE: Students will be able to suggest ways paper and other natural resources can be used and recycled in the classroom.

MATERIALS:

- waste paper generated in the classroom
- any of the following:
  grocery bag
  box
  magazine
  gift wrap paper
  cards
  newspaper
  lunch bag
  milk carton

KEYWORDS: conservation, natural resources

PROCEDURE:

For one week ask students to save all waste paper generated by class activities.
Assign groups to separate papers into two stacks daily: one that has been completely used (e.g. on both sides) and one, for paper that could be used again.

At the end of the week, compare the amount of paper in the stacks and lead a class discussion on "Are we wasting paper?" Give each group some of the reusable paper, pencils, and one of these articles: grocery bag, box, magazine, gift wrap paper, cards, newspaper, lunch bag, or milk carton.

Ask each group to list on the paper all the ways they can think of to reuse the article, or list alternatives to these items that could be used over and over again (e.g. reusable plastic containers instead of sandwich bags, thermos instead of milk carton, etc.). After ten minutes, share the ideas. Repeat the exercise with items used in the classroom.

FOLLOW-UP:

1. Maintain a room recycling center. Make gifts, models, table decorations, collages, bookmarks, name tags, etc.

2. Give each student a 12 x 12 inch piece of Masonite painted a slate color to use instead of paper for practicing writing and drawing skills. Use chalk and erase the markings with a cloth at the conclusion of each exercise.

3. Instead of using construction paper to teach color awareness, use color cut from magazine pictures.

4. See "Making Recycled Paper" exercise in this curriculum. Try making recycled holiday cards, creative writing paper, report covers, etc.

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To Live I Need...

(Adapted from Recycle Alaska Activities Handbook, Department of Environmental Conservation, Juneau, AK)

GRADE LEVELS: 4-6

SUBJECT AREAS: social studies, language arts

CONCEPT: People's wants are unlimited but resources are limited, therefore choices must be made.

OBJECTIVE: Students will be able to state one item previously considered to be "essential" which he/she could live without.

MATERIALS: butcher paper, crayons

KEYWORDS: renewable resources, essential

PROCEDURE:

1. Have the students think of the things they use every day and make a list called "to live I need." They will separate the essentials from those things that are just nice to have. List the essentials.

2. One item at a time, focus on these items, and facilitate discussion about them. Some sample questions might be:

-Where did it come from?
-What are the basic ingredients?
-Are the ingredients found in nature?
-Are they renewable?
-Are they non-renewable?
-Are they made by people?

3. Design a chart for the items discussed. Sample chart:

Essential Things List	**Where Does It Come From** (Found in nature? Made by people? Renewable? Non-renewable?)	**Basic Ingredient List**

_____

_____

_____

_____

_____

_____

_____

All Wrapped Up

(Adapted from Recycling Our Resources: A Recycling/Solid Waste Curriculum for Kindergarten through 6th Grade, Oneida-Herkimer Solid Waste Project, Cornell Cooperative Extension of Oneida County)

GRADE LEVELS: 4-6

SUBJECT AREAS: social studies

CONCEPT: Why do we need packaging? How can we reduce the amount of waste it generates?

OBJECTIVE: To understand the purpose of packaging and to be able to identify wasteful packaging.

MATERIALS: product packaging, old magazines

KEYWORDS: packaging, renewable resources

BACKGROUND: Why do we buy one product instead of another? Often it's because of the packaging. Packaging accounts for 10-15% (and sometimes more than 50%) of the cost of a product and approximately 1/3 of what goes into a family's trash can. Excess and non-recyclable packaging add to our energy and waste problems. We can cut down on packaging.

Packaging has several uses. It may provide protection to a product during shipping. It may provide protection to the consumer by preventing contamination or tampering. Or it may prove a useful marketing tool for the manufacturer. In some cases, the packaging may serve multiple purposes. Packaging often differs from culture to culture. Generally, Americans are accustomed to seeing a lot of packaging material. On the other hand, some European cultures use relatively little packaging. For example, Americans expect their purchased items to be placed in a paper or plastic bag as a convenient method of carrying the item home. Some Europeans, however, frequent open food markets where they bring their own wicker basket or cloth bag which is used over and over again. In addition, U.S. supermarkets often feature fruits and vegetables wrapped in plastic shrink wrap and polystyrene (styrofoam). Open food markets do not use synthetic wrapping, instead they rely on nature's own packaging, ie. the banana peel or potato skin.

Packaging often serves as a way to promote a product, and we often are lured into buying something we may not really need.

PROCEDURE:

Have the students bring in examples of packaging. Discuss:

- Why is the product packaged? (To protect the product, protect health, prevent theft or tampering, provide advertising, provide convenience, promote purchasing, make the product look larger or more appealing)
- Is the packaging essential, or wasteful? Why and why not? What criteria are you using to make your decision?
- What influence do you think packaging has on how well the product sells?

Design a way to categorize the packaging. For example, sort it according to "natural" packaging (bananas, apples, peanuts); recyclable packaging (paper bags, returnable bottles); and nonrecyclable packaging. Discuss:

- What happens to the packaging once the product is used?
- Which packaging is made from: recycled materials, renewable resources?
- Which packaging would you label: most wasteful, least wasteful? Why?

Brainstorm ways you could reduce the amount of packaging you purchase. For example, could you purchase products in bulk? How would this help reduce packaging? (A 3-ounce tube of toothpaste requires 50% more packaging per

ounce than a 7-ounce tube.)

FOLLOW-UP:

- List three examples each of recyclable and non-recyclable packaging.
- What criteria might you consider when deciding whether packaging is necessary or wasteful.
- What happens to most of the packaging you purchase? What do you think about this?

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Household Toxic Chemicals

(Adapted from Earth Day 1990: Lesson Plan & Home Survey - K-6, Standford University, CA)

GRADE LEVELS: 4-6

SUBJECT AREAS: science, social studies

CONCEPT: Household hazardous waste.

OBJECTIVE: To realize that chemicals and toxics are all around us and that we can make a choice whether or not to use them.

MATERIALS:

- 4-5 cleaning products, solvents, pesticides, etc.
- tape
- paper, pencil or pen
- handouts: **Home Toxics Survey** and **Possible Substitutions for Household Toxics**

KEYWORDS: toxic

BACKGROUND: A toxic is any substance that is capable of harming a person if ingested, inhaled, or absorbed through any body surface. Toxic substances vary widely in the types of harm they cause and the conditions under which they become harmful. The effects of the toxic substances vary widely, too. Acute reactions are sudden ones such as vomiting or dizziness. Chronic reactions occur over longer periods and include symptoms such as decline in mental alertness, change in behavior, cancer, and mutations that can harm unborn children of exposed parents. Because toxics can cause both acute and chronic reactions, they are a broader category than poisons, which produce acute reactions only. For this reason, the words toxic and poison are not interchangeable.

Nobody is "for" toxic chemicals in the sense of wanting to endanger ourselves and others, and yet many toxic substances seem to be a necessary part of our lives and have come to be considered essential in our homes, our workplaces, and our schools. This predicament of needing substances that sometimes produce undesirable effects forces people to make choices about what is acceptable to them. Different people are willing to take different risks related to toxic chemicals and have varying concerns about the effects of toxins on themselves and people around them. Some people know that many of the products they use are potentially toxic but consider the risk worthwhile. Others try to avoid toxics and thus forego the benefits of certain products.

Many people do not know that household chemicals can be toxic. Most of the dangerous substances in the home are found in cleaners, solvents, pesticides, and products used for automotive care.

NOTE: It is not always possible to avoid the use of toxic substances (i.e. - if you have termites, you can either move out or use a pesticide to remove them).

In this activity, students survey themselves and their families to find out attitudes and beliefs people hold about toxics. Older students are also introduced to the term toxic, risk, and benefit (a risk is a possible danger; a benefit is an advantage).

PROCEDURE:

1. Collect four or five familiar cleaning products. Tape the lid on so that students cannot open the containers. Prepare a chart on butcher paper titled "Toxics Survey Results" that students can use to record the results of their surveys. The chart should list all of the survey questions and allow space for recording the responses.

2. Introduce the activity and the unit by displaying the household products you have gathered. Ask students, "What are

these things? What are they used for? What do we know about them? Is there anything dangerous about using them? What don't we know about these things that might be important to know?" In order to find out more about what we as a class think about toxics, complete the **Home Toxics Survey**.

3. Hand out one Home Toxic Survey to each student and explain that the survey is not a test, students do not need to write their names on the survey; there are no right or wrong answers. Give the student a few minutes to complete the survey.

4. Divide students into groups of four. Have each group discuss the following questions using the survey:

- What are toxics
- Where do we find toxics?
- Who uses toxics? Why?
- Are we always aware of the presence of toxics?

5. Have each group share their responses to these questions with the class. Accept all responses; do not provide answers at this point. This is a time for students to begin thinking about toxics and for you to assess their initial understanding and attitudes. Talk with students about the idea that nobody is "for" toxics but most people think these substances are a necessary part of their lives. Tell them some people know many of the products they use are toxic yet consider it beneficial to continue using them, while other people avoid toxics by using an alternative or doing without certain products altogether.

6. Introduce the words risk and benefit. Help students discuss the meaning of these words.

7. Tell students that people's knowledge of toxic differs, as do their opinions, and that over the next two days the students are going to learn more about toxics. They will interview their family to find out what they know and think about toxics.

8. Ask students to interview one of the adults in their home.

9. Discussion questions:

- Are most people concerned or not concerned about toxics?
- What does toxic mean?
- What ideas did most people in the survey agree on?
- What else have we learned?
- Was there anything that surprised you?
- What does opinion mean?
- What is the difference between fact and opinion?
- What would you like to learn about toxics?
- What choices can we make that are more beneficial to the environment and therefore to all of us?

Home Toxics Survey

1. What is your age? _____ Are you a male or female? _____

2. What do you think of when you hear the word toxic?

_____

3. Which of the following do you use? Which of the following do you consider toxic? (Leave blank if you don't use these products.)

Item	Use	Consider toxic
Laundry detergent used to wash clothes.		
Cleanser used in your house to clean sinks & bathtubs.		
Furniture polish used to clean & shine furniture.		
Drain cleaner used in sink & bathtub drains.		
Glass cleaner used to clean windows & mirrors.		
Baking soda used in cooking.		
Air freshener used to make the air smell fresh.		
Ant spray used to kill ants in & around the house.		
Hair spray some family members use to keep their hair in place.		

4. When do you think it is okay to use something that is toxic?

_____

5. What room in your home do you think contains the most toxics? _____

6. Which statement best describes your home?

____ There are no toxics in my home.
____ There are some toxics in my home.
____ I do not know if there are toxics in my home.

7. Would you want to be told if something you are about to buy might be toxic?

____ Yes
____ No
____ Sometimes

8. Do you think that people who work where there are toxics should be told this when they are hired?

____ Yes
____ No
____ Sometimes

9. Do you think individuals should decide whether to buy and use toxics, or do you think the government should make it illegal to sell toxics?

____ Individual should decide.
____ Government should make it illegal.
____ I don't know.

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Possible Substitutions for Household Toxics

(*Source: Edited from* A Guide to the Safe Use and Disposal of Hazardous Household Products, *Metropolitan Area Planning Council, Massachusetts.)*

Instead Of:	Try:
Air Freshener	Set vinegar out in an open dish.
Drain Cleaner	Pour boiling water down the drain, or use a plunger or a metal snake.
Furniture Polish	1 tsp. lemon oil in 1 pint mineral oil, or rub crushed raw nuts on the wood for an oily polish.
Houseplant Insecticides	Wash leaves with soapy water, then rinse.
Mothballs	Put clothes in cedar chests, or place cedar chips around clothes.
Oven Cleaner	Salt, baking soda, water (and elbow grease!).
Roach Spray	Chopped bay leaves & cucumber skins, or boric acid (sold in powdered form), or 1 part borax &1 part brown sugar set out in dishes (these are not as effective, & the latter two may be hazardous to animals & children).
Silver Cleaner	Soak silver in 1 qt. warm water containing 1 tsp. baking soda, 1 tsp. salt, & a piece of aluminum foil.
Toilet-Bowl Cleaner	1/2 cup bleach.
Window Cleaner	2 tbsp. vinegar in 1 qt. water.

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History of Glass

(Adapted from Wrap Sessions: Town of Islip Recycling Curriculum, by Department of Environmental Control, Town if Islip, NY)

GRADE LEVELS: 4-6

SUBJECT AREAS: reading, comprehension

CONCEPT: What is glass, and how is it made and used?

OBJECTIVE: To learn about the history of glass, what it is made of, and how it is used.

MATERIALS: handout: **History of Glass**

KEYWORDS: glass, recycling

PROCEDURE: Have students read **"History of Glass"** and answer the questions on the following pages.

Answers: 1-T, 2-F, 3-T, 4-F, 5-T, 6-F, 7-T, 8-T

FOLLOW-UP:

Using an encyclopedia, research the following topics and make your own time line for their discovery and use to the present time.

Tin	Iron	Gold
Aluminum	Steel	Uranium
Plastic	Copper	Silver
Petroleum	Lead	

History of Glass

Glass is a material that comes from three powder-like substances, ground-up sand, baking soda, and dusty limestone. It is recyclable again and again and is easy to dispose of with little harm to the environment.

But how is it made? The three ingredients are mixed in large containers or vats until they melt and become liquid. This hot, clear liquid is now what we call glass. It is then shaped, cooled, and left to harden for use everywhere.

Years ago, scientists discovered a way to spin the glass into wool-like thread or fiber. These fibers were found to be good for building materials in boats, homes, and offices. This material is called fiberglass.

Glass is indeed an old but very useful product, but remember that when broken it has sharp edges that can cut people and animals.

Below is a time line showing when and how long glass has been and is used.

TIME LINE -- HISTORY OF GLASS!

First jar made of glass	3000 BC	

All glass ancient container	1500 BC	
Blowpipe to Shape Glass Used	30 BC	
	50 AD	First Glass Window
	1535 AD	First Window in Western Hemisphere
	1685 AD	First Mirror
	1790 AD	First Glass Eyeglasses
	1980 AD	Microwave Glass & Fiber for Telephone Cables

Based on your reading on glass and the Time Line, complete the following worksheet.

A. Be a Glass Recipe Writer...

Write the directions to make glass. Ingredients:
1 _____
2 _____
3 _____

Procedure: Combine your ingredients and place them at a very high temperature in a _____ or _____. Let _____ and _____ _____ and then _____ into _____.

List five (5) different uses of glass.
1 _____
2 _____
3 _____
4 _____
5 _____

B. Circle T for true - F for false.

1) Glass is one of the oldest materials made by humans. T/F

2) Glass has been used for 3000 years. T/F

3) Ancient people probably used glass for carrying liquid. T/F

4) The blowpipe was invented in 30 A.D. T/F

5) The first use of glass for home construction took place in 50 A.D. T/F

6) The mirror was invented about 130 years after the first window in the Western Hemisphere. T/F

7) Eyeglasses were invented in the 18th Century. T/F

8) The use of glass is about 5000 years old. T/F

Recycled Water?

(Adapted from Recycling: Mining Resources From Trash, Cornell Waste Management Institute)

GRADE LEVELS: 4-6

SUBJECT AREAS: social studies, science

CONCEPT: Everything we do to our water affects its quality, from washing clothes to siting a new landfill.

OBJECTIVE: To investigate how water is recycled in a small environment and to learn on a small scale how water is cycled on earth.

MATERIALS:

- Soil
- Container -- 2 liter plastic bottle works best
- 1 or 2 plants depending on size of container
- Gravel or stone
- Water
- Scissors or knife

KEYWORDS: water cycle

BACKGROUND: The amount of water on the earth is the same today as in the days of the dinosaurs. Everything we do to our water affects its quality. In the exercise that follows, we will see how water is recycled. Think about the effects that humans have on this cycle.

PROCEDURE:

1. Cut the 2-liter bottle in two pieces at the top of the hard plastic base.

2. Remove the softer plastic from inside the hard plastic bottom, if possible.

3. Place a layer of stones on the bottom of the clear plastic and add three to four inches of soil.

4. Put the plant in the container, making sure that the soil is firm around the roots.

5. Add one to two tablespoons of water depending on how moist the soil is.

6. Place the top of the bottle securely on the base. Keep the cap on the bottle. Place it in a sunny window.

7. If the water cycle is working, water droplets called condensation will form over time inside the dome. When enough condensation forms, it will rain and water the plants.

FOLLOW-UP:

Discuss the fact that rain contains more than just water -- it also includes pollutants picked up from the air. Some of these pollutants form acids and cause acid rain, which can stunt tree growth and kill fish and other aquatic organisms.

As an extra experiment, fill another bottle 1/4 full with water colored with food coloring, screw the cover on, and place the water in a sunny window. Ask the students whether they expect the condensation to be colored or clear. (It will be clear, because when water evaporates, any dissolved substances are left behind.)

The Cornell Waste Management Institute
http://cwmi.css.cornell.edu

Solid Waste/Recycling

(Adapted from Earth Day 1990: Lesson Plan and Home Survey - K-6, Stanford University)

GRADE LEVELS: 4-6

SUBJECT AREAS: social studies, home economics, math

CONCEPT: Stimulate thought on what we throw away.

OBJECTIVE: To see what percentage of waste is packaging.

MATERIALS:

- Examples of household garbage items
- paper
- felt markers or crayons
- glue sticks
- handout: **Home Recycling Survey** (2 pages)

KEYWORDS: precycling, recycling

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

The average American throws away 4 pounds of garbage per day. In 1990, it is estimated that Americans will throw away over 1 million tons of aluminum cans and foil, more than 11 million tons of glass bottles and jars, over 4 and a half million tons of office paper and nearly 10 million tons of newspaper. Almost all of this material could be recycled.

Recycling saves large amounts of energy. Recycling one glass jar saves enough energy to light a100-watt light bulb for four hours. Recycling one soda can saves as much energy as if the can were half full of gasoline.

When waste products are recycled, fewer raw materials are used. Americans threw away 35 billion aluminum cans last year - we threw away enough aluminum to build an entire air fleet four times over. Recycling paper reduces the pressure on our forests for wood pulps.

PROCEDURE:

Collect a variety of household items that are thrown into the garbage. Try to include items which could be used again, such as paper grocery bags, aluminum foil, and things which create "instant" garbage such as disposal diapers and overpackaged products. Also include items which could be recycled, such as newspapers or glass jars.

Introduce the notion of reuse by displaying a variety of household items which are frequently thrown into the garbage but could be used for other purposes. Ask students to describe uses for each of these household products. Survey the class by holding up each item and asking for a show of hands if the item could probably be found in their garbage at home.

Tell the class that, in order to reduce the amount of garbage we produce, some of the items could be used again and some could be "replaced" at the store by purchasing other products in the first place. For example, nondisposable items

produce less garbage than items made to be used only once. Explain to the students that when we use an item more than once (for the same or different use) we call it re-using. Recycling is remaking a product.

Students will take home a set of questions (the **Home Recycling Survey**) to be answered by them and at least one family member.

FOLLOW-UP:

Discuss the following questions:

- What items can be found in the garbage in most of our households?
- Are any of the items used again (reused) in most of our households?
- If so, what are they used for?
- Does our town have a place where people can take items to be recycled?
- If so, have any of you ever been there? What kinds of things did you take to be recycled?
- Where do most of the people we surveyed think our garbage goes once it leaves our homes?
- What are some ways that you might reduce the amount of garbage in your home?

Home Recycling Survey

1. Put X's by the items that go into your garbage:

___ cans (aluminum and/or tin)
___ glass bottles
___ paper
___ aluminum foil
___ styrofoam (containers or packaging materials)
___ cardboard
___ disposable diapers
___ plastic containers
___ newspapers
___ grocery bags (paper or plastic)
___ egg cartons
___ batteries
___ clothing
___ catalogs and magazines

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

_____

_____

_____

3. Does your town or city have a place to recycle any of these items?

___ Yes ___ No ___ I don't know

4. Where does your garbage go once it leaves your house? (Draw a picture or explain in words.)

_____

_____

_____

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

Benefits:

_____

_____

_____

Drawbacks:

_____

_____

_____

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

Instant garbage Possible alternative

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

7. How does reusing things help the environment?

_____

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Speak Up For Recycling

(Adapted from A-way With Waste: A Waste Management Curriculum for Schools, 2nd ed., by State of Washington, Department of Ecology)

GRADE LEVELS: 4-6

SUBJECT AREAS: speech, language arts

CONCEPT: Organizing a speech in terms of ideas to investigate and support is an effective way to present a persuasive argument.

OBJECTIVE: Students will present a persuasive, well-organized speech promoting the establishment of a school recycling program.

MATERIALS: note cards, pen

KEYWORDS: recycling

PROCEDURE: To develop an idea and speech, students will:

1. Think up possible statements.

2. Rework possible statements to produce a positive statement.

3. Brainstorm reasons to support it.

4. Rate reasons in the order in which they will be presented: least persuasive to most persuasive.

5. Write a short introduction to the speech. Introduction includes: introduction of self, short history of situation or problem at hand, and a statement of thesis.

6. Write short transition phrases leading from one reason to the next to give speech continuity.

7. Write summary/conclusion that restates the problem and summarizes the most persuasive reasons, leaving the audience with an important point to consider.

8. Write the speech onto note cards, one main point per card.

9. Practice the speech so that students can deliver it smoothly, not reading the cards but using them only for reference while looking at their audience and feeling prepared for speaking in public.

FOLLOW-UP:

1. Students present speech to community groups, city council, county commissioners.

2. Students attend public meetings on other public problems and evaluate the effectiveness of the presentations.

3. Students attend trials and court hearings to evaluate techniques and effectiveness of presentations.

4. Teacher arranges visits of lawyers to class to discuss techniques of persuasive speaking.

5. Students write letters to the editors of local papers advocating that recycling be included as a method of solid waste management.

6. Students discuss how recycling and "resource recovery" can work together as part of a solid waste management plan.

What Is Biodegradable?

(Adapted from Recycle Alaska Activities Handbook,
Alaska Department of Environmental Conservation, Juneau, AK)

GRADE LEVELS: 4-6

SUBJECT AREAS: science

CONCEPT: Some materials decompose when buried; others do not. Microorganisms play a vital role in the decomposition process.

OBJECTIVE: Students will be able to differentiate between the kinds of material that nature recycles and those it does not.

MATERIALS:
ten pieces of each of the following:

glass
paper
steel or other metal
plastic
apple, lettuce, or other fruit or vegetable

ten containers, jars, or flower pots
soil
sterile potting mix
masking tape or labels
handout: **Watching Wastes Rot: Record**

KEYWORDS: biodegradation, decomposition, microorganisms

BACKGROUND: Decomposition occurs everywhere. If everything existed forever, we would be buried in our waste. Our waste products are varied: some are made of easily degradable materials while others will last for thousands of years.

PROCEDURE:
Display a piece of glass, paper, metal, plastic, and food. Ask the class to predict which of these substances are biodegradable (capable of rotting or decomposing)? Conduct the following experiment to determine whether their predictions were correct.

Dig enough soil from a garden or vacant lot to fill five containers. (One pound cottage cheese containers would be suitable.) Fill five of the containers half fullwith soil, and the other five half full with sterile potting mix. Place a piece of each type of waste into each container. Continue filling the containers with soil or sterile mix, whichever they already contain. Add enough water to all pots so that the soil or sterile mix is damp but not wet to the touch. Cover the containers. Label the containers to indicate the type of waste and whether it contains soil or sterile mix.

After one week, examine the waste in each container. Which wastes are decomposing? Cover the wastes again, and continue to check them once a week for as long as you want. Record your observations.
Check the original predictions and draw conclusions about which substances are biodegradable and under what conditions.

FOLLOW-UP:
Explore degradable plastics. Many producers of plastic bags are now producing plastic bags they say will degrade.

There are two types of degradable plastic bags; photodegradable and corn starch biodegradable.

Find out what makes these plastic bags degrade and perform an experiment similar to the one above.

Questions:
1. What makes these plastic bags degradable?
2. Does the whole bag degrade? Are there any waste products left over?

Watching Wastes Rot: Record

Name: _____ Date experiment started: _____

Fill in the following table each time you check your pots. Under "Waste", write the name of the item that you buried in the pot. Under "Compost", describe the condition of the item buried in compost each time you check it. Include such things as how decomposed the item looks, what color it is, whether or not you see fungi (spots or thin strands) on it. Under "Sterile Mix", describe in the same way the condition of the item buried in the sterile mix.

Date: _____ Time since waste was buried: _____

Waste	Compost	Sterile Mix
1.		
2.		
3.		
4.		
5.		

Which items decomposed most quickly?

Which items didn't decompose to all?

In general, did items decompose more quickly in compost or in sterile mix? Why do you think this is true?

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Best Ever Compost

(Adapted from Composting: Waste to Resources, Cornell Waste Management Institute)

GRADE LEVELS: 4-6

SUBJECT AREAS: science, technology

CONCEPT: Composting turns organic wastes into a valuable product.

OBJECTIVE: To learn about composting.

MATERIALS:
Kitchen Compost

Add a mixture of some or all of the following ingredients:
- -vegetable peels and seeds
- -fruit peels and seeds
- -coffee grounds
- -eggs shells
- -nut shells
- -any other vegetable or fruit scraps

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

Yard or Garden Compost

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

KEYWORDS: compost, biodegradation

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

Composting is like baking a cake. Simply add the ingredients, stir, "bake," and out comes -- compost!

Whether you compost kitchen wastes or yard and garden wastes, there are a few basic steps to follow. Here are the necessary ingredients and general directions for composting.

PROCEDURE:

1. Choose a container for making your compost. Any type of composting bin will do (chicken wire enclosure, wooden box, etc.).

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

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

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

5. Allow the pile to "bake". It should heat up quickly and reach the desired temperature (90 to 140 degree F, or 32 to 60 degree F) in four to five days.

6. "Stir" your compost as it bakes by turning it with a pitch fork or shovel if you want to speed up the baking time.

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

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

9. Your "best ever compost" should look like dark crumbly soil mixed with small pieces of organic material. It should have a sweet, earthly smell.

10. Feed compost to hungry plants by mixing it with the soil.

FOLLOW-UP:
Try growing a few beans or other seeds in pots, some filled with sand and others filled with a mixture of sand and compost. Compare how well the seedlings grow. Discuss the plants' need for nutrients and water. Sand is a poor nutrient source and does not store water. When compost is mixed in, both of these needs are better met. Gardeners can similarly enrich their gardens using compost.

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Garbage: It's For The Worms

(Adapted from Recycling: Mining Resources from Trash, Cornell Waste Management Institute)

GRADE LEVELS: 4-6, 7-8

SUBJECT AREAS: science

CONCEPT: Can worms produce soil from food wastes?

OBJECTIVE: To see biodegradation of food scraps and learn that there can be more productive uses for food garbage than throwing it away.

MATERIALS:
- plastic 5 gal bucket with small holes drilled in the bottom
- wooden box, fish tank, or other large container (to build wooden box, see instructions below)
- red worms
- bedding (newspaper, leaves, paper bags, and other materials)
- water
- food scraps or other organic wastes

If building a container:
-1 4x8-foot sheet of 1/2-inch exterior plywood
-1 12-foot length of 2x4 lumber
-1 16-foot length of 2x4 lumber
-1/2 pound of 16d galvanized nails
-2 pounds of 6d galvanized nails
-2 galvanized door hinges
-optional: 1 pint of clear varnish or polyurethane
-optional: plastic sheet for placing under and over the bin
-1 pound of worms for every 1/2 pound of food wastes produced per day (Worms sold as fishing bait are best. Red worms are available from Flowerfield Enterprises, 10332 Shaver Rd, Kalamazoo, MI 49002; 616-327-0108.)
-Bedding for worms: moistened shredded newspaper or cardboard, peat moss, or brown leaves

Tools:
-tape measure
-skill saw or hand saw
-hammer
-saw horse
-long straight-edge or chalk snap line
-screwdriver
-drill with 1/2-inch bit
-eye and ear protection
-work gloves
-optional: paint brush

KEYWORDS: biodegrade, compost

BACKGROUND: Worms in the house? Yuk! But this composting system actually works! The worms stay in the box and eat household scraps, and the box gives off little odor. Worm composting can be done in apartment buildings or

other homes with no yard space. You might try it in your school! Many types of existing containers will work if you do not care to build a worm bin.

PROCEDURE:
Shred the bedding needed into a mixing bucket. Fill the container to the top with dry bedding (it takes a long time to shred enough paper). Moisten the bedding materials for the worms by placing it in a 5-gallon bucket and adding enough water to dampen all the materials. Don't worry about getting the bedding material too wet because excess moisture will drain off when it is placed into the composting container. It is a good idea to put wet bedding materials into the bin outdoors and wait until all the water has drained out (up to two hours).

Add about 10 inches of moistened bedding to the bottom of the bin. In go the worms! Leave the lid off for a while and the worms will work down into the bedding away from the light. Then add more bedding until the bin is 3/4 full.

Dig a small hole in the bedding and add your vegetable and food scraps. Then cover the hole with the bedding. Small amounts of meat scraps can be added in the same way. Do not add any potentially hazardous chemicals, or any nonbiodegradable wastes such as glass, metal, or plastic.

Keep your compost moist, but not wet. If flies are a problem, place more bedding materials over the wastes or a sheet of plastic over the bedding, or try placing some flypaper inside the lid. Every three to six months, start a new bin and move the worms into it. If you have built the two-sided bin, move the compost to one side of the bin and add new bedding to the empty half. At this time, add food wastes to the new bedding only. Within one month, the worms will crawl over to the new bedding and the finished compost on the "old" side can be harvested. Then add new bedding to the "old" side.

Building a Worm Composting Bin

1. Measure and cut the plywood as shown, so you have one 24x42-inch top, one 23x42-inch base, two 16x24-inch ends, and two 16x42-inch sides.

2. Cut the 12-foot length of 2x4 lumber into five pieces: two 39-inch pieces, two 23-inch pieces, and one 20-inch piece.

3. Lay the five pieces on edge on a flat surface to form a rectangle with the long pieces on the inside and the 20-inch length centered parallel to the ends. Nail the pieces together with two 16d nails at each joint.

4. Nail the 23x42-inch piece of plywood onto the frame with 6d nails every 3 inches.

5. Cut four 1-foot length from the 16-foot length of 2x4 lumber (Save the remaining 12-foot piece). Take the two 16x42-inch pieces of plywood and place a 1-foot length flat against each short end and flush with the top and side edges. Nail the 2x4s in place using 6d nails.

6. Set the plywood sides up against the base frame so the bottom edges of the 2x4s rest on top of the base frame and the bottom edges of the plywood sides overlap the base frame. Nail the plywood sides to the base frame using 6d nails.

7. To complete the box, nail the 16x24-inch pieces of plywood onto the base and sides at each end.

8. To reinforce the box, make sure a nail is staggered at least every 3 inches wherever plywood and 2x4s meet.

9. Drill 12 one-half-inch holes through the plywood bottom of the box for drainage.

10. To build the frame for the lid, cut the remaining 12-foot piece of the 16-foot length of 2x4 lumber into two 45-inch pieces, and two 20-inch pieces. Lay the pieces flat to form a rectangle, with short pieces on the inside.

11. Lay the 24x42-inch piece of plywood on top of the lid frame so the plywood is 1 1/2 inches inside all the edges of the frame. Nail the plywood onto the frame with 6d nails.

12. Attach the hinges to the inside of the back of the box at each end (on the 2x4) and the corresponding undersides of the back edge of the lid frame, so the lid stands upright when opened.

13. The unfinished box should last for at least five years; finishing the box with varnish or polyurethane, however, will protect the wood and prolong the life of the box. Two coats of varnish with a light sanding between coats should be sufficient.

14. Find a good location for the box. It can be placed anywhere as long as the temperature is more than 50 degrees F (10 degrees C). The most productive temperature is 55 to 77 degrees F (13 to 25 degrees C). Garages, basements, and kitchens are all possibilities as well as the outdoors in warm weather (not in direct sunlight). Make sure to place the box where it is convenient for you to use. It is wise to place a plastic sheet under the box.

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Can We Make It Go Away?

Back to Trash Goes To School

GRADE LEVELS: 4-6

SUBJECT AREAS: science, math

CONCEPT: We can never make something into nothing.

OBJECTIVE: to help us to realize that we cannot make things go away. They are always there, just in a different form.

MATERIALS:

Experiment #1: apple; pot of moist soil
Experiment #2: 3 steel cans; can opener
Experiment #3: water; powdered lemonade; glass and spoon
Experiment #4: nurses' scale, person
Experiment #5: newspaper; metal tweezers or tongs; bunson burner or matches; metal bucket or other fireproof container; bucket of water

KEYWORDS: solution, compact, dissolve

BACKGROUND: Once something is created, it may change form, size, shape, chemistry, or appearance, but we can never make it go away. We try to make unwanted items such as garbage go away, but we will see that although they may disappear in one form, they will still be there.

PROCEDURE:
Experiment #1:

- Fill a pot or other container with soil, and weigh it.

- Cut 1/2 of an apple and weigh it.
- Bury the apple in the soil (It is gone.)
- Weigh pot with soil and apple.

Question: Did the apple go away? *(No, it is just out of sight.)*

Experiment #2:

- Weigh 3 steel cans.

- Cut the tops and bottoms off and then flatten the cans.
- Weigh the cans again.

Questions: Did the cans go away? *(No, they're just smaller.)*
Did they lose weight? *(No, they just changed shape.)*

Experiment #3: Can we make the powdered lemonade disappear?

- Take a pitcher of water and weigh it.

- Measure out and weigh enough powder to make a pitcher of lemonade.
- Dissolve the powder into the liquid and stir until it disappears.
- Weigh the pitcher of lemonade and compare to the weight of the pitcher of water.

Question: Did the powder go away? (The powder is gone, but you can see from the increased weight of the lemonade compared with plain water that the ingredients in the powder are still there, but now in a dissolved form.)

Experiment #4: If we drink the lemonade, will it disappear?

- Weigh a person on the nurse's scale.

- Weigh a large empty glass, then fill with lemonade and weigh again.
- Weigh a person, have them drink the glass of lemonade, then weigh them again.

Question: Did the person's weight change? *(Yes, the person is now heavier because the weight of the lemonade has been added to their own weight.)*

Experiment #5: If we burn something, does it go away?
NOTE: Be very careful when working with a flame. The teacher may want to demonstrate this experiment.

- Weigh a piece of newspaper.

- Hold the newspaper with tongs or tweezers.
- Outside, or in a well-ventilated place, light the paper and let it burn. Have a bucket of water on hand in case of emergency. Drop the flaming paper into a metal bucket or other fireproof container.
- Collect all of the ash and weigh it.

Questions: Did the paper go away? *(Yes, but not really. The elements in the paper changed form -- some went up in smoke and others stayed behind in the ash.)*
Did the weight change? Why? *(The weight decreased because we didn't measure what went up in smoke.)*

FOLLOW-UP:
Discuss the idea of making things go away. Where is away? We can never get rid of anything completely, we can just change it from one form to another.

Discuss how this relates to cleaning up the environment. For example, we can reduce the need for landfills by incinerating our wastes. But, incineration causes air pollution. When we remove pollutants from the smoke, we clean up the air, but we are still left with the pollutants to get rid of as solid or liquid wastes. Also, the ashes that are left behind must still be safely disposed of.

Does Degradable Plastic Really Degrade?

(Adapted from Recycled Alaska Activities Handbook,
Alaska Department of Environmental Conservation, Juneau, AK)

GRADE LEVELS: 4-6

SUBJECT AREAS: science
CONCEPT: Even goods which are biodegradable decompose at various rates.

OBJECTIVE: To see if plastic degrades and how fast different types degrade.

MATERIALS:

- plastic (as many brands or varieties of plastic as you can find). Look for photodegradable, corn starch "biodegradable", and nondegradable plastics.
- scrap wood
- nails

KEYWORDS: photodegradation, biodegradation

PROCEDURE:
Cut two pieces from each type of plastic. Every piece should be approximately the same size. Collect several brands and thickness.

Note: Photodegradable means that the product is broken down by exposure to light. Corn starch biodegradable plastic is broken down by microorganisms, which actually eat the corn starch and leave the plastic behind.

1. Find a safe place outside the school that is not disturbed too much.

2. Take two pieces of scrap wood and attach one sample of each type of plastic to each board. Use a piece of nondegradable plastic as a control.

3. Place one set of samples outside where they will be exposed to the sun. The other set should be buried at least partially in soil so that the soil microoranisms will have a chance to carry out degradation.

4. It will take several months to see any changes so you may need to start your experiment in the beginning of the school year.

5. Check your samples once a month, and record any changes.

Month	Corn Starch Degradable Plastic #1	Corn Starch Degradable Plastic #1	Photo-Degradable Plastic #1	Photo-Degradable Plastic #2	Non-Degradable Plastic
Sept					
Oct					
Nov					
***Dec**					
***Jan**					
***Feb**					

*__Note__: in Northern climates, you may not be able to observe samples year-round.

FOLLOW-UP:
Discuss under what environmental conditions each type of plastic would decompose? Would they decompose in a landfill? Along the highway? In the ocean? (Plastics in the ocean pose a hazard to marine life.)

Mix And Match Waste Game

(Adapted from Recycling: Mining Resources From Trash, Cornell Waste Management Institute)

GRADE LEVELS: 4-6

SUBJECT AREAS: science, social studies

CONCEPT: There are many options for dealing with solid wastes.

OBJECTIVE: To learn some of the vocabulary associated with solid wastes.

MATERIALS: handout: **Mix and Match Waste Game**

KEYWORDS: leachate, sanitary landfill

PROCEDURE: Have the students complete the Mix and Match Waste Game.

Answers:1-C, 2-E, 3-A, 4-I, 5-F, 6-G, 7-B, 8-J, 9-K, 10-H, 11-D, 12-L, 13-M, 14-N.

Mix and Match Waste Game

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

1. Compost pile	A. When natural materials break down and become soil.
2. Conservation	B. Dirty.
3. Decomposition	C. A place to put vegetable peels, leaves, and grass clippings where they will decompose to humus.
4. Environment	D. Chemicals and some industrial and household wastes that are harmful to all living things.
5. Leachate	E. Wise use of our natural resources to avoid waste.
6. Natural resources	F. The dirty water that collects after rain runs through a landfill.
7. Polluted	G. Things we depend on in our environment thatare supplied by nature, such as air, water, soil, and wildlife.
8. Recycling	H. A place where garbage is properly buried to protect water and the surrounding environment.
9. Reuse	I. The world around us.
10. Sanitary Landfill	J. Collecting and using materials to make new products.
11. Toxic waste	K. Using items more than one time, i.e. peanut butter jars to hold buttons or nails.
12. Waste wise	L. Using our heads about conserving, recycling,and any problems we might have dealing with solid waste.
13. Solid waste	M. Everything we throw away, i.e., glass, metal, plastic, and kitchen scraps.
14. Resource Recovery Plant	N. A place where waste is burned and energy is produced.

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Recycling Word Search

(Source unknown)

Back to Trash Goes To School

GRADE LEVELS: 4-6

SUBJECT AREAS: science, social studies

CONCEPT: There are lots of kinds of solid wastes that can be recycled.

OBJECTIVE: To become familiar with what kinds of solid wastes can be recycled.

MATERIALS: handout: **Solid Waste Word Search** (below)

KEYWORDS: corrugated

PROCEDURE: Discuss recycling, including how it saves energy and raw materials and reduces pollution. Have the students complete the Recycling Word Search.

Recycling Word Search

Can you find these words? (All are things that can be recycled.)

IRON	TIN CANS	LEAVES
STEEL	ALUMINUM CANS	GLASS
BRASS	CARS	JARS
COPPER	TIRES	RAGS
ZINC	PLASTICS	PAPER
GOLD	ASPHALT	NEWSPAPER
LEAD	CONCRETE	CORRUGATED
METALS	MOTOR OIL	OFFICE PAPER
WOOD		

Things That Can Be Recycled

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

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

Solid Waste Word Match

(Source unkown)

Back to Trash Goes To School

GRADE LEVELS: 4-6

SUBJECT AREAS: social studies

CONCEPT: Many wastes can be recycled.

OBJECTIVE: To think about how many types of materials can be recycled.

MATERIALS: handout: **Solid Waste Word Match** (below)

KEYWORDS: cellulose

PROCEDURE:

Answers: 1-h, 2-e, 3-a, 4-i, 5-c, 6-d, 7-f, 8-b, 9-l, 10-k, 11-g, 12-e,k,m

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Solid Waste Word Match

Match the left and right columns.

1. Recyclable, ground-up glass	a. Paper
2. Changes organic materials into a soil-like mixture	b. Motor oil
3. 30% of all landfill waste	c. Cellulose insulation
4. A use of shredded newspaper	d. Aluminum
5. A use of finely ground newspaper	e. Composting
6. Most is imported from Australia and Jamacia; recycling saves 95% of the energy to process	f. Plastics
7. Made from petroleum and natural gas; recycling is still in infancy	g. Natural Resources
8. Some communities require gas stations to collect this for recycling	h. Cullet
9. Some states have deposits on these and collect up to 90% of them	i. Animal bedding
10. Materials that can't be recycled go here	j. Landfills or incinerators
11. If materials aren't recycled, more of these items are used	k. Beverage containers
12. How can we manage our waste in the U.S.? Choose all that fit)	l. Reduce, reuse, & recycle

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Trash Trivia Game

Adapted from "Recycling: Mining Resources From Trash" (1991)

Cornell Waste Management

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GRADE LEVELS: 4-6

SUBJECT AREAS: social studies, science

CONCEPT: How much garbage do we generate, and what are the benefits of recycling?

OBJECTIVE: To learn facts and figures about recycling and solid waste disposal.

MATERIALS:

handout: **Trash Trivia Game Cards**
timer
score sheets
pencil or pen

KEYWORDS: recycling, natural resources, solid waste

PROCEDURE:

1. Divide into two to four teams of three to four members.
2. A member from one team picks a card. The team has 30 seconds to answer the trivia question.
3. If team members answer correctly, they take another turn. If not, the other team takes a turn.
4. Each team gets one point for each correct answer.

Trash Trivia Game

(Correct answers are in bold).

Which country has 6% of the world's population and produces half of the world's garbage?
A. The Soviet Union
B. China
C. The United States

How many trees must be cut to provide paper for one edition of the Sunday New York Times?
A. 62
B. 628
C. 75,000

How many trees are saved when one ton of paper is recycled?
A. 5
B. 17
C. 100

How many tons of dangerous waste are produced by American industries each year?
A. 3 thousand
B. 1 million

C. 250 million

What percentage of landfills in the United States were closed between 1984 and 1988?
A. 30%
B. 5%
C. 50%

What is New York's largest export?
A. food
B. waste paper
C. shoes

How many pounds of glass does each person in the United States use each year?
A. 100
B. 10
C. 50

How much of Japan's waste stream was recycled in one very effective program?
A. 30%
B. 50%
C. 80%

When you buy $11.00 of groceries, how much of that money pays for the product packaging?
A. 10 cents
B. $1.00
C. $5.00

What percentage of our garbage is plant matter and can be composted?
A. 25-30
B. 80
C. 3

By what year should all communities in New York State have started mandatory recycling programs?
A. 1980
B. 1992
C. 2000

How many tons of solid waste does New York State produce in one day?
A. 270
B. 2700
C. 27,000

Should we put all our waste in a landfill?
A. Yes. Out of sight, out of mind.
B. No. Everyone should dig a hole in his or her backyard.
C. No! Fewer and fewer communities are allowing landfills to be built. Land is in demand for housing and recreational use. Many communities are concerned about groundwater pollution, which can seep from a landfill site.

Name something that is made from recycled glass.
Bottles, bricks, construction materials, road-building materials, fiber glass insulation

In how many weeks is the average aluminum can remelted and back on the supermarket shelves?
A. 2

B. 30
C. 6

Why should you recycle your glass and metal containers?
Much less energy (work) is used to make a bottle or can from recycled materials than from raw materials. Glass is originally made from sand and aluminum cans are made from mineral ore.

How much can you pay for packaging when you buy a product?
A. Up to half the total cost
B. 75% of the total cost
C. 3% of the total cost

What percentage of trash is made up of discarded packaging wastes?
A. 70%
B. 30-40%
C. 5%

Which requires less energy: producing aluminum cans from recycled aluminum instead of from bauxite ore?
A. Both ways use the same amount of energy.
B. Recycling uses more energy than mining ore.
C. 90-95% less energy is used when aluminum cans are recycled.

How many tons of solid waste does the world currently produce each year?
A. 7
B. 1000
C. 1/2-1 billion

How many pounds of solid waste per person in the United States are put in landfills each year?
A. 1500
B. 100
C. 500

How many tons of paper that could be recycled does the U.S. throw away each year?
A. 40 million
B. 1 million
C. 1 billion

Name an item that could be reused but is normally thrown away.
Yogurt container, styrofoam package, plastic bag, rubber tire, coffee can, glass bottle

If you can buy a can of soda pop, what should you do with the can after you have finished the soda?
A. Crumple it up and throw it on the ground. It will rot in a while.
B. Throw it in a trash can with other paper wrappers and garbage.
C. Put it with other cans to be recycled, or return it for the deposit.

What two things should you keep out of your compost?
A. apple cores
B. eggshells
C. aluminum cans
D. meat scraps

From what natural resource is new paper made?
A. grass
B. trees

C. stones

What creature is not supposed to be in your compost pile?
A. a worm
B. a mouse
C. a spider

Where is compost naturally found?
A. in the air
B. in the soil
C. under your bed

Why shouldn't we dump our wastes in the ocean?
A. Garbage will break down faster if it is put in a landfill.
B. Waste pollutes the ocean and harms animals and plants that live there.
C. It makes tidal waves.

What can you do with the compost you make from your kitchen and yard wastes?
A. Send it to a landfill.
B. Use it to enrich the soil in your garden.
C. Feed it to your dog.

If we recycle the aluminum trash that Americans throw away every three months, we could:
A. Rebuild the entire U.S. airline fleet.
B. Save a lot of energy.
C. Conserve valuable resources.
{all three answers correct}

If we recycle we:
A. Won't need any more landfills or incinerators.
B. Can reduce the amount of waste going to landfills and incinerators by 25- 50%.
C. Don't need any other disposal methods.

Recycling:
A. Doesn't produce any pollution.
B. Often costs money.
C. Causes lots of pollution.

Incineration:
A. Can solve all our solid waste problems.
B. Serves as part of the solid waste solution in some communities.
C. Only has negative environmental effects.

How can we send less green waste to landfills?
A. Composting in our backyards.
B. Changing our yard management practices, for example leaving grass clippings on the lawn.
C. Teaching our neighbors to compost.
{all three answers correct}

What can we do with wastes that can't be composted or recycled?
A. Dump them on the roadside.
B. Burn them in an incinerator.
C. Bury them in a landfill.

The Throwaway Three: A Skit

(Adapted from Let's Recycle Lesson Plans for Grades K-6 and 7-12, US EPA)

Trash Goes To School
Cornell Waste Management Institute

GRADE LEVELS: 4-6

SUBJECT AREAS: social studies

CONCEPT: There is no such thing as throwing "away" our trash.

OBJECTIVE: To inspire students to think about how much waste we produce and how we dispose of it.

MATERIALS: see list of props (listed in the skit)

KEYWORDS: industrialist, refuse

PROCEDURE: This skit presents the growing amount of trash in the world. As the skit progresses, each player throws more trash on the pile in the middle of the room so that a high stack is created. Someone suggests one way to solve the problem is to recycle. A discussion of ways to solve the problem of too much garbage and trash might follow the performance (see Discussion Notes, below).

Click here for Skit. PDF format

DISCUSSION

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

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

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

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

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

Settler: Had very little garbage, mostly decomposable.

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

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

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

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

Questions to discuss:

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

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The Garbage Diet: A Skit

*(Adapted from Wrap Sessions: Town of Islip Recycling Curriculum
Dept of Environmental Control, Town of Islip, NY)*

Back to Trash Goes To School

GRADE LEVELS: 4-6

SUBJECT AREAS: social studies

CONCEPT: We all can work to reduce the amount of waste we produce.

OBJECTIVE: To help students to think of lifestyle changes that would produce less waste.

MATERIALS: table and chairs, garbage can, and old radio

KEYWORDS: reduce, reuse

PROCEDURE:
CAST
1) Mother - 42 years old, Mrs. Linda Green, Engineer
2) Father - 42 years old, Mr. Ken Green, Teacher
3) Teenager - 16 years old, Maria Green
4) Elementary school-age child - 8 years old, Joseph Green
5) Neighbor - Mrs Gray
6) Relative - Aunt Alice, from New Jersey
7) Grandparent - Grandma (or Grandpa) 70 years old
8) Dawn (Maria's friend) - 16 years old
9) Narrator

BACKGROUND INFORMATION

MOTHER: Mrs. Green works as an engineer. She works hard at her job because she wants her family to have things. She leaves home about 7 a.m. each day and returns about 6 p.m. She commutes to her job.

FATHER: Mr. Green works as a teacher. He leaves home about 7:30 a.m. and returns about 3:30 p.m. Then he starts to cook dinner and do other household chores.

MARIA: High School student. Very popular. Does well in school.

JOSEPH: Third grade student. Very interested in the environment, which he is now learning about in school.

GRANDMOTHER: Born in 1918. She has seen many changes. When she was born there was no TV or radio and almost no one owned a car.

THE PLAY

NARRATOR: The play begins with Mr. & Mrs. Green, Maria, and Joseph sitting around the table eating dinner.
MR. GREEN: What did you do in school today, Joseph?
JOSEPH: Well, we learned about garbage, Dad.
MR. GREEN: Garbage? Are you kidding? I don't think that's a subject for the dinner table, Joseph.
JOSEPH: Oh, but it is. Mrs. Driscoll says each person makes 3-4 pounds of garbage everyday. For homework she told us to make a list of some of the things in our garbage.
MARIA: I don't make four pounds of garbage a day.

JOSEPH: Mrs. Driscoll says teenagers make more than four pounds of garbage a day.
MARIA: I don't believe that. I'll bet you make more garbage than I do.
JOSEPH: Bet I don't.
MRS. GREEN: Why don't you have a contest to see who can make the least amount of garbage in a week?
JOSEPH: We could all do it.
JOSEPH: Could we Dad? Could we? I could write about it and get extra credit.
MR. GREEN: Well, OK, but just for a week.
MRS. GREEN: I suggest that instead of a contest we make it a family project. OK? Let's separate things that get thrown out from things that could be reduced, re-used, or recycled.
JOSEPH: That will reduce the amount of trash that goes to the landfill, Mom!
MRS. GREEN: Is everyone agreed?
EVERYONE: "OK"
NARRATOR: It's now a quarter to seven in the morning. Maria and Joseph are eating breakfast.
JOSEPH: Now remember, Maria, newspaper in one pile, then there are cans for deposit, no-deposit cans, bottles for deposit, no-deposit bottles, food scraps, plastic...
MARIA: I can't remember all that. Who cares about garbage anyway. I'm too busy.
JOSEPH: It's important, Maria. If we don't do something about the garbage, we're going to have serious problems.
MARIA: Like what?
JOSEPH: For one thing, we won't have any place to put it!
For another, it really hurts the water.
MARIA: That's not my problem. Is it?
MRS. GREEN: Hey kids - it's getting late. Joseph your lunch is on the counter.
JOSEPH: But Mom, you used plastic. Plastic is not recyclable.
MRS. GREEN: Joseph, what should we do?
JOSEPH: Maybe I'll save this clean plastic bag and re-use it tomorrow.

* *
NARRATOR: It is now evening. Grandmother, Aunt Alice (from New Jersey), and a neighbor have come to visit.
AUNT ALICE: I hear you folks are going on a garbage diet.
MRS. GREEN: Yes, but it's so much extra work.
GRANDMOTHER: Well, this might surprise you, but when I was a child we had no garbage at all.
MARIA: No garbage? How come Grandma?
GRANDMOTHER: Well, there was just about no plastic at all, and bottles and cans were pretty scarce too.
MRS. GREEN: What about spoiled leftovers or scraps? Who collected that?
GRANDMA: Well no one did. We just put it in a compost pile.
NEIGHBOR: I've got one of those. I just throw the food in a bin in the corner of my backyard. Then later, I put it on my flowers. Sure makes them grow.
MRS. GREEN: I don't want a smelly pile of food rotting in my backyard.
NEIGHBOR: It doesn't smell as long as someone remembers to "TURN" it with a shovel every month, or more often if you have time.
MARIA: But that's work!
GRANDMA: Well, Maria, most worthwhile things do involve some work. But the work has to be shared. For example, your parents work away from home all day so it might be up to the rest of you to help out.
NEIGHBOR: Here in our community recycling's easy. All you need are two pails. One for things that can be recycled, the other for things that cannot.
MARIA: But Grandma, what did you do with all the packages after the food was all gone?
GRANDMA: Well, there were almost no packages.
JOSEPH: You must have starved!
GRANDMA: It wasn't as easy to get food as it is now, but we managed.
MARIA: What did you do?
GRANDMA: Well, just about everyone grew a lot of food in the backyard. Then we cooked the food and stored them in special jars. That's called "canning." Just about everyone had a canning closet full of food which they hoped would last a long time. Potatoes, turnips, carrots, and sweet potatoes were kept in the basement. No plastic bags, no metal cans, no cardboard boxes.

MRS. GREEN: And no food in February.
GRANDMA: Oh, it rarely got that bad, but it's like anything else...there are advantages and disadvantages to having packages.
JOSEPH: Weren't there stores when you were young Grandma?
GRANDMA: Oh there were stores, but you had to bring your own container in which to take the food home. Or, the store gave you a container which you had to give back later.
AUNT ALICE: It seems to me that you people in cities have more garbage problems than in other places.
MRS. GREEN: That's because our drinking water is under the ground. When garbage is thrown out on the ground, any parts that dissolve can go into the water if not properly managed.
MARIA: But that means we can never throw anything out!
MRS. GREEN: That's not as hard as it sounds, Maria. Take that old radio you threw away this morning.
MARIA: Oh, that radio was broken, Mom.
GRANDMA: Yes, but I'll bet your school has a course in electricity.
MARIA: Why didn't I think of that? They could probably have fixed it. But I don't want that radio anyway.
GRANDMA: Yes, but there are people who don't have any radio at all. I'll bet they'd be happy to get a fixed-up old radio.
MARIA: How come you're so smart, Grandma?
JOSEPH: She's not smart, Maria. She's just old.
MR. GREEN: JOSEPH!
GRANDMA: Joseph is right. People learn by making mistakes. The older you are, the more mistakes you've made, and the more you've learned.
MR. GREEN: That's why we have recycling. It's as though everyone is saying, "we've made mistakes, but now we've learned." But even if we repair, recycle, and reduce, we still will have some garbage that will need to be incinerated or sent to a landfill.
GRANDMA: What have you learned, Ken?
MR. GREEN: I was afraid you were going to ask me that. I've learned that going on a garbage diet isn't easy.
JOSEPH: But it's important. Right, Dad?
MR. GREEN: Right, Joseph.
NEIGHBOR: It's not enough to talk about it. Everyone has to do something about it. Wouldn't it be great if every family went on a garbage diet?
MARIA: We would have the world's smallest garbage dump!
MRS. GREEN: And the cleanest water. Joseph has taught us that.
DOOR BELL RINGS...
MRS. GREEN: Maria, it's your friend, Dawn.
DAWN: Hi, Maria. Want to go to the mall?
MARIA: OK, Dawn, but first I have to go through my garbage pail.
DAWN: Your garbage pail????
MARIA: Yes. I want to find an old radio I threw out this morning.
DAWN: OK, but some people are weird.
MARIA: It's not weird. You want clean water, don't you?
DAWN: Well, sure, I guess.
MARIA: Well it's not enough to talk about it. We have to do something about it.
MR. GREEN: We ALL have to do something about it.

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Sarah Cynthia Sylvia Stout

(Adapted from Wrap Sessions: Town of Islip Recycling Curriculum
Dept of Environmental Control, Town of Islip, NY)

Back to Trash Goes To School

GRADE LEVELS: 4-6

SUBJECT AREAS: English, language, reading, listening comprehension

CONCEPT: To allow students to identify with the characters.

OBJECTIVE: To increase awareness of how much garbage we produce.

MATERIALS: pen or pencil and handouts:

Sarah Cynthia Sylvia Stout
Reading/Listing Worksheet

KEYWORDS: compostable, recycle

BACKGROUND: Below is a poem about Sarah Cynthia Sylvia Stout and how she acts and feels about garbage. As you listen to the teacher read the poem out loud, fill in the worksheet or raise your hand as you hear the words that fill in the worksheet. Start with the words that rhyme, then do it again until you have filled in most of the sheet.

PROCEDURE: Read the poem to students and ask them to fill in the chart below.

FOLLOW-UP: Draw a picture of what you think Sarah Cynthia Sylvia Stout looks like and how her house looks. When you are finished, help your teacher make a bulletin board to share your ideas with others.

SARAH CYNTHIA SYLVIA STOUT
by Shel Silverstein

Sarah Cynthia Sylvia Stout
Would not take the garbage out.
She'd wash the dishes and scrub the pans
Cook the yams and spice the hams,
And though her parents would scream and shout,
She simply would not take the garbage out.
And so it piled up to the ceiling:
Coffee grounds, potato peelings,
Brown bananas and rotten peas,
Chunks of sour cottage cheese.
It filled the can, it covered the floor,
It cracked the windows and blocked the door,
With bacon rinds and chicken bones,
Drippy ends of ice cream cones,
Prune pits, peach pits, orange peels,
Gloppy glumps of cold oatmeal,
Pizza crusts and withered greens,
Soggy beans, and tangerines,
Crusts of black-burned buttered toast,

Grisly bits of beefy roast.
The garbage rolled on down the halls,
It raised the roof, it broke the walls,
I mean, greasy napkins, cookie crumbs,
Blobs of gooey bubble gum,
Cellophane from old bologna,
Rubbery, blubbery macaroni,
Peanut butter, caked and dry,
Curdled milk, and crusts of pie,
Rotting melons, dried-up mustard,
Eggshells mixed with lemon custard,
Cold French fries and rancid meat,
Yellow lumps of Cream of Wheat.
At last the garbage reached so high
That finally it touched the sky,
And none of her friends would come to play,
And all of her neighbors moved away;
And finally, Sarah Cynthia Stout
Said, "Okay, I'll take the garbage out!"
But then, of course it was too late,
The garbage reached across the state,
From New York to the Golden Gate;
And there in the garbage she did hate
Poor Sarah met an awful fate
That I cannot right now relate
Because the hour is much too late
But children, remember Sarah Stout,
And always take the garbage out.

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READING/LISTENING WORKSHEET

WORDS THAT RHYME - Example: Out/Stout

WORDS THAT MEAN GARBAGE - Example: Rotten Peas, Ground Coffee

WORDS THAT NAME PLACES - Example: Ceiling

WORDS THAT SHOW ACTION - Example: Scream/Shout

Circle the best answer:

1) Sarah Cynthia Sylvia Stout hates

a) garbage
b) food
c) school

2) She is very

a) smart
b) lazy

c) silly

3) Most of the garbage is made of

a) dead leaves
b) old clothes
c) rotten food

4) The garbage is so bad that it

a) is taken to the dump
b) piles up to the sky
c) burned and buried

Fill in the missing words...

1) When Sarah would NOT take the garbage out, her father _____ and _____.

2) The messy food filled the _____ and _____ of the floor.

3) Two kinds of fruits that were rotting were _____ and _____.

4) A word that means bad or rotten meat is _____.

5) The garbage spread from _____ State to the Golden Gate.

Write one or two sentences to answer the following questions:

1) What is Sarah Cynthia Sylvia Stout's problem?

_____
_____
_____
_____
_____
_____

2) List ten (10) things that mean garbage in the poem. Are they compostable or recyclable?

1. _____ compostable or recyclable?
2. _____ compostable or recyclable?
3. _____ compostable or recyclable?
4. _____ compostable or recyclable?
5. _____ compostable or recyclable?
6. _____ compostable or recyclable?
7. _____ compostable or recyclable?
8. _____ compostable or recyclable?
9. _____ compostable or recyclable?

10._____ compostable or recyclable?

3) What happens when Sarah Cynthia Sylvia Stout won't throw the garbage out?

_____
_____
_____
_____

4) What kind of person do you think she is?

_____
_____
_____

5) What would have happened if she had composted her food scraps?

_____
_____
_____

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Trace Your Waste

(Adapted from Recycling: Mining Resources from Trash
Cornell Waste Management Institute)

Back to Trash Goes to School

GRADE LEVELS: 4-6

SUBJECT AREAS: social studies, home economics, math

CONCEPT: Youth can explore their community by finding out what is done with the waste they produce, e.g. trash, and sewage.

OBJECTIVE: To make students aware of where their own waste ends up and realize that this has an impact on the quality of our lives.

MATERIALS:
Map of town or county
Paper, pencil
Telephone
Resource people:

county government
Board of Supervisors
recycling coordinator
Department of Public Works
county planners

Places:

Landfill
Incineration plant
Recycling facility
Composting facility
Other waste disposal facility

KEYWORDS: solid waste
PROCEDURE:
1. Identify all the waste disposal options in your community.
2. Mark them on a map.
3. Decide where various types of garbage can go. Each item may have several options.
4. Think about what recycling and composting options are available in your community. Are there others that would be desirable? If so, make recommendations to the appropriate local government authorities.
5. Optional: Use the information you gather to write a report on waste disposal or create a bulletin board or exhibit.

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What Is This Bike Made Of?

(Adapted from Recycling: Mining Resources from Trash
Cornell Waste Management Institute)

Back to Trash Goes to School

GRADE LEVELS: 4-6

SUBJECT AREAS: social studies, home economics, math

CONCEPT: What are natural resources, and why are they important?

OBJECTIVE: To identify how many resources are used to produce an item and why each resource is so important.

MATERIALS: paper, pencil, bicycle or picture of one

KEYWORDS: natural resource

BACKGROUND: Use an object that youth are familiar with to explore how many resources are used to make it. Youth should realize that everything is made from a natural resource. Example: pencil, house, bicycle, car, softball.

PROCEDURE: Take an item that you are familiar with and list all the raw materials needed to produce it.

Example: Bike - aluminum (bauxite); steel; plastic; rubber

"What Is This Made Of" Record

Item being examined _____

Parts that make up the object	Raw materials needed	Renewable in 100 years?
e.g. Bike	aluminum - bauxite	no

What Is Oil Really Like?

Adapted from 4th R Recycling Curriculum, by San Francisco Recycling Program, San Francisco, CA

Back to Trash Goes to School

GRADE LEVELS: 4-6

SUBJECT AREAS: science

CONCEPT: What are the properties of motor oil and what effect does oil have on the environment.

OBJECTIVE: To discover the properties in motor oil and see how it reacts when it is put in contact with other natural resources such as water, soil, and plants.

MATERIALS:
* motor oil in 35mm film container (caution: could be harmful if improperly handled)
* jars of water
* ceramic bowls with soil in them
* small plants in pot
* feathers

KEYWORDS: oil, properties

BACKGROUND: Millions of gallons of used motor oil are drained from family cars and disposed of each year. The oil is dumped into storm drains, on vacant lots, and into trash cans. This is an incredible waste of a potentially useful resource that is becoming increasingly scarce and expensive. When improperly disposed, oil can have negative environmental and health effects.

PROCEDURE:
Explain that in this lesson we will discover the properties of oil (what oil is like and what it does when it is used with other things). We will do three experiments. We want to observe what oil does when it comes in contact with water, soil, and plants. Divide the children into small groups. Each group should record their observations regarding:

1. oil with water
2. oil with soil
3. oil with plants
4. oil with animals (bird feathers)

Have each group choose a secretary to record the observations. Each group receives a small film canister with oil, a jar with water, a bowl of soil, and a seedling or plant.
Discuss the findings. Elicit summaries of the students' observations, and post them on the board. After a week, the OIL WITH PLANTS experiment will be completed. Add those findings to the dittoes posted on the board.

FOLLOW-UP: Discuss the following questions:

* How many of you have family cars? Have you seen people adding oil to their cars at the curbside? Have you seen empty cans of oil in the gutter?
* What happens to motor oil when you pour it on the ground, in the sewer, or in the trash can?
* How can we solve the used oil problem? How can we keep used motor oil out of the environment?

* Will your local gas station or recycling center accept used oil?
If they don't, why not?
How can you convince them to recycle used motor oil?

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The Cornell Waste Management Institute
http://cwmi.css.cornell.edu

Sludge

Back to Trash Goes to School

GRADE LEVEL: 4-6

SUBJECT AREAS: reading, science, social studies

CONCEPT: What is sludge, and what can we do with it?

OBJECTIVE: To become familiar with the idea that sludge is a waste product but can also be a resource, depending on its characteristics and how we manage it.

MATERIALS: Handouts:

Sludge: A Waste and A Resource
Questions About Sludge
Sludge: Mix and Match

KEYWORDS: incinerator, toxic, nutrients

PROCEDURE: Have students read the information on the following page, then answer the questions and fill out the mix and match vocabulary exercise.

Answers: 1-f, 2-c, 3-a, 4-d, 5-g, 6-h, 7-i, 8-b, 9-e

Sludge: A Waste and A Resource

Have you ever stopped to think about what happens to water after it goes down the drain in your sink, bathtub, or toilet? This water is called **wastewater**. If you live in the country, your house probably has a **septic system** which separates wastewater into solid and liquid portions. The liquid portion filters through the soil underground. The solid portion collects in an underground tank, and every few years a truck comes to pump out the solids and take them to a building called a **sewage treatment plant** for disposal.
If your house does not have a septic system, your wastewater probably ends up eventually in a lake or stream, but first it is cleaned up so that it will not cause water pollution. Wastewater goes from your house through a series of pipes to the sewage treatment plant. There, the wastewater is separated into two parts: 1) the liquid portion, which is cleaned and sent into a lake or stream, and 2) the solid portion, called **sludge**.

What happens to sludge? Often it is sent to a **landfill**, where it is buried along with garbage and other types of wastes. In some communities it is burned in an **incinerator**, and in other areas it is spread on land or dumped in the ocean. Which of these do you think is the best thing to do with sludge?

The most common way of getting rid of sludge is to send it to a landfill. One problem with this method is that many landfills are filling up, and towns are having trouble finding places to put new ones.

If sludge is sent to an incinerator, most of it is burned up, but there is a part that will not burn. This part, called **ash**, usually is taken to a landfill. Some of the chemicals in sludge go into the air when sludge is burned, and some people are worried that burning sludge will cause air pollution.

In areas where there is plenty of land, spreading sludge on fields can be a good idea. Sludge contains **nutrients**, chemicals which help plants to grow, so sludge can be used to replace other kinds of fertilizers. One problem with spreading sludge on land is that some sludges contain chemicals that are **toxic.** That means they can injure our health if they get into the food we eat or the water we drink. Scientists can do chemical tests to measure what toxic chemicals are in the sludge and then decide whether it is a good kind of sludge to use on land.

Some cities that are near the sea send their sludge on a barge out into the ocean for dumping. This is now against the law because it causes water pollution in the ocean, and these cities will have to find new ways of getting rid of their sludge.

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Questions about Sludge

1. Sludge comes from:

a) garbage
b) the ocean
c) cleaning wastewater
d) air pollution

2. Four ways of getting rid of sludge are:

1)_____
2)_____
3)_____
4)_____

3. One possible problem with incineration of sludge is

_____

4. Spreading sludge on land is

a) never a good idea.
b) sometimes a good idea, depending on what toxic chemicals are in the sludge.

5. Sludge can help plants by providing

a) ash
b) nutrients
c) garbage
d) toxic chemicals

6. What do you think we should do with sludge?

_____
_____

7. How can we make less sludge?

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Sludge: Mix and Match

Match the vocabulary words in the left column with the correct definitions in the right column.

1. Sludge	a) the solids that are left after sludge is burned at an incinerator
2. sewage treatment plant	b) chemicals that help plants to grow
3. ash	c) a place where wastewater is cleaned up
4. septic system	d) a way of treating wastewater in areas where there is no sewage treatment plant
5. incinerator	e) water that goes down the drain
6. toxic	f) the solid part that is left over when wastewater is treated at a sewage treatment plant
7. landfill	g) a place where sludge can be burned
8. nutrients	h) able to injure human health
9. wastewater	i) a place where garbage is buried in the ground

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Recycling and Precycling

Adapted from Earth Day 1990: Lesson Plan and Home Survey - K-6, Stanford University, CA

Back to Trash Goes to School

GRADE LEVELS: 7-8

SUBJECT AREAS: social studies, home economics

CONCEPT: Recycling saves energy and raw materials, and reduces pollution.

OBJECTIVE: To get students to think about the benefits of recycling and the ways that our buying habits influence the amount of garbage we produce.

MATERIALS:

Examples of household garbage items
Handout: **Home Recycling Survey**

KEYWORDS: precycling, disposable, durable

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

The average American throws away 4 pounds of garbage per day. In 1990, it is estimated that Americans will throw away over 1 million tons of aluminum cans and foil, more than 11 million tons of glass bottles and jars, over 4 and a half million tons of office paper and nearly 10 million tons of newspaper. Almost all of this material could be recycled.

Recycling saves large amounts of energy. Recycling one glass jar saves enough energy to light a 100-watt light bulb for four hours. Recycling one soda can saves as much energy as if the can were half full of gasoline. Recycling an aluminum can results in 85% less air pollution and 97% less water pollution than creating an aluminum can from raw materials.

When waste products are recycled, fewer raw materials must be used. Americans threw away 35 billion aluminum cans last year, enough aluminum to build an entire air fleet four times over. Recycling paper reduces the pressure on our forests for wood pulp, so that less logging is needed.

PROCEDURE:

1. Display the household items and ask students what characteristics the items have in common and whether the items might be found in their homes. Tell students that over the next two days they will be thinking about garbage and ways that people can reduce the amount of garbage they produce.

Ask students if any of the items could be used again, either in the same way they were used originally or in a different way. Introduce the terms "reduce," "reuse," and "recycle."

Hand out the survey and explain that the survey is not a test, and there are no right or wrong answers.

Divide the students into groups of four. Have each group discuss what their answers would be to the survey questions. Then have them discuss the following questions:

What three items on the list do you think are found in the garbage of most of your homes?

Where do you think our garbage goes once it leaves our homes?

Have the group share their discussion with the class. Discuss with the students why it is difficult for some people to recycle (their town may not have recycling facilities, their lifestyle is reliant upon disposable products, etc.) Point out that everyone must define a starting point that makes sense for their own lifestyle. They can gradually work on more ways to reduce the amount of garbage they produce.

Introduce the term "precycling" which means to reduce waste by not buying a product in the first place, buying an alternative product that produces less garbage, or buying a product that can be recycled once it is used. Precycling involves selecting a product carefully after considering the manner in which it is produced and packaged, whether it can be reused or recycled, and its overall impact on the environment once it is discarded.

2. Discussion questions:

- What did we find out from the results of the survey?

- Does it appear that most of the people in our survey recycle some household items?

- What ideas did the people surveyed have for precycling? (What alternative products did people list in question six?)

- Why is it important to think about ways to reduce the amount of garbage we produce?

- What might happen if we continue to use disposable products such as disposable diapers, razors, cups, etc.?

- What would it take to convince more people to recycle in our town?

- Agree upon one way that everyone in your group could reduce the amount of garbage in his/her home. Make sure your choice is realistic for each group member (i.e., it is a product that every person now uses, it is re-usable, recyclable and/or replaceable with another product).

HOME RECYCLING SURVEY

1. Put an X by the items that typically go into your garbage.
___ cans (aluminum and/or tin)
___ glass bottles
___ paper
___ aluminum foil
___ styrofoam (containers and packaging materials)
___ cardboard
___ disposable diapers
___ plastic containers
___ newspapers
___ grocery bags (paper or plastic)
___ egg cartons
___ batteries
___ old clothing

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

_____
_____

3. Does your town or city have a place to recycle any of these items?
___ Yes ___ No ___ I don't know

4. Where does your garbage go once it leaves your house?

_____
_____
_____
_____

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

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

6. List five products that your family purchases which produce "instant garbage".
They may come packaged in such a way that you throw away packaging as soon as you open them or they may be disposable so that you throw them away after using them only once or a few times. Can you think of any alternatives to these products?
Instant garbage Possible alternative

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

7. How does it help the environment to reuse things?

_____
_____
_____
_____

8. If you use batteries, how can you reduce the amount you use?

_____
_____
_____
_____

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Do We Throw This Away Or Fix It?

Adapted from A-Way With Waste: A Waste Management Curriculum for Schools, 2nd ed.
by State of Washington, Dept of Ecology

Back to Trash Goes to School

GRADE LEVELS: 7-8

SUBJECT AREAS: industrial arts, horticulture, Vo-Tec

CONCEPT: Durable repairable items are better then disposables.

OBJECTIVE: Students will learn simple repair techniques in order to extend the life of useful equipment and reduce the use of natural resources, the loss of energy, and the cost of landfilling.

MATERIALS:

broken tool
repair equipment:

pliers
hammer
drill
files
saw

KEYWORDS: durable, rivet, peen, planned obsolescence

BACKGROUND: Today's world is a fast paced throw-away society. Industry provides us with disposables rather than durable goods. We throw things away rather than fixing them or giving them to a needy family. Discuss choices that students can make when buying things. Better quality items are more economical in the long term because they last (i.e., appliances, good tools, clothes, radios, stereos).

PROCEDURE:
1. Collect broken tools.

a. Ask students to donate broken tools from home or from friends.
b. Put an ad in the local paper stating that you are collecting old tools for educational purposes. (Beware, you may be flooded with tools. It may be helpful to be specific about what types of tools you want.)
c. Look through junk stores and garage sales for fixable items.

2. Assess the damage to the tool or appliance to see if it is affordable to fix it.

3. Buy or make handles for tools you have received with broken handles.

4. For more extensive repairs, the use of the school shop equipment may be needed. Most repairs can be made using pliers, hammer, drill, files, and a saw.

Example of tool repair: Shovel with broken handle.

Buy a new handle, making sure a rivet is included. Burn out the remainder of the handle and drill out the rivet that

holds it. Line up the new handle and shove it as far as you can into the hole of the blade. Then, place the handle on a wood block and drive the blade down with another woodblock until you get a tight fit. Drill through the rivet hole and insert the rivet and peen the end down.

FOLLOW-UP:
List some of the tools that are thrown away that could be repaired.

What is "planned obsolescence"? How is the concept related to waste?

Collect old bikes or lawn mowers and old parts to see how many working items you have in the end. Then sell them, use them, or provide them to needy children.
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Trash or Treasure?

Back to Trash Goes to School

GRADE LEVELS: 7-8

SUBJECT AREAS:
science
social studies
language arts
environmental education
home economics

CONCEPT: "Trash" includes valuable resources.

OBJECTIVE: To have students find out why, how, and where they should recycle or reuse what they throw away.

MATERIALS:
handout: **Waste Checklist**
pen or pencil

KEYWORDS: brainstorm, feasible

BACKGROUND: The United States is the number one producer of garbage in the world. This is a fact that needs to be changed. We have too much garbage to dispose of it in a traditional manner. Instead, we need to look at our trash as a resource. By reducing, reusing, sharing, and recycling, we can accomplish this, leaving less waste to be disposed of using traditional and new innovative methods.

PROCEDURE:

1. Give each student a copy of the **Waste Checklist** to fill out, or put the list on the board and work through it as a group. Feel free to add your own items.

2. Consider the following questions:

- How could you have reused items?
- Did you wonder whether the napkins were paper or cloth? What difference might this make?
- What could you have done with recyclable items?
- What could you have done with apple cores or orange peels?
- Which items are difficult to reuse or recycle? Why?
- Should we as a society be making products that are reusable or recyclable?
- Should items that are wrapped in difficult-to-dispose-of packaging cost more or be banned?
- Did any of your classmates reuse or recycle any of the items you threw away?
- How did they reuse or recycle the items?
- Was reusing or recycling them easy to do? Why or why not?
- What do you think happens to the items you threw away?
- What items can you recycle in your school?

FOLLOW-UP:
Brainstorm the steps your class might take to design and implement a recycling project for your classroom or school. Select a project that is feasible. For example, collect and recycle paper from the school's copy machine and classrooms. Who can you contact to help you with your project?

Consider doing your project!

Waste Checklist

Directions: Put an X next to the items you threw in the wastebasket this week.

_____ Paper bag
_____ Newspaper
_____ Book
_____ Magazine
_____ Paper milk carton
_____ Other paper
_____ Napkin
_____ Aluminum can
_____ Apple core
_____ Old clothes
_____ Plastic milk carton
_____ Tin can
_____ Glass jar
_____ Gum Wrapper
_____ Orange peel
_____ Plastic bag
_____ Broken toy
_____ Grass clippings
_____ Batteries
_____ Old Clothing
_____ Other

Of all the items you threw out, take an inventory to see how they could have been shared, reused, avoided or reduced, recycled, or composted.
Which items had to be disposed of in a landfill or incinerator?

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Wise Use Of Paper

Adapted from A-Way With Waste: A Waste Management Curriculum for Schools, 2nd ed., by Dept of Ecology, State of Washington

Back to Trash Goes to School

GRADE LEVELS: 7-8

SUBJECT AREAS: social science, math

CONCEPT: Production and reduction of wastes.

OBJECTIVE: To make students, teacher, and school staff aware that they are the first links in the paper recycling process. They will understand that reusing and recycling paper is a way of conserving resources, protecting the environment, and reducing energy use.

MATERIALS: three boxes; scale
KEYWORDS: reduction

BACKGROUND: We use and throw away enormous amounts of paper. About 30%, by weight, of household waste is paper, making it the largest single component of household garbage. Annually, each person in the United States used 580 pounds of paper -- approximately 2 trees' worth. That adds up to 440 million trees a year used to make paper. Americans consume more paper / year / person than any other nation in the world. Paper products use about 35% of the world's annual commercial wood harvest, a share that will probably grow to 50% by the year 2000.

Some paper can be reused or recycled, thus saving money and natural resources. Each ton of paper that is recycled replaces and preserves 13-20 500-pound harvestable trees. Making paper from recycled paper uses 30 to 55% less energy than making paper directly from trees.

PROCEDURE:
1. Have students collect, for a week, the classroom paper they would normally throw away in a week.

2. Weigh the paper. Divide the total by the number of students to see how much each student generated on average. Divide the collected discarded paper into two boxes:

a. paper we can still use
b. paper we have used completely

3. When practical, use paper from box "a" for classroom work and assignments.

4. Put this now fully-used paper into a third box and weigh it. How much paper was reused?

5. Discuss with students where paper comes from. Illustrate on the blackboard the paper process (e.g., trees -- logging -- truck transportation -- processing and production -- wholesale warehouse -- store -- you). Emphasize the use of energy at every step of this process.

Ask: What has happened to the cost of energy in the last five years?

Discuss the environmental effects of logging and paper production, the effects on streams, fish, air, and water quality.

6. Discuss what happens to paper when thrown away. What would be the result if the whole school used two sides of the paper instead of just one? Money saved? Amount of paper used? Pollution reduced? Energy conserved?

7. Referring to the fully used paper - Ask: Can this paper be recycled into new paper or cardboard? What things are made from recycled paper? (New paper, toilet paper, paper towels, building materials, and packaging such as cereal boxes.) How can you tell if something has been made from recycled paper? (Look for the recycling logo on the package. In the case of cereal boxes, if the cardboard is gray, it was most likely made from recycled paper.) Note: 80% of recycled paper is used in packaging.

FOLLOW-UP:
Investigate other wastes that schools throw away and how these wastes might be reduced.

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Packaging Design

Adapted from AVR - Teachers' Resource Guide, Association for Vermont Recyclers

Back to Trash Goes to School

GRADE LEVELS: 7-8

SUBJECT AREAS:
art
social science
home economics
industrial arts

CONCEPT: Packaging is useful and necessary for many reasons, but also contributes significantly to our society's solid waste problems.

OBJECTIVE: Students will explore different aspects of packaging design and will use these guidelines in their own design project.

MATERIALS: magazines and drawing materials

KEYWORDS: design, prototype

BACKGROUND:
Functions and benefits of packaging:

* preservation and protection of contents
* sanitation and safety, protection of public health
* identification of product
* prevention of theft
* providing instruction as to product use
* compliance with regulatory standards
* manufacturing of packaging provides employment
* increased sales and profits by making the product attractive
* may decrease cost of product to consumer

Drawbacks of packaging:

* contributes significantly to solid waste (1/3 of our trash is packaging). Without reuse or recycling, the energy and natural resources that go into packaging are lost forever in landfills
* may create false impression about the amount or quality of product
* may increase the cost of a product to the consumer

How could packaging be designed to waste less?

PROCEDURE:
1. Have students bring in products from home or look in lunch bags for packaged items. Consider the following questions:

- Which packages minimize waste? How?
- Which packages produce a lot of waste? How?
- What are possible ways to reuse or recycle each of the packages discussed?

- Are there any that can't be reused or recycled? Why?
- What qualities do the natural forms of packaging have that many of our modern packaging lack?
- How might some of the over-packaged or wastefully packaged items be better packaged?

2. Have students choose one of the products for which they would like to design an alternative package.

3. Ask the students to look at their products and decide what the designers were trying to accomplish. Discuss the functions and drawbacks of packaging. Are any of the products or packages designed to protect the environment?

4. Have the students design a new environmentally-sound alternative to their packaging. The design should take into consideration waste reduction, reuse, and recycling as well as public safety, product protection, shipping weight, cost of packaging material, advertising, and public demand. New design parameters should include some or all of the following: minimum resource extraction, minimum use of hazardous materials, minimum mixing of different materials, etc. How do these new parameters conflict with or limit the old ones?

5. Have the students make drawings of prototypes, present them to the class and explain how their design decisions were made.

FOLLOW-UP: Explore what makes students decide what items to purchase.

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How Do We Decide?

Adapted from Recycling Study Guide, by Hallowell et. al, Wisconsin Department of Natural Resources

Back to Trash Goes to School

GRADE LEVELS: 7-8

SUBJECT AREAS:
social studies
mathematics
language arts
home economics
marketing
environmental education

CONCEPT: Advertisements are used to make products appeal to consumers. Sometimes we buy products because of this appeal, even if the products are not environmentally responsible choices.

OBJECTIVE: To have students quantify the number of times television and radio ads try to sell products for reasons not related to product quality, and list some of the techniques advertisers use to promote products.

MATERIALS:
- copies of advertisements for various products
- handout: **Survey on Use of Disposable Products**

KEYWORDS: advertising, packaging

PROCEDURE:
1. Find samples of different advertisements for the same type of item (soda, detergent, potato chips). Select ads for different name-brands and types of packaging. Discuss:

- Which product would you buy? Why?
- What is advertising? What is the purpose of advertising?
- Does advertising influence what you buy? How?
- Which advertisement do you like best? Why?
- Do your reasons have anything to do with the quality or function of the product?
- Do you purchase name-brand items instead of generic items? Why?

2. Discuss ways in which products are promoted on television, radio and in print. Analyze at least 25 ads. Note the following:

- Does the advertisement mention the packaging?
- Is the packaging recyclable or reusable?
- Does the ad suggest what you should do with the packaging?

3. Design a chart to help analyze characteristics of these ads. A sample follows (feel free to add other categories):

Name of Name of
Product #1 Product #2 .....
Television_____
Radio_____
Print (magazines, newspapers) _____

Others_____
Status_____
New and Improved_____
Convenience_____
Sex Appeal_____
Symbols_____
Self-Image_____
Flashy Packaging_____
Band Wagon_____
Vague Pronouns_____
Keeping up with the Joneses_____
Other_____

4. Show the results of the surveys done by the students. Discuss:

- Which marketing strategies were used most often to promote packaged product?
- What strategies were used that were not listed on the sample form?
- What usually happens to the packaging?
- Do you think the manufacturer of the product should be responsible for what happens to the packaging once it is bought?

FOLLOW-UP:
Name three reasons you buy one type of packaged product instead of another.
How often are your reasons based on the quality or function of the product?
Discuss ways in which advertisements may influence what you choose to purchase.
Complete the **Survey on Use of Disposable Products**

Survey on Use of Disposable Products

1. What types of products do you buy?
Durable products: (example: cassette tapes, pens, mechanical pencils, combs, appliances, etc.)

Disposable products: (examples: shampoo bottles, fast food containers, toothpaste pumps, plastic packaging, juice boxes, razors, plastic bags, etc.)

2. How much of these types of products do you buy? (be specific)

How often?

3. Do you consider buying alternatives to disposable products? (examples: reusable canvas bags rather than plastic or paper ones, unpackaged products versus packaged ones, washable dishes rather than disposable ones)

4. What do you do with disposable products when you are finished with them?

5. Are you aware of opportunities for plastic recycling in your community?
Yes ____ No _____
Do you save plastics for recycling?
Yes ____ No _____

6. How often do you buy clothes? (number of items per week, month or year)

How do you decide what to buy? (Are you conscious of fashion, etc.? Be specific.)

What do you do with clothes you don't want anymore?

7. What types of things do you recycle and why? (example: to claim deposit, for environmental reasons)

Survey written by Ann Gouldin, High School Senior 1990

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The Cornell Waste Management Institute
http://cwmi.css.cornell.edu

Toxics Lesson Plan

Adapted from Earth Day 1990, Lesson Plan and Home Survey - K-6, Stanford University, CA

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GRADE LEVELS: 7-8

SUBJECT AREAS:
science
home economics
social studies

CONCEPT: Many of the products that we use at home contain toxic chemicals. Some of them could be replaced with safer alternatives.

OBJECTIVE: To realize that chemicals and toxics are all around us and we can make a choice whether or not to use them.

MATERIALS:

- household toxics such as cleansers, solvents, pesticides, engine care products
- handouts:

Household Hazardous Product Survey
Possible Substitutions for Household Toxics

-pen

KEYWORDS: toxic substances

BACKGROUND: A toxic material is any substance that is capable of harming a person if ingested, inhaled, or absorbed through any body surface. Toxic substances vary widely in the types of harm they cause, the conditions under which they become harmful, and the amount it takes to cause harm. The effects of the toxic substances vary widely, too. Acute reactions include vomiting and dizziness. Chronic reactions include decline in mental alertness, change in behavior, cancer and mutation that can harm unborn children of exposed parents. Because toxics can cause both acute and chronic reactions, they are a broader category than poisons, which produce acute reaction only. For this reason, the words "toxic" and "poisonous" are not interchangeable.

Nobody is "for" toxic chemicals in the sense of wanting to endanger ourselves and others, and yet many toxic substances seem to be a necessary part of our lives and have come to be considered essential in our homes, our workplaces, and our schools. This predicament of needing substances that sometimes produce undesirable effects forces people to make choices about what is acceptable to them. Different people are willing to take different risks related to toxics and have varying concerns about the effects of toxics on themselves and people around them. Some people know that many of the products they use are potentially toxic but consider the risk worthwhile. Others try to avoid toxics and thus sacrifice the benefits of certain products.

We do not know exactly how many households in our society use commercial cleaning products, but the number is quite high. In a survey conducted in the Seattle area, 97.5% of the respondents said they had household cleaners in their home. In a 1979 consumer survey of the most-used item sold in the supermarkets, soaps and detergents topped

the list, and other cleaning products such as scouring powders and air fresheners were bought by more people than staples such as milk and butter.

Many people do not know that household chemicals can be quite toxic. Most of the dangerous substances in the home are found in cleaners, solvents, pesticides, and products used for automotive care.

In this activity, students survey themselves and their families to find out attitudes and beliefs people hold about toxics. Older students are also introduced to the terms toxic, risk, and benefit (a risk is a possible danger; a benefit is an advantage). NOTE: handling toxic products can be dangerous to health.

PROCEDURE:
1. During the activity each student will answer the survey questions. Later, for a home learning activity, students will interview family members. Make enough copies of the Household Hazardous Waste Survey so that each student can conduct the home survey.

2. Introduce the students to the survey by posing the questions to the class and discussing their responses. Explain that a survey is a set of questions with no right or wrong answers; surveys allow us to find out what different people think about the same questions.

3. Tell the class that they will be taking home the same set of questions that they have just answered in class. Tell them that they should ask each member of their family to record their individual responses on a separate sheet and share their responses verbally with the child. Ask the student to bring the survey back to school the following day.

4. Discuss questions:

a. What does "toxic" seem to mean to the people we surveyed?
b. Do most people seem to agree on the question of when it is okay to use toxics? If not, why do you think people have different ideas about this?
c. Did members of your family answer the questions the same way as you and as each other?
d. What else did you find out?
e. Was there anything that surprised you?
f. If possible, make copies of the **Household Hazardous Waste Substitution List** for each student to take home.

FOLLOW UP:
Have students draw floor plans for their homes, indicating where and what types of hazardous products may be found there. Discuss safe storage of hazardous products to prevent injury by children and pets. Extend this to a discussion of safe disposal of hazardous wastes (Unwanted portions should be given away or taken to a hazardous waste collection site. Pouring substances such as paint thinner or used motor oil down the drain causes water pollution, and throwing hazardous wastes away may cause pollution of the water draining from the landfill.)

Household Hazardous Product Survey

1. How many of the following potentially hazardous products are found in your home? Make a check mark in column A for each type of waste, such as paint thinner, that you find.

2. Use column B to ask your parents if these items were in their homes when they were kids.

A	ITEM	B
	Nail polish remover	
	Oven cleaner	
	Kerosene	

	Gasoline	
	Bleach	
	Furniture polish	
	Furniture refinisher	
	Paint stripper	
	Paint thinner	
	Drain cleaner	
	Weed killer	
	Degreaser	
	Rug cleaner	
	Metal polish	
	Rust remover	
	Car wax	
	Wood preservative	
	Antifreeze	
	Motor oil	
	Insect repellent	
	Pest strips	
	Batteries	
	Others	

3. Were there any items that YOU checked off in Column A that your parents did not include in Column B? What were they and where are they found in your home?

_____
_____
_____

4. List the ways you can reduce the amount of hazardous products in your home.

_____
_____
_____
_____

5. How can you and your family safely dispose of household hazardous waste?

_____
_____
_____
_____

6. In your house, which room contained the most hazardous products? Why?

_____
_____
_____
_____

Possible Substitutions for Household Toxics

Air Freshener: Set vinegar out in an open dish.

Drain Cleaner: Pour boiling water down the drain, or use a plunger or a metal snake.

Furniture Polish: 1 tsp. lemon oil in 1 pint mineral oil, or rub crushed raw nuts on the wood for an oily polish.

Houseplant Insecticides: Wash leaves with soapy water, then rinse.

Mothballs: Put clothes in cedar chests, or place cedar chips around clothes.

Oven Cleaner: Salt, baking soda, water (and elbow grease!).

Roach Spray: Chopped bay leaves and cucumber skins, or boric acid (sold in powdered form), or 1 part borax and 1 part brown sugar set out in dishes (these are not as effective, and the latter two may be hazardous to animals and children).

Silver Cleaner: Soak silver in 1 qt. warm water containing 1 tsp. baking soda, 1 tsp. salt, and a piece of aluminum foil.

Toilet-Bowl Cleaner: 1/2 cup bleach.

Window Cleaner: 2 tbsp. vinegar in 1 qt. water

Source: Edited from A Guide to the Safe Use and Disposal of Hazardous Household Products, *Metropolitan Area Planning Council, Massachusetts*
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Don't Be Last To Join In: Recycle Today

Adapted from Recycling Makes Sen$e For Your School, Pennsylvania Resources Council

Back to Trash Goes To School

GRADE LEVELS: 7-8

SUBJECT AREAS:
math
economics
social studies
public speaking

CONCEPT: Planning, organizing, and implementing a paper recycling program.

OBJECTIVE: To implement recycling in your school system.

MATERIALS:
containers or bins for collecting recyclables
floor

KEYWORDS: waste reduction, implementation

BACKGROUND:
Why recycle?
Because recycling...
* Conserves energy and natural resources.
* Creates public awareness of conservation needs.
* Gives students hands-on experience with a small business.
* Provides a solution to the problem of litter and solid waste reduction.

PROCEDURE:
1. Organize an initial research committee to find out:

a. The interest level within the school and community.
b. The amount of help you can count on from teachers - preferably those who have been involved with recycling, e.g., paper drive for Scouts and churches.
c. The possible cooperation of the principal, and his or her willingness for school-wide participation. It is essential to the success of your program to get the support of the custodial staff as well.
d. What activities students are already involved in and how much time they can devote (study halls, after school, weekends) to recycling.
e. What materials can be recycled in school and in the community.
f. What students know about recycling.

2. Research your market (where can you sell recyclables nearby, and what are they paying?)

a. Contact scrap dealers and other buyers of recyclables.
b. Find out what materials they accept, how they want them prepared, the minimum quantities accepted, and how much they will pay for them.
c. Find out if they will provide containers or assist in transporting the recyclables.
d. Decide what materials you will collect.
e. Contact local government agencies that deal with solid waste and recycling (e.g. Cooperative Extension, the

Environmental Management Council, the Solid Waste Division).

3. Determine equipment and facilities needed and how much to fund them.

a. Identify safe areas around the school that could be used for collection and storage. Check fire safety standards with the fire inspector.
b. Decide on one or two places where you can site your recycling operation.
c. Investigate types of storage containers and bins, find out where to get them.
d. Realize the starting cost (approx. $150)
e. Discuss preliminary fund raiser possibilities. Select and conduct one.

4. Decide how the recycling operation will be run.

a. Will it be a drop-off center or staffed?

If staffed, who will staff it?
Students or teachers?
Parental aid if permitted?

b. How many people are needed?
c. What days will the center be open?
d. What will the hours be?

5. Write proposal for principal.
Include the information you have gathered from your committee's research:

a. interest level
b. type of operation
c. location sites
d. staffing solution
e. fund raising potential

6. Get school board approval if needed.

a. If required, have committee write a proposal for principal to submit to the school board.
b. Start with initial proposal given to the principal, include all information again and be sure to list sources in school for materials.
c. Important because...

i. With school board approval, activity has the status of a school function.
ii. As a school function, teachers are relieved of primary legal liability.

7. Decide how recyclables will be collected.
Suggestions:

a. Talk to local collectors to find out their requirements (e.g. how paper should be sorted, what kinds of glass may be recycled, etc.).
b. Put a recycling box for clean scrap in classrooms and offices, next to wastebaskets for other materials.
c. If there is a school store or soda machine, put containers for aluminum cans next to the machines.

8. Develop a plan of operation.

a. Choose a permanent committee of directors.

i. Include: roughly 10 teachers, 15-20 students, 1 administrator, (3-5 parents depending on school policy).
ii. Define responsibilities of the directors.

b. Set procedures for students involved in staffing the center.
c. Decide how to publicize the recycling program.

9. Present a plan to the faculty.

a. After school board or principal approval, at the next scheduled faculty meeting, hand out ditto with detailed facts about the recycling center.
b. Explain how the recyclables are prepared.
c. Give a few remarks emphasizing the center's value to the school and community.
d. Allow time for a question and answer session.

10. Present plan to the students.

a. Hold an assembly to:

i. show the need for recycling
ii. give information on other centers
iii. tell how the center is to work
iv. tell how they can help

b. Have a peer teaching program to keep people updated.
c. Announce (for a week) a meeting for all students interested in helping at the center.

11. Publicize the program.

a. Make sure students and staff are educated and periodically updated about the program.
b. Schedule a poster contest with students.
c. Put information in the local paper (run a contest for the best articles and have the winners published).
d. Never underestimate the power of "word-of-mouth" publicity.

12. Maintain reliability.

a. Keep regular hours. Be open when you are scheduled to be.
b. If your center is staffed, make certain volunteers are present when scheduled.
c. Make certain containers are available for collection and are emptied regularly.
d. Keep your collection center tidy.

13. Evaluate the program.

a. How much material is being collected?
b. How much does it cost to run the program?
c. What problems have developed?

FOLLOW-UP:
Expand your recycling operation and encourage involvement by others from your school.

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Math Problems: Aluminum Recycling

Adapted from Classroom Activities, by Dept of Economic & Community Development, State of Maine

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GRADE LEVELS: 7-8

SUBJECT AREAS: math, economics

CONCEPT: Recycling aluminum makes sense economically as well as environmentally.

OBJECTIVE: To become aware of the economics involved in recycling aluminum.

MATERIALS:
pen or pencil
handout: **Math Problems: Aluminum Recycling**

KEYWORDS: recycling

BACKGROUND: Compared with creating an aluminum can from raw materials, recycling one soda can results in 85% less air pollution and 97% less water pollution and uses 90% less energy.

New York State, like several other states, has a bottle deposit law. The bottle bill gives people an incentive to keep litter off the streets and bottles and cans out of the landfill. For each deposit container you bring to the store you receive 5 cents and the container usually is recycled by the company. In other states, cans may be taken to recycling centers which pay by the pound. The following exercise takes place in such a recycling center.

PROCEDURE: Discuss the advantages of recycling aluminum, and have the students complete the problems on the following page.

Answers:
1. 24 cans/lb x 15,000 lb/trailer = 360,000 cans/trailer
2. Answer will depend on your price per can or per pound. For example, if price is 60 cents per pound: $0.60/lb x 15,000 lb = $9,000
3. 15,000 lbs/trailer / 30 lbs/collector = 500 can collectors/trailer
4. 15,000 lbs/trailer / 800 lbs/bale = 18 complete bales (and 3/4 of another bale)/trailer
5. 24 cans/lb x 800 lb/bale = 19,200 cans / bale
6. 100 bales/boxcar x 800 lbs/bale = 80,000 lb. cans / boxcar
7. 100 bales/boxcar x 19,200 cans/bale = 1,920,000 cans / boxcar
8. Answer will depend on your price per can or per pound. For example, if price is 60 cents per pound: $0.60/lb x 80,000 lb/boxcar = $48,000/boxcar

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Math Problems: Aluminum Recycling

Recycling centers store the used cans they buy from can collectors in trailers. A full trailer holds 15,000 pounds of loose cans. There are about 24 aluminum cans in a pound. When the trailer is full, it is hauled to a processing plant where the loose cans are pressed into huge 800-pound bales. Bales are loaded into rail boxcars for a trip to an aluminum company remelting plant. Remelted cans are rolled into new aluminum for new cans.

If you are in a state with a bottle bill, the value of each container is five or ten cents. If your state does not have a bottle bill, find out how much per pound your nearest recycling center pays for aluminum. If you have no recycling center near you, ask a local scrap metal dealer for the price paid for aluminum scrap. Use a price of 60 cents per pound

if you cannot get a local figure.

1. Suppose you own a recycling center. If you want to fill your trailer full of used beverage cans, how many cans will you need?

_____

2. How much cash can you collect for the cans in a full trailer?

_____

3. If each can collector brings 30 pounds, how many collectors must visit the center before a trailer is full?

_____

4. When the trailer is hauled to a processing plant (where loose cans are baled), how many complete bales can be made from one trailer load?

_____

5. How many cans are in one bale?

_____

6. The bales are loaded in railroad boxcars. A boxcar holds 100 bales. How many pounds of cans are in a full boxcar?

_____

7. How many cans are in a full boxcar?

_____

8. How much were can collectors paid for the cans in a boxcar?

_____

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Composting: A Great, Rotten Idea

Adapted from Recycling Study Guide, by Hallowell et al., Wisconsin Dept. of Natural Resources

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GRADE LEVELS: 7-8

SUBJECT AREAS:
science
health
environment eduction
vocational agriculture
home economics

CONCEPT: About 30% of our solid waste is valuable biodegradable material that can be used to improve soil.

OBJECTIVE: To have students investigate the pros and cons of composting.

MATERIALS:
rotting log
grass clippings
leaves or food scraps
microscope or hand lens

KEYWORDS: decomposition, biodegradable, fungi, bacteria

BACKGROUND: When we mention "recycling," we often think of recycling glass bottles, aluminum cans, and newspaper. But another 30% of the household garbage we throw out also can be recycled. These recyclables are food scraps, leaves, grass clippings and other biodegradable organic wastes. Organic waste can be recycled by composting. Simply stated, composting creates optimal conditions for decomposition to occur. Decomposition is the biochemical process by which bacteria, fungi and other microscopic organisms break organic "wastes" into nutrients that can be used by plants and animals. Decomposition occurs in nature whenever a leaf falls to the ground or an animal dies. The results of decomposition in a compost pile is a nutrient-rich humus that is excellent for improving soil quality and plant growth.

PROCEDURE:
1. Define: recyclable, biodegradable. List items that are recyclable and/or biodegradable. Discuss:

Are there recyclable materials that aren't biodegradable? (e.g., aluminum.) Are there biodegradable materials that aren't recyclable? (e.g. food scraps).

2. Feel, smell, and look at the rotting log, grass clippings, leaves or food scraps. What words would you use to describe these materials? List these words. Do the words have positive and/or negative connotations? Why?

3. Explain what is happening to the rotting material. Discuss:

What is the natural process that breaks biodegradable material into particles that can be used again by plants and animals? *(decomposition)*

What organisms assist in this decomposition process? *(fungi, bacteria, earthworms, springtails, mites, etc.)* Take a look under a microscope to find out what you cannot see with the naked eye.

What will your rotting material finally become? *(humus)*

4. Imagine a world where decomposition doesn't take place. Discuss:

What would happen to organic materials like dead animals, leaves or sewage?

Could plants and animals survive if decomposition didn't occur? Why or why not?

Is decomposition important? Why?

5. List items you throw away that are biodegradable. Discuss:

How might you and your family recycle these materials?

What is composting?

Why do you think people compost household organic wastes?

6. What are some benefits of composting household food and yard wastes? For example:

- doesn't require the purchase of expensive plastic bags often used for disposing household and yard wastes.

- saves the cost of transporting wastes to and handling wastes at the landfill or incinerator.

- reduces pollution from landfill (leachate and methane gas) or incinerator.
- creates nutrient-rich humus you can use to improve the texture of your yard and garden soil; saves money you might spend on mulch.

7. What are some possible problems with composting? What suggestions do you have for solving the problems? For example:

It's too much work. *(Mowing the lawn and washing the car are work, too, but we choose to do these activities because they're satisfying - so is composting! And composting has a positive impact on the environment, which can make us feel good.)*

You'd have to run outside everytime you eat an apple or peel a potato. *(Just place the scraps into a plastic container with a lid. Keep the container in or under the kitchen sink, then take the waste to the compost pile whenever the container is full.)*

There's not enough space. *(Share a compost pile with neighbors, and encourage the town to collect and compost yard wastes from people who don't have enough space for a compost pile of their own).*

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Watching Waste Rot

Adapted From Composting: Wastes to Resources, Cornell Waste Management Institute

Back to Trash Goes To School

GRADE LEVELS: 7-8

SUBJECT AREAS: science

CONCEPT: What types of materials decompose, and at what speeds?

OBJECTIVE: To observe biodegradation, noting differences in degradability of various types of wastes.

MATERIALS:

handout: **Watching Waste Rot: Record**
wide-mouth jars
compost sample
organic wastes (you may use one of several kinds of wastes)
flower pots
labels for jars and pots
record sheet
pencil

KEYWORDS: biodegradable, decomposition

BACKGROUND: The organisms in a compost pile need air. When there is not enough air, the organisms die. New organisms that can survive without air come into the compost pile. These new organisms produce a gas that has a nasty smell.

The organisms in a compost pile also need to be able to get at all the wastes to break them down. Is it easier for the organisms to get at large pieces of wastes or small pieces?

Let's investigate how long it takes to break down wastes in the presence and absence of air. Let's also see how long it takes to break down wastes of different sizes.

PROCEDURE:
Fill two wide-mouth jars half-full with compost (contact Cooperative Extension or garden clubs to get compost). Place equal amounts of a particular waste in each jar. Then fill the rest of both jars with compost, burying the waste. Fill the first jar with water and place a lid on the jar. Add just enough water to the second jar so the compost is damp but not wet to the touch. Leave the second jar exposed to air. (Check on the second jar every few days to make sure the compost is still moist, but do not overwater.)

Repeat the procedure with other wastes. Label each jar with the name of the waste placed in it.

Take two more equal portions of a particular waste. Cut the first portion into small pieces, Leave the second portion uncut. Fill two flower pots half full with compost. Place the cut-up waste in the first pot and the uncut waste in the second pot. Cover the waste with compost, filling the pots. Add water to the pots so that the compost is damp but not wet to the touch. Check your pots every few days to be sure they are still moist, but do not overwater.

Check your waste after two weeks. Which wastes are decomposing? Record your observations.

Watching Waste Rot: Record

Name: _____

Date: _____ Date experiment started: _____

Fill in the following table. Under "Waste", write the name of the item that you buried in the jar or pot. Under "Compost", describe the condition of the item buried in the compost. Include such things as how decomposed the item looks, what color it is, and whether or not you see fungi (spots or thin strands) on it.

Waste	Exposed to Air (Y or N)	Compost
1.		
2.		
3.		
4.		
5.		

Waste	Cut/Uncut	Compost
1.		
2.		
3.		
4.		
5.		

Did items decompose faster in the jar with air or the jar with water?

Was there a smell coming from either jar? If yes, what caused the smell?

Were items more decomposed when they were cut up or uncut? Why?

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How Hot Is My Compost?

Back to Trash Goes To School

GRADE LEVELS: 7-8

SUBJECT AREAS: science

CONCEPT: Compost heats up.

OBJECTIVE: To study the dynamics of heat in the composting process.

MATERIALS:
- handout: **Compost Temperature Record**
- laboratory or meat thermometer
- work gloves
- pencil

KEYWORDS: Fahrenheit, Celcius, dynamics

BACKGROUND: When your compost pile is working ideally, it will get hot. The temperature can rise to 150 degrees F (66 degrees C) during the composting process. In the winter, if the compost is working fast, snow will melt on the pile and you may even see water vapor coming off the top. The center of the pile will be warm to the touch.

Turning your compost pile adds air to the pile. Because the microorganisms and soil animals in the pile need air to do their work, turning the pile increases their activity. What effect does turning the compost pile have on its temperature?

PROCEDURE: As your compost pile works, take its temperature. Wearing a glove, place the thermometer deep into the center of the pile. Record the temperature on the Compost Temperature Record. NOTE: Your compost pile or container must be at least 4 cubic feet in volume in order to heat up adequately.

Compost Temperature Record

Name:_____

Date compost pile started:_____

Today's date:_____

Date last turned:_____

Temperature (Degree F or C):_____

Observations (smell, color of material):

What effect did turning the pile have on its temperature?

What effect does turning have on the speed of breaking down material in a compost pile? Why?

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Not In My Backyard: Siting A Resource Recovery Facility

Adapted from Oscars Options, Rhode Island

Back to Trash Goes To School

GRADE LEVELS: 7-8

SUBJECT AREAS: social studies, science

CONCEPT: The waste we generate must go somewhere.

OBJECTIVE: Students will examine the complex social, economic, and environmental problem of siting a resource recovery facility to determine the advantages and disadvantages for the community.

MATERIALS:
* pen or pencil
* handouts: instruction sheet for each group of students (below) and worksheet for each Town Council member

Group 1 - Save the Earth
Group 2 - Neighbors United
Group 3 - Resource Recovery Inc.
Group 4 - Environmental Quality Control
Group 5 - The Town Council

KEYWORDS: resource recovery

BACKGROUND:
Siting any solid waste facility has become very controversial. People are afraid of negative effects to themselves and the environment. At the same time that we do not want facilities near us, we are still generating tons and tons of waste that must be disposed of. Reduction, reuse, and recycling are important strategies, but no matter how good and efficient we become, there will still be residual waste that must go somewhere. Our options include reducing, recycling, composting, landfilling, incinerating and others. Each community will need to come up with a plan to manage its waste. This exercise can be carried out for a resource recovery facility or any other disposal option.

PROCEDURE:
Tell students that they are going to role-play a town meeting in which an important decision must be made. Explain that the town has a solid waste disposal problem and is considering the construction of an incinerator/resource recovery system to be part of the solution. Students will conduct a town meeting to decide whether or not the incinerator should be built.

Divide the class into five groups. Four of the groups will represent specific interest groups testifying at this public hearing. The fifth group will represent the Town Council whose responsibility is to hear the testimony and make a final determination on siting the resource recovery facility. Assign a role to each group and distribute the appropriate instruction sheets.

Explain that one representative from each group will present the group's position and concerns to the Council. Each Town Council member will be allowed to ask questions of the group following the presentation. After all of the position statements have been presented, a block of time for the groups to question each other and for general discussion will be provided. Allow time for discussion and selection of a group spokesperson. Depending on the amount of background information your students possess, you may wish to extend the lesson to allow further work and/or library research or you may proceed with the hearing.

When the group members are ready to make their presentations, assemble the entire class and have the Town Council members sit facing them. The meeting is called to order by the Council Chairperson. Each group spokesperson presents a position statement. After questions and discussion, the Council votes on the proposal to site the facility.

FOLLOW-UP:
Students may want to use this exercise with another group (youth or adult) to help them better understand the complexity of the problem.

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SITING A RESOURCE RECOVERY FACILITY: A PUBLIC HEARING

GROUP 1 - SAVE THE EARTH

The Town Council plans to build a Resource Recovery Facility (RRF) to solve the solid waste disposal problem in our town. They have also proposed a law which will require people to recycle certain things. Under the law, each household would separate aluminum cans and glass from the rest of their waste. These things would be picked up and brought to a processing site near the RRF where they would be sorted and sold. The rest of the waste would be burned. Heat from the waste could be used to produce steam. In turn, the steam could make electricity. The power produced could be used on site or it could be sold to the local power company. The production of electricity would help pay for the cost of running the RRF. Since burning waste reduces its volume, the landfill would receive less waste each day. It would be able to stay open for several more years.

You are a member of a group that is opposed to the Resource Recovery Facility because:

1. There is a chance that the smoke and ash from the burning waste will contain toxic substances. You are worried about dioxin.

2. The town has not discussed the problem of toxics in the ash. After the waste has been burned, the ash will be buried in the landfill.

3. There will be dust and noise pollution from truck traffic.

4. Community members have not made a firm commitment to reduce their solid waste. Careful shopping, composting of yard and kitchen waste, and recycling are all things people must start doing before other alternatives are considered.

You support recycling but think the Town Council has not gone far enough. You want the law to require separation of all glass, metal and plastic food and beverage containers, and newspapers. You think the town should have a composting program. Perhaps the town should ban the sale of non-recyclable items in local stores.

READ AND DISCUSS THE POSITION THAT YOUR GROUP REPRESENTS. OUTLINE YOUR PRESENTATION AND CHOOSE 2 OR 3 MEMBERS OF YOUR GROUP TO JOINTLY PRESENT YOUR CASE TO THE TOWN COUNCIL.

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SITING A RESOURCE RECOVERY FACILITY: A PUBLIC HEARING

GROUP 2 - NEIGHBORS UNITED

The Town Council plans to build a Resource Recovery Facility (RRF) to solve the solid waste disposal problem in our town. They have also proposed a law which will require people to recycle certain things. Under the law, each household would separate aluminum cans and glass from the rest of their waste. These things would be picked up and brought to a processing site near the RRF where they would be sorted and sold. The rest of the waste would be burned. Heat from the waste could be used to produce steam. In turn, the steam could make electricity. The power produced could be used on site or it could be sold to the local power company. The production of electricity would help pay for the cost of running the RRF. Since burning waste reduces its volume, the landfill would receive less waste each day. It would be able to stay open for several more years.

You are a member of a group of people who live in the neighborhood where the Resource Recovery Facility is to be built. You are opposed to the facility because:

1. You think that the presence of a Resource Recovery Facility will lower the value of your property.

2. The truck traffic will disturb your quiet neighborhood.

3. You are concerned about the effect of air and noise pollution on your family's health.

You are also against the proposed recycling program because:

1. Separating the trash is too much work.

2. You have no place to store the things until they are picked up.

3. Extra garbage services will cost more money. That will mean an increase in your taxes.

READ AND DISCUSS THE POSITION THAT YOUR GROUP REPRESENTS. OUTLINE YOUR PRESENTATION AND CHOOSE 2 OR 3 MEMBERS OF YOUR GROUP TO JOINTLY PRESENT YOUR CASE TO THE TOWN COUNCIL.

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SITING A RESOURCE RECOVERY FACILITY: A PUBLIC HEARING

GROUP 3 - RESOURCE RECOVERY INC.

The Town Council plans to build a Resource Recovery Facility (RRF) to solve the solid waste disposal problem in our town. They have also proposed a law which will require people to recycle certain things. Under the law, each household would separate aluminum cans and glass from the rest of their waste. These things would be picked up and brought to a processing site near the RRF where they would be sorted and sold. The rest of the waste would be burned. Heat from the waste could be used to produce steam. In turn, the steam could make electricity. The power produced could be used on site or it could be sold to the local power company. The production of electricity would help pay for the cost of running the RRF. Since burning waste reduces its volume, the landfill would receive less waste each day. It would be able to stay open for several more years.

You are part of the engineering firm which plans to build the Resource Recovery Facility. You are in favor of the project because:

1. It will make a positive contribution to the community by reducing the solid waste problem. Electricity will be produced and many jobs will be created.

2. The problem of toxic substances can be avoided by burning the waste at the proper temperature.

3. Air pollution can be controlled by pollution control devices built into the smoke stacks.

4. The ash will go to a landfill, where plastic liners would collect any leachate.

5. Dust and noise can be controlled by using paved roads that go around, and not through, residential areas. Planting a noise barrier such as rows of trees would also help.

Your company also favors recycling because both aluminum and glass can cause problems for the RRF. Aluminum and glass do not burn well. You know that selling these things will produce money to help pay for extra disposal costs. You would not oppose recycling more items.

READ AND DISCUSS THE POSITION THAT YOUR GROUP REPRESENTS. OUTLINE YOUR PRESENTATION AND CHOOSE 2 OR 3 MEMBERS OF YOUR GROUP TO JOINTLY PRESENT YOUR CASE TO THE TOWN COUNCIL.

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SITING A RESOURCE RECOVERY FACILITY: A PUBLIC HEARING

GROUP 4 - ENVIRONMENTAL QUALITY CONTROL

The Town Council plans to build a Resource Recovery Facility (RRF) to solve the solid waste disposal problem in our town. They have also proposed a law which will require people to recycle certain things. Under the law, each household would separate aluminum cans and glass from the rest of their waste. These things would be picked up and brought to a processing site near the RRF where they would be sorted and sold. The rest of the waste would be burned. Heat from the waste could be used to produce steam. In turn, the steam could make electricity. The power produced could be used on site or it could be sold to the local power company. The production of electricity would help pay for the cost of running the RRF. Since burning waste reduces its volume, the landfill would receive less waste each day. It would be able to stay open for several more years.

You work for the state agency which is responsible for managing solid waste. The agency is concerned about the disposal crisis in the town. You support the construction of a Resource Recovery Facility because:

1. The town has no room to site a new landfill. Current landfill space is quickly filling up. A Resource Recovery Facility will reduce the volume of waste coming into the existing landfill by 85%. This will extend the life of the landfill.

2. Energy recovery will help to offset rising fuel prices.

3. An RRF operated according to state laws and regulations should not create environmental problems.

You are also in favor of recycling because:

1. It is a good way to conserve natural resources.

2. The RRF will work more efficiently and safely if recyclables are removed.

READ AND DISCUSS THE POSITION THAT YOUR GROUP REPRESENTS. OUTLINE YOUR PRESENTATION AND CHOOSE 2 OR 3 MEMBERS OF YOUR GROUP TO JOINTLY PRESENT YOUR CASE TO THE TOWN COUNCIL.

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SITING A RESOURCE RECOVERY FACILITY: A PUBLIC HEARING

GROUP 5 - THE TOWN COUNCIL

The Town Council plans to build a Resource Recovery Facility (RRF) to solve the solid waste disposal problem in our town. They have also proposed a law which will require people to recycle certain things. Under the law, each household would separate aluminum cans and glass from the rest of their waste. These things would be picked up and brought to a processing site near the RRF where they would be sorted and sold. The rest of the waste would be burned. Heat from the waste could be used to produce steam. In turn, the steam could make electricity. The power produced could be used on site or it could be sold to the local power company. The production of electricity would help pay for the cost of running the RRF. Since burning waste reduces its volume, the landfill would receive less waste each day. It would be able to stay open for several more years.

You are the elected members of the Town Council. You must listen to both sides of the issue. Some groups have concerns about the construction of the Resource Recovery Facility. Others have reasons to support it. As they speak, you should take notes on the important points raised on each side of the issue. It is your responsibility to decide whether or not to build the facility. Your decision must be the best for all of the people in your town.

Choose one member of your group to be the chairperson. It will be that person's job to call the hearing to order. Then, he or she must call upon each of the groups to present information either for or against the RRF. Members of the Town Council will have a chance to question speakers after they present their positions.

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SITING A RESOURCE RECOVERY FACILITY: A PUBLIC HEARING

TOWN COUNCIL WORKSHEET

	What are they in favor of?	What are they in favor of?	Ideas for a compromise?
GROUP 1			
GROUP 2			
GROUP 3			
GROUP 4			

How Do Landfills Work?

Back to Trash Goes To School

GRADE LEVELS: 7-8

SUBJECT AREAS: science

CONCEPT: 90% of solid waste is currently disposed of in landfills.

OBJECTIVE: Students will learn how a sanitary landfill is made and operates, and will understand some of the associated pollution problems.

MATERIALS:

* one 5-gallon container and two lids
* clear plastic bag large enough to fit in the container
* three bricks

KEYWORDS: leachate, sanitary landfill

BACKGROUND: Did you know that hogs used to act as garbage disposals in New York City? Long ago there were no garbage trucks or city dumps. In the 1700's, people threw their garbage out of their house into the streets. Hogs roamed the streets eating garbage.

Times have changed. Today several common methods are used to dispose of garbage. They range from burning to burying it in sanitary landfills. The current design of landfills does not promote the breakdown of wastes but does help to reduce their environmental impacts. In New York State, all new landfills have a plastic and clay liner at least 10-feet thick under the garbage, and a 4-foot thick cover over the top. These layers minimize the immediate environmental impacts of landfills but exclude the water, air, and temperature changes needed to degrade waste. Still, some degradation takes place over time, and leachate must be collected. (Leachate is the contaminated water that seeps out of landfills.) Each modern landfill in New York State has a leachate collection system to help keep the leachate from polluting groundwater and surface water supplies.

PROCEDURE:
We will explore one of our modern disposal methods: the sanitary landfill. Use the following procedure to construct a small-scale replica of a sanitary landfill:

1. Cut four 3-inch circles out of the sides of a 5-gallon container.

2. Make one straight cut in the lid from the rim to the center.

3. Cut a half-inch hole in the center of the lid and another in the center of the bottom of the container. Fold the lid together so the ends overlap, and put it down into the bottom of the container. This will serve as the impermeable liner in the landfill.

4. Place a plastic bag inside the container. Pull a corner of the bag out through the hole in the bottom of the container. This will act as the leachate collection system.

5. On top of the plastic liner, place a 10-inch layer of gravel and soil in the bucket and pack it down.

6. Fill the container daily with layers of small pieces of the following: scraps from your lunches, leaves from the

school yard, paper, glass, aluminum, steel, and plastic. The material should be put in at a ratio of four parts waste and one part soil. A good rule to follow would be one inch of waste covered by 1/4 inch of soil. Remember to always cover the waste with soil and pack it down lightly. (To really simulate a landfill, use clay or glacial till as cover as it is less permeable.) Sprinkle a small amount of water on the landfill after each layer of waste and soil is added.

7. Fill the mini-landfill one-half to three-quarters full. Cover with 4 inches of soil. Place the container on three bricks so there will be space under the container for the corners of the plastic bag to fill with leachate.

8. Water occasionally to simulate rain, but don't overwater. Try to reproduce the conditions that exist for a real landfill.

9. When the mini-landfill is complete, use the second lid to cover the container and let it sit for at least two months.

10. After two months have passed, collect the leachate that ended up in the corner of the plastic bag. Empty the contents of the mini-landfill to see which items decomposed and which did not.

Discuss some of the possible hazards that might result from an improperly designed landfill.

FOLLOW UP:

1. Test a sample of leachate for acidity (pH).
How does the leachate smell?

2. Research why leachate needs to be controlled at landfills.
What materials leach from landfills?

3. Take a tour of your local landfill, and find out what is done with the leachate.

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Garbology

Adapted from materials by the Conservation & Environmental Studies Center, Burlington County, NJ

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GRADE LEVELS: 7-8

SUBJECT AREAS: social studies

CONCEPT: If archaeologists in the future were to dig up one of our landfills, what would it tell them about our lifestyles and values?

OBJECTIVE: To get students to think about how wasteful our society can be, and how much of what we call waste can in fact be a valuable resource.

MATERIALS:
None necessary, but discussion could be enhanced by having on hand a variety of objects or pictures representing life in the present compared with the past.

KEYWORDS: resource recovery, planned obsolescence

BACKGROUND: Solid waste dumping grounds are a characteristic of all human settlements. Archaeologists use old dumping grounds as a "link to the past" through which they can learn about ancient civilizations.

The Industrial Revolution of the mid-19th century signaled a change from an agriculturally-based lifestyle to one based on industry and technology. The resulting lifestyle changes have had an important effect on the composition and amounts of solid waste produced.

Materials such as nylon, plastic, and aluminum were unheard of or rare a century ago, when wastes were more likely to be composed of paper, wood, and other biodegradable materials. Another difference that has occurred over the past 100 years is the designed lifetime of products. Until the 20th century, possessions were treasured and handed down to succeeding generations as family heirlooms. With the onset of mass production, many materials made today are designed to last for a limited period of time. This is known as planned obsolescence. This has resulted in a vast increase in the amount of solid waste we produce.

Shoppers today come home with much more than food or other purchased items. In addition, we bring home (and immediately throw away) vast amounts of packaging, used for convenience, sanitation, or marketing. In fact, 1/3 of our trash is packaging. Americans living in less-developed countries are familiar with the idea that waste can be a resource, since many items such as glass jars or plastic containers are removed from their garbage by locals to whom such items are valuable and useful.

Items made from materials such as glass, plastics, or aluminum will last for centuries without decomposing. In modern landfills, even biodegradable materials may not degrade because of the lack of air and water needed by microorganisms. "Garbologists," such as William Rathje of the University of Arizona, have dug into landfills and found undecayed newspapers, leaves, and food over 30 years old.

Garbologists of the future may single out the second half of the 20th century as a time of unprecedented wastefulness of the world's resources. Many of the world's energy resources and raw materials are rapidly dwindling, and some people have suggested that the landfills from our throw-away society will be "mined" in the future as the world's supply of resources becomes more scarce.
Many of our nation's landfills are filling up or being closed because of environmental contamination problems. As local awareness and opposition to landfills have grown, new sites have become ever harder to find. The costs of garbage disposal have risen dramatically because of the scarcity of available sites and because new landfills are built

with many more precautions to protect the environment. As the costs of garbage disposal escalate, we are beginning to look more carefully at what we throw away and to realize that much of what we have traditionally called garbage can instead be used as a resource. Resource recovery operations separate solid wastes into items that can be recycled or reused, and the remainder may be burned for energy generation.

PROCEDURE:
Ask the class to imagine that they are archaeologists of the future, trying to learn about our civilization by studying the artifacts and wastes we have left behind. Have the class work together to produce a timeline describing the types of objects that could typically be found for 20-year intervals from 1900 to the year 2000.
For example:

1900-1920 wood furniture, glass bottles
1920-1940 farm tools, canning jars
1940-1960 manual typewriters, auto tires
1960-1980 aluminum cans, plastic bottles
1980-2000 video tapes, computer components

Point out the differences in materials used from one era to another, such as the introduction of plastics and synthetic chemical compounds.

Discuss what assumptions you might make about society during each time interval, based on the artifacts that were found. For each time interval, what conclusions could be drawn about lifestyles, eating habits, clothing, technology, and impacts on the environment?

Ask the students to write an essay on one of the following questions, comparing their own attitudes with those of their grandparents' generation:

- What is your opinion on the quality and durability of goods made today, compared with 50-100 years ago?
- Were past products made so they could be repaired easily? How about those of today?
- Did people take care of the belongings so that they would last as long as possible? More than they do now?
- What are the consequences of the lifestyle differences between your generation and your grandparents' generation, in terms of the amount of solid waste produced?
- Do you think that people of the future will find more solid wastes from present civilization than we have found from the past? If so, why?
- What do you think will be left behind by today's society that could be found in a few thousand years?
- Do you think any of the solid wastes from present day society might be harmful to future civilizations on earth (e.g. radioactive wastes)? Are the solid wastes of past civilizations harmful to us? If so, how?

FOLLOW-UP:
Have the students make a list of all the disposable objects they can find at home, then discuss possible alternatives to these products or ways of extending their useful lifetimes.

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Map Your Area

Adapted from A-way with Waste: A Waste Management Curriculum for Schools, 2nd ed., by State of Washington, Dept of Ecology

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GRADE LEVELS: 7-8

SUBJECT AREAS:
business
social studies
earth science (mapping skills)

CONCEPT: There are many important groups and individuals that need to be recognized and consulted in the successful operation of a business. Mapping a business district and key business contacts is a valuable tool in the management of a business or project.

OBJECTIVE: Students will map the geographic boundaries of a recycling program's service areas and include the location of buyers important to the program. They will use this map as an aid in managing a school recycling program or project.

MATERIALS:
- county map
- colored pins
- pen or pencil
- telephone
- telephone book

KEYWORDS: feasibility study

BACKGROUND: To better understand their entire community, students will plot all the businesses and buyers related to the recycling industry. The more businesses they are aware of, the more leverage they will have when it comes to markets for their materials and support for their program.

PROCEDURE: Students will:
1. Map the boundaries of the program's service area and locations where waste processing facilities are located, i.e., processing plants, landfills, recycling drop-off centers and transfer stations, incinerators, composting facilities, etc. (You may need to call your recycling coordinator to find locations.)

2. List contacts important to the recycling program and create a map symbol for each. Using the symbols you create, draw a map. If possible, include numbers and locations of area residents for use in deciding where to locate drop-off centers.

a. Compile lists of individuals and groups willing to contribute financially to the program.
b. List neighborhood groups that have expressed interest in the recycling effort.
c. List major contributors of recyclable materials (industries, restaurants, households in community, etc.), and place symbols on the map).
d. Identify government agencies involved, and mark on the map.
e. Inventory possible media sources to be used for publicity.

3. Use your map to devise "action plans" -- methods to systematically contact contributors, pick up materials, etc.

FOLLOW-UP:
Which businesses in your community would be interested in a school recycling project? Why?

Who are the most important people to contact in your community to help your school recycling program?

How will the map with symbols of important contacts help your recycling program?

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Human Problem Solvers

Adapted from Recycling: Activities for the Classroom, by Mary Bowman and Herbert Coon, ERIC Clearinghouse for Science, Math, & Environmental Education, Ohio State University

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GRADE LEVELS: 7-8

SUBJECT AREAS: social studies

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

OBJECTIVE: To investigate solutions for a problem in your community.

MATERIALS: chalk board to record solutions

KEYWORDS: citizen, brainstorm

BACKGROUND: Give your students the following information to demonstrate one solution to an environmental problem.

Aluminum was first made available in abundance at economical prices in the early years of this century. Today over 5,000,000 tons are produced each year to be used in countless ways.

Naturally, with a metal that is this widely used in products, some of these are discarded to become part of our solid waste each year. Aluminum lasts so well that actually less than 1% of all solid waste is aluminum. But with 400 trillion pounds of solid waste and garbage each year, the disposal problem is a real one that has not yet been solved in the United States.

More than 20% of the aluminum used today was once in some other manufactured form. And that percentage could grow with more people getting interested in recycling.

Here is how recycling works: collected soda cans, for example, are brought to one of the hundreds of aluminum reclamation centers or to independent scrap dealers who pay for them according to weight. Then this scrap is shredded, put together in large bundles and sent off to aluminum producers. At the producer, the metal is melted and ready to be used again.

Everyone benefits from recycling of aluminum. The collecting group, like the scouts or school team, earns money for its own use or for community service. The landscape is made more attractive by eliminating litter. There is less solid waste to dispose of, and therefore, less polluting of the environment. And, a valuable natural resource has been conserved by reusing it in products that people want and need. Recycling of aluminum saves 95% of the energy that would be needed to make new metal from ore.

PROCEDURE: Now ask your students to think of a solid waste problem in their community and to devise some possible solutions. Students generally have less inhibited ideas than adults and often come up with very creative solutions.

1. How can we recycle other products as successfully as aluminum?
2. Brainstorm about laws, deposits, environmental and economic incentives to encourage people to participate in solid

waste solutions.
3. What can we do to make recycling of plastics, batteries, tires, paper, organic materials, and others more successful?
4. Remember if you come up with good ideas, talk to your recycling department about them.

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What Is This Computer Made Of?

Adapted from Recycling: Mining Resources From Trash, Cornell Waste Management Institute

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GRADE LEVELS: 7-8

SUBJECT AREAS: science, social studies

CONCEPT: Everything is made from natural resources, some of which are renewable and others of which are not.

OBJECTIVE: To identify how many resources are used to produce an item and why each resource is so important. To have students examine their own use of renewable and nonrenewable natural resources, determine which are essential for their survival and suggest ways they might change their lifestyles to make more careful use of natural resources.

MATERIALS:

paper
pencils
handout: **"What Is This Made Of" Record**

KEYWORDS: natural resources, renewable, finite

BACKGROUND: Most resources are renewable if we have a million years to wait for their production. Renewable resources can be remade in a relatively short time period. Nonrenewable or finite resources may take millions of years, and only if conditions are right. We would like to think we can "manage" our renewable resources, yet we have failed, given the depletion of oil supplies and the rapidly increasing rate of extinction of plant and animal species. Wise use and conservation must be stressed so that we can maintain our resources over the long term.

PROCEDURE:

1. What is a natural resource? Define and list several examples.

2. Define the term "renewable" and "nonrenewable" resource. *(Some renewable resources are: solar energy, water, food and wood. Some nonrenewable resources are: petroleum, tin, bauxite, coal, copper, and lead.)*
3. Use an object that youth are familiar with to explore how many resources are used to make it. Youth should realize that everything is made from natural resources. Example: computer, pencil, house, bicycle, car, softball. List all the raw materials needed to produce whatever object you have chosen. Decide if the resources are renewable or nonrenewable. Discuss the implications of exhausting limited resources. (i.e. the politics of petroleum)

Example: House:

glass (sand)
wood (trees)
cement (sand, water)
aluminum (bauxite)
electricity (coal or oil)
oil
stone or rock
steel
brick

plastic
water

4. Have students list a product they used or consumed between the time they got home from school yesterday and when they went to bed.
-or-
Describe a scenario or event and as a group; list what products were used.

5. Discuss which products are made of renewable resources and which of nonrenewable resources. Classify each product as: essential to survival, maintenance of lifestyle, or a luxury. **Discuss**:

Which, if any, items listed in the "essential" category are really not essential for survival? Explain your response.

Do you think your parents and grandparents would place the products in different categories? Why or why not?

6. After discussing the lists, suggest alternatives for each item, making an effort to replace items that you think are inefficient or wasteful with items that are less wasteful. **Discuss:**

Would using alternatives increase your use of renewable resources (e.g., buying milk in refillable (and ultimately, recyclable) glass bottles rather than in plastic jugs or paper cartons)?

How might changes in the production and consumption of these products influence the economy and the environment?

FOLLOW-UP:
Look at the list of items you listed as luxuries. Which items could you give up without major change in your lifestyle?

Make a list, beginning with the easiest item to give up and ending with the most difficult. Could you give up the top three items on this list for a day, week, or month? Try it. How do you feel about it?

Think of several ways to reuse and recycle items you decided you can't give up.

Identify some of the economic, cultural and environmental impacts of any changes you make or recommend. Consider the implications if your entire family, school, community and country made such changes.

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"What Is This Made Of" Record

Item being examined _____

Parts that make up the object	Raw material needed	Renewable in 100 years?
e.g. computer	copper wire	no

Supply And Demand

Adapted from materials by the American Paper Institute

Back to Trash Goes To School

GRADE LEVELS: 7-8

SUBJECT AREAS: economics, social studies

CONCEPT: Supply and demand.

OBJECTIVE: To realize that there can be and is a demand for things we throw away.

MATERIALS:
flow chart
handout: **Supply and Demand**
pen or pencil

KEYWORDS: supply, demand

BACKGROUND: Recycling is an increasingly important part of the business world. Materials like used paper, glass, metal, and plastic are valuable resources. Many of these products are in demand and some are looking for markets. Just like any new business, the recycling business is finding out where it fits into the economic structure. If we want to help recycling succeed, we must buy items made from recycled materials. The following exercise addresses the supply and demand of waste paper.

The supply of a material is the amount the owners are willing to sell at any one time, place, and price. The supply of one material affects the production, supply, and price of other materials. For example, if waste paper is in short supply, then the cost of cellulose insulation, which is made of waste paper, will be relatively high.

Demand is the amount of an item that buyers are willing to purchase at any one time, place, and price. The demand for one material may affect the demand and price of other, very different materials.

Supply and demand interact, each having an effect on the other and on the cost of materials and goods. When the price of a material such as waste paper is high, more people are willing to sell it. Therefore, the supply of waste paper for sales goes up. When the supply increases past the demand, sellers must compete for buyers. They lower their prices to sell their supply. At the lower price, some sellers no longer want to sell their waste paper. Therefore, the supply of waste paper for sale goes down. When the demand for waste paper is high, the mill raises the price they are willing to pay. When the price goes up, the circle of supply and demand starts again.

Flow chart for waste paper

Collectors gather 10 tons of waste paper > > > > > >

This supply is bought by a waste paper dealer,
who bales it and ships it to a recycling mill > > > > > >

The mill makes 9 tons of recycled paperboard > > > > > >

This paperboard is sold to a carton manufacturer > > > > > >
The carton manufacturer makes 30,000 paperboard cartons > > > > > >

The cartons are sold to a soap factory > > > > > >

The soap factory fills the cartons > > > > > >

The soap goes to the supermarket for the public to buy > > > > > >

and the cardboard cartons are collected for recycling > > > > > >

PROCEDURE: Discuss the flow chart and how the ideas of supply and demand affect recycling of paper. Then have the students complete the supply and demand questions.

Supply and Demand

SUPPLY

1. How does the supply of waste paper affect the ability of soap manufacturers to package their products in cartons made from recycled paperboard?

_____

_____

_____

2. List three things you can do to affect the supply of waste paper.

a ._____

b ._____

c ._____

3. If people collect more waste than a recycling mill can use, what will the mill do?

_____

_____

_____

4. If there is a shortage of waste paper, what will be the effect on the recycling mill?

_____

_____

_____

5. What can the mill do to increase the supply of waste paper?

_____

_____

_____

6. If a waste paper dealer pays collectors $12 per ton of paper, and his business expenses are $25 per ton, what must he charge the recycling mill in order to make a 10% profit on his cost?

_____

_____

_____

7. If the price of a raw material goes up, what is the usual effect on the price of the finished product?

_____

_____

_____

DEMAND

1. List three things that could affect the demand for a particular brand of soap.

a._____

b._____

c._____

2. Let's assume that "Brand-x" soap becomes very popular. Every box in the supermarket is sold, and people still want more. The supermarket then orders 75% more boxes of soap instead of their usual order of 30,000. List in chronological sequence the effect this change in demand will have on each of the operations shown in the flow chart above.

_____

_____

_____

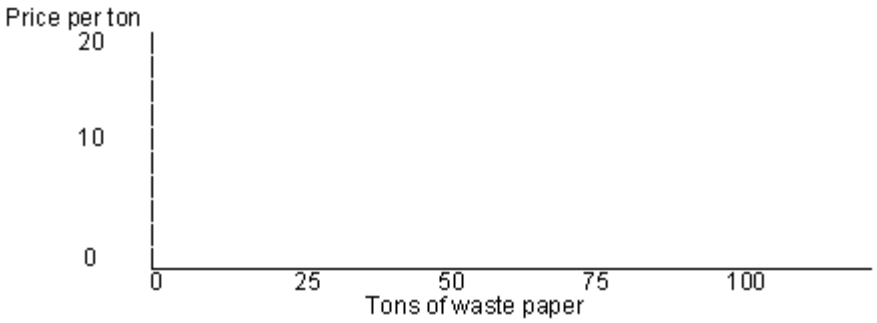
3. In the following table, the first set of figures has been filled in for you. Find the figures that are missing from the second and third set of figures. Round off your answers to the nearest whole number. Note: the dealer's profit is 10% of his total expenses per ton or $5.00 per ton, whichever is less.

Create a fourth set of figures yourself, based on the same dealer's expenses and percentage of profit.

	Collector Receives	Dealer's Expenses	Dealer's Profit	Mill Pays
1.	$12/ton	$25/ton	$3.70/ton	$40.70/ton
2.	$20/ton	$25/ton		$49.50/ton
3.		$25/ton	$5.00/ton	$65/ton
4.				

SUPPLY AND DEMAND

1. You can graph the relationship between supply and demand:



2. The supply curve shows how many tons collectors will supply at each price.

a. Fill in the above graph with the numbers from your chart.

b. Suppose waste paper sells for $18/ton, and at that price, collectors will supply 70 tons. Put a dot where the $18 line meets the 70-ton line.

c. If the price falls to $14/ton, collectors will supply 50 tons. Put a dot where the $14 line meets the 50-ton line.

d. When the waste paper sells for $10/ton, collectors will think it is worth their while to sell only 30 tons. Put a dot where the $10 line meets the 30-ton line.

e. When waste paper sells for $8/ton, collectors will want to sell only 10 tons. Put a dot where the $8 line crosses the 10-ton line.

f. Now connect all the dots. The line is called the Supply Curve.

3. Questions:

a. Now suppose the economy is in a recession, and the products made from waste paper are not selling well. If the mill is forced to lower its demand from 70 tons to 40 tons, what will be the effect on the price of waste paper? Graph the results on the Supply Curve.

b. If the demand is further lowered to 10 tons, what will be the effect on the price? Graph the results on the curve.

c. When the demand for paper increases and the mill needs 60 tons, what price will it pay, based on the supply curve? Graph the results.

d. What will happen if collectors begin to supply more than the dealers demand?

_____

_____

_____

e. What will happen if the supply falls below what the dealers need?

_____

_____

_____

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How Do Our Attitudes Affect Waste?

Adapted from AVR - Teachers' Resource Guide, by Association for Vermont Recyclers

Back to Trash Goes To School

GRADE LEVELS: 9-12

SUBJECT AREAS: home economics, English, social studies

CONCEPT: Each of us is responsible for the size and content of the waste stream we generate.

OBJECTIVE: Students will assess typical purchasing practices to determine the influence of packaging on consumer choices and to determine if consumers consider waste disposal and recycling when making purchasing decisions.

MATERIALS: handout: **Survey on Use of Disposable Products**

KEYWORDS: recycling, waste stream, packaging

BACKGROUND: $1 out of every $11 is spent on packaging. While we need to protect the contents of the products we are purchasing, the amount of unnecessary packaging can be excessive. Buying reasonably packaged products would decrease the amount of waste we throw out.

PROCEDURE:

1. Discuss the leading questions:

What influences our purchasing choices?
Why is there so much waste?

Use the **Survey on Use of Disposable Products** or develop your own questionnaire with the class to use in interviewing people in a grocery store to find out why they are purchasing the items in their cart. Hypothesize from class discussion what the outcome of the poll will be.

2. For homework, have students interview family members for practice. Then have them interview shoppers, asking each about several items in their cart. Before the students do the interviewing, discuss with them the following points:

a. When surveying people you do not know in a store, first get permission from the store manager for conducting the survey.
b. Introduce yourself and ask the shoppers if they would mindanswering some questions for a school survey.
c. Thank them, and be polite.

3. As a class, chart and analyze the results of the poll. Compare with class hypotheses. Identify the most common reasons for buying a food product. What percentage of the shoppers are concerned about waste disposal costs and options when deciding what to buy? How often was recyclability taken into account? How many shoppers knew of local recycling opportunities?

FOLLOW-UP:
Discuss:

What are the major influences on consumer habits?
How can we change our purchasing habits to reduce solid waste?

Have students write a Positive Action Checklist for themselves or for others to help people become aware of solid waste problems and solutions.

Publish the class findings in the local newspaper.

Survey on Use of Disposable Products

1. What types of products do you buy?
Durable products: (example: cassette tapes, pens, mechanical pencils, combs, appliances, etc.)

Disposable products: (examples: shampoo bottles, fast food containers, toothpaste pumps, plastic packaging, juice boxes, razors, plastic bags, etc.)

2. How much of these types of products do you buy? (be specific)

How often?

3. Do you consider buying alternatives to disposable products? (examples: reusable canvas bags rather than plastic or paper ones, unpackaged products versus packaged ones, washable dishes rather than disposable ones)

4. What do you do with disposable products when you are finished with them?

5. Are you aware of opportunities for plastic recycling in your community?

Yes ____ No _____
Do you save plastics for recycling?
Yes ____ No _____

6. Are you aware of opportunities for glass recycling in your community?

Yes ____ No _____
Do you save glass for recycling?
Yes ____ No _____

7. What types of things do you recycle and why? (example: to claim deposit, for environmental reasons)

6. How often do you buy clothes? (number of items per week, month or year)

How do you decide what to buy? (Are you conscious of fashion, etc.? Be specific.)

What do you do with clothes you don't want anymore?

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Survey written by Ann Gouldin, High School Senior 1990

How Does Waste Affect Our Natural Resources?

Adapted from A-way With Waste: A Waste Management Curriculum for Schools, 2nd ed., by State of Washington, Dept of Ecology

Back to Trash Goes To School

GRADE LEVELS: 9-12

SUBJECT AREAS: environmental science, social science

CONCEPT: Natural resources are limited.

OBJECTIVE: Students will compare estimated life expectancies of some nonrenewable natural resources and will understand the role recycling and careful use play in extending the availability of these resources.

MATERIALS:

handouts: **Selected Nonrenewable Natural Resources** (PDF file) and **Worksheet: Nonrenewable Resources**

KEYWORDS: static use, reserve base

BACKGROUND: The global demand for and consumption of most major nonfuel mineral commodities is projected to increase three to five percent annually, slightly more than doubling by the year 2000. There is a limit to how long an increasing population can continue to make increasing demands on our finite resources. Concentrated, easily mined reserves of nonrenewable resources are being depleted. The availability of these resources can be extended by careful use and recycling.

PROCEDURE:
1. Distribute copies of the table **Selected Nonrenewable Natural Resources: Their Life Expectancies and Prime Consumers** (PDF file). Have students complete the worksheet and/or discuss the questions in class.

2. Discuss three alternate depletion patterns for a nonrenewable resource:

A. If we mine it, use it, and throw it away,
B. If we recycle it, or
C. If we reduce per capita use and recycle what is used.

What would a graph look like of the depletion of a nonrenewable resource under these three scenarios? *(Under Scenario A, the curve would rise steeply, peak sharply, and then fall steeply when supplies are used up. Under Scenario B, the peak would be lower and less sharp, and farther to the right, indicating longer term availability of the resource. Under the third scenario, the peak is further flattened, and availability of the resource is extended even farther into the future.)*

How can we determine how long a given resource might last? Any projections are based on two major sets of assumptions: (1) We must estimate the potentially available supply at existing (or future) acceptable prices and with existing (or improved) technology, and (2) We must estimate the annual rate at which the resources may be used.

Worksheet: Nonrenewable Resources

Name_____Date_____

Examine the table "Selected Nonrenewable Natural Resources: Their Life Expectancies and Prime Consumers." Then answer the following questions:

1. Which column under the heading "Life Expectancy in Years" do you think is more accurate in estimating the length of time our nonrenewable resources will last?

2. What are some factors leading to the accelerated use of resources?

3. Examine the "static use" column under the heading "Life Expectancy in Years." Which nonrenewable natural resource will be used up first?

4. Which countries have the highest reserves of this resource? Locate these countries on a world map.

5. Why does the U.S. need to be concerned with the depletion of this resource?

6. Which nonrenewable resource will last the longest according to the static index?

7. According to the projected rates index?

8. Which countries have the highest reserves of this resource?

9. With which countries will the U.S. need to cooperate in order to get the amount of this resource it needs?

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Energy Use Adds Up

Adapted from AVR - Teachers' Resource Guide, by Association for Vermont Recyclers

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GRADE LEVELS: 9-12

SUBJECT AREAS: math, economics, social studies

CONCEPT: Producing energy costs us money, affects our environment, and produces waste products.

OBJECTIVE: To investigate the amount of power used in your home and what appliances use the most.

MATERIALS:
- handout: **Energy Consumption of Appliances**
- home, school, or apartment to assess

KEYWORDS: kilowatt hour, wattage

BACKGROUND: As you will see upon completion of this activity, we use a lot of energy in our lives. Something as simple as leaving the television on for 8 hours can cost us 2656 watts. We tend to flip a switch without thinking about the source of the energy or the waste products produced as a result of our use. What are the environmental effects of power produced by water, burning, wind, sun, or nuclear reactions?

PROCEDURE:
Using the attached list, check off the appliances you and your family use. List any others not included. (Check for wattage printed on the UNPLUGGED appliance.)

Estimate your hours of usage and find the total consumption per day. Find out the cost and source (oil, coal, gas, hydroelectric, nuclear) of energy from your local utility company, and add up your average daily energy cost. Then check off the appliances you think you could do without or use less, such as turning off the T.V. when no one is watching it. Compare the new list with the original:

1. What are the environmental costs per kilowatt hour consumed?
2. What are the sources of energy? (i.e. solar, nuclear, coal)
3. Where does the waste from energy generation go? (i.e. ash, nuclear waste)

FOLLOW-UP:
Explore the waste products produced by the use of power from water, wind, nuclear, burning of waste or other fuel source, batteries, sun or others.

Energy Consumption of Appliances

Item	Average Wattage/hour
Air condition	1,566
Blanket, electric	177
Boiler	1,436
Clock	2

Clothes dryer	5,000
Coffee maker	1,225
Dehumidifier	257
Dishwasher	1,201
Disposal (sink)	445
Fan	200
Food Blender	386
Food freezer (15-21 cu. ft., conventional)	375
Food freezer (15-21 cu. ft., frost-free)	562
Frying pan	1,196
Heater, portable	1,322
Humidifier	117
Iron	1,088
Lighting	100
Microwave oven	1,500
Personal computer	50
Radio	71
Range	2,207
Refrigerator (16-18 cu. ft., frost-free)	615
Self-cleaning oven	2,500
Sewing machine	75
Television, color	332
Toaster	1,146
Vacuum cleaner	630
VCR	40
Washing machine	512
Water heater, quick recovery	4,500

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Recycle All That You Can In School

Adapted from How to Organize Effective Recycling Programs Within Schools, Morris County Solid Waste Management Office, PA

Back to Trash Goes to School

GRADE LEVELS: 9-12

SUBJECT AREAS: social studies, economics, public speaking

CONCEPT: Recycling saves energy and natural resources, reduces pollution, and decreases production of solid waste.

OBJECTIVE: To start an effective school recycling program.

MATERIALS:

containers for recycling
school recycling plan

KEYWORDS: natural resources

PROCEDURE: The following outline is a step-by-step procedure for establishing a recycling program in a school district.

I. Designate a coordinator for the recycling program.

A. The more people you get involved, the more successful your program will be. School administrators, janitors, teachers and students should be included.

II. Choose a method of marketing the recyclables. The following are some alternatives:

- Make arrangements with the municipality to collect the material on a regular basis at a specific location on the school grounds, or
- Transport the material in a school-owned vehicle to a municipal recycling center, or
- Arrange for collection of material by a recycling vendor.

III. Keeping in mind that recycling-related costs will have to be included in the annual budget, undertake a study to estimate future recycling costs. Consider the costs to be incurred for personnel, miscellaneous supplies (for publicity purposes), storage containers (for offices, classrooms, cafeterias, libraries and central storage locations) and transportation.

IV. Determine what materials are to be recycled.

A. Schools can recycle high-grade paper (some examples are lined composition paper, photocopy paper, letterhead, memo paper, computer paper) generated in administrative offices and classrooms.
B. Schools may consider recycling newspaper, corrugated cardboard, aluminum beverage cans, plastic, and glass (food and beverage containers) to further reduce their solid waste stream. Contact your local Recycling Coordinator to find out what is currently recyclable in your area. Composting of yard wastes (brush and leaves) might also be considered.

V. Establish a system for separating, collecting and storing recyclables.

A. Where recyclables will be safely and conveniently deposited in offices,

1. Place properly-labeled containers for paper in the front of each classroom. Comply with whatever restrictions dealers have placed on what types of paper they will accept. Be sure to comply with health, fire and safety codes when selecting and placing containers (metal, rather than paper containers may be preferable in some instances).
2. Place well-marked bins for aluminum and glass near wastebaskets in all areas where food is prepared or eaten. Limiting the openings to recycling containers often helps to alert users that they are not garbage receptacles, i.e., a small hole for cans and bottles).

3. Find an area for flattening, bundling and storing corrugated cardboard and storing newspaper.

B. Decide who will collect recyclables, how frequently the collection will occur and what equipment will be necessary. A sample plan follows:

1. Custodians collect material throughout the school facilities every Friday afternoon by placing each type of recyclable material in a special garbage can, bin or hamper.

2. Custodians then take recyclables to a designated storage area on the school grounds (within a school building proper, in a shed, in a roll-off container or dumpster) until they can be marketed.

C. Educate the school community about the program.

1. Send a memo detailing the program to administrators, teachers, and staff.

2. Schedule time for explaining the program. The education can be done by students, teachers, administrators, or recycling coordinators. Sometimes, the message is better received when delivered by students.

a. Explain the necessity for recycling in the school by referring to the state recycling law, environmental needs, and the fact that we are throwing away valuable resources.
b. Explain how the program will work, including the following:

i. Show samples of the materials to be recycled. Some markets also accept materials such as magazines and corrugated cardboard mixed with office paper. It is important to discuss with your markets what materials will be acceptable.
ii. Explain the importance of keeping recycling containers free of contaminants (e.g., chewing gum, food waste, paper napkins/towels/tissues, waxed paper, aluminum foil, plastics, paper clips.) Note: Staples are generally not considered a contaminant.
iii. Explain where the various recyclables should be deposited within each room and when they will be collected from individual rooms.
iv. Let people know who the program coordinator is so he or she can assist and be notified if there are any problems.

3. Display recycling poster and set up displays in prominent locations in the schools.

4. Include general information about the program in school notice and newsletters which are taken home or are mailed to the student's parents.

5. To unify the program and to heighten its visibility, use the standard recycling symbol or a recycling slogan or mascot in all recycling publicity and on all recycling containers. Consider sponsoring a contest to acquire a suitable slogan or mascot, or ask the art teacher if students may design a poster and decorate storage containers during art classes.

6. Publicize the recycling program in the community-at-large via the local media. Send press releases or contact newspapers, cable television and radio stations to arrange coverage of the recycling program. The media will be particularly interested in unique or unusual events such as the announcement of the winner of the design-a-logo contest or the arrival at a milestone (e.g., the collection of the first ton of paper).

7. Develop a form which can be appropriately filled out and given to anyone whose recyclables are contaminated with unacceptable material or whose regular garbage contains recyclables.

F. Setting good examples for youth to follow is an important task for the schools. If children develop the recycling habit in school, they will probably practice recycling at home and elsewhere in the community; thus the school should be proud of its efforts to "give its trash a second chance."

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A Computer Model For A Recycling Center

Adapted from A-way With Waste: A Waste Management Curriculum for Schools, 2nd ed., by State of Washington, Dept of Ecology

Back to Trash Goes to School

GRADE LEVELS: 9-12

SUBJECT AREAS: computer science, math

CONCEPT: A computer can save a business time and money.

OBJECTIVE: Students will develop a working model computer program of a recycling center which can be used to make decisions about a school recycling program.

MATERIALS:
*computer and manual
*information from school recycling coordinator

KEYWORDS: material management

BACKGROUND: A recycling center has three suboperations for which computer programs should be developed. These suboperations are:

1. material management at the recycling site,
2. work schedules during the hours of operation at the recycling site, and
3. the business finances of running the recycling center.

Material management - This aspect involves:

a. the quantity of materials being generated,
b. the size of the containers and the volume/mass they will hold at the school's recycling site, and
c. the scheduling of pickup and transportation of materials to the local private recycler.

Work schedules - This aspect could involve:

a. scheduling individuals to perform the following tasks - breaking glass, cleanup, separating materials, tieing and stacking newspapers (depending on requirements of local markets), closing up the school center, etc.
b. providing a schedule for pickup of recyclables,
c. providing the appropriate number of workers for peak periods.

Business finances - This aspect involves:

a. monitoring the income, expenses, and earnings of the program,
b. distributing the earnings to the various organizations involved in running the school center.

NOTE: Most programs will not make a profit if time and set-up costs are considered, but there are avoided costs such as reduced tipping fees at the landfill or incinerator because of lowered volumes of trash.

PROCEDURE:
1. Raw data involving the three aspects mentioned above must be obtained from the individual operating the school

center. Once the data are obtained, the programs should be developed and continually modified to accurately reflect the operation of the recycling center.

2. Daily or weekly entries should be made in the program to keep track of the center's operations.

3. Periodic printouts of the three aspects of the center should be made available to the individuals in charge of running the recycling center. The information provided will enable them to make sound decisions concerning the center's operations.

FOLLOW-UP:
List three operations involved in a school recycling center which might be efficiently handled by a computer program.

Who could develop and process a computer program for a recycling center in your school?

Once a computer program for a recycling center has been established, estimate the savings in time to operate the center.

How might a computer program save money for a recycling center?

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Math Problems: Recycling Economics

Adapted from Classroom Activities, Office of Community Development, Waste Recycling and Reduction, Augusta, ME

Back to Trash Goes to School

GRADE LEVELS: 7-8

SUBJECT AREAS: math, economics, business

CONCEPT: Fixed and variable costs.

OBJECTIVE: To study the economics of business, using recycling as an example.

MATERIALS:

handout: **Math Problems: Recycling Economics**

KEYWORDS: fixed costs, variable costs, cost avoidance

BACKGROUND: Recycling is essentially a new business; it has been done for years but only where convenient and economically profitable. Now we are facing problems because we produce so much garbage.

We are now implementing recycling laws, and we are finally starting to pay the real cost of disposal. Recycling is becoming a very popular cost-avoidance method of disposal.

PROCEDURE: Explain the ideas of fixed costs, variable costs, and cost avoidance, and have the students complete the problems on the following pages.

Answers:

1. Fixed costs may include insurance, labor, rent, heat, telephone, taxes and advertising. Fixed costs remain unchanged, no matter how much business is done.

2. Variable costs may include labor, electricity, gasoline and repairs. The longer you operate machinery, the more fuel or electricity it needs and the faster it wears out. Variable costs rise and fall as business increases or decreases.

3. $1,200 / 60,000 lbs. = 2 cents/lb.
5 cents/lb. - 2 cents/lb. = 3 cents/lb.

4. $1,200 / 120,000/lb. = 1 cent/lb.
5 cents/lb. - 1 cent/lb. = 4 cents/lb.

5. Doubling the number of pounds of cans processed has cut in half the fixed cost per pound, resulting in an increase in the amount of money available for variable cost and profit.

Suppose variable costs added another 2 cents per pound of expenses. Profit would be 1 cent per pound if 60,000 pounds were processed, 2 cents per pound if 120,000 pounds were processed.

Math Problems: Recycling Economics

Most recycling business expenses are fixed costs. These costs remain the same no matter how many pounds of cans the center collects per month.

Other expenses depend on how many cans the center collects. These are called variable costs.
1. Can you list some examples of fixed costs that a recycling center might have?

_____

2. Can you list some examples of variable costs that a recycling center might have?

_____

3. If a recycling center's fixed costs total $1,200 a month and 60,000 pounds are being processed, how much is being spent per pound for fixed cost?

_____

How much per pound is left for variable cost and profit out of a 5 cent per pound difference between the amount paid can collectors and the amount received from an aluminum company?

_____

4. If the center can process 120,000 pounds a month without increasing fixed costs of $1,200, how much is then being spent per pound for fixed costs?

_____

How much per pound is left for variable costs and profit?

_____

5. Can you explain why a recycling business may earn more money as the number of cans collected increases?

_____

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De"compost"ition

Adapted from Increasing Solid Waste Awareness in the Classroom: Lessons in Resource Recovery, by Jennifer Cotner, Cornell Cooperatative Extension of Genesee County

Back to Trash Goes to School

GRADE LEVELS: 9-12

SUBJECT AREAS: science, ecology

CONCEPT: Decomposition of organics.

OBJECTIVE: To develop an understanding of the decomposition process and the parameters which influence the rate at which it occurs.

MATERIALS:

* 2 compost piles, of the same size and made up of materials in the same stage of decomposition. (In the fall, have students bring in grass clippings, leaves, and food wastes.)
* pitch fork or shovel
* nitrogen fertilizer
* thermometer

KEYWORDS: decompose, aerobic, anaerobic, humus

BACKGROUND: Can you think of a system of recycling which is already being practiced in nature? Have you ever walked through the woods and spotted an old log? And did you take a closer look to find all kinds of neat creepy, crawly critters? What you were witnessing was a form of "composting", recycling back to the soil the nutrients that were once a part of the plants and animals.

In decomposition, microorganisms in the form of bacteria, protozoa, fungi, and invertebrates are able to break down dead plants and animals to obtain energy. They also release many of the nutrients back into the environment for the benefit of future plants and animals. Two types of decomposition can occur in composting:

<u>with oxygen</u>
dead vegetation + oxygen + water --> carbon dioxide + water + energy + heat
<u>without oxygen</u>
dead vegetation + water -->carbon dioxide + methane + hydrogen sulfide + energy

Both processes are called respiration, the metabolic transformation of food into energy. Process 1, however, occurs in the presence of oxygen and is called aerobic respiration. Process 2 occurs in the absence of oxygen and is called anaerobic respiration. Aerobic respiration occurs at a faster rate than anaerobic respiration because bacteria are able to metabolize more quickly in the presence of oxygen and heat.

Study the two formulas and answer the following questions:
1. If respiration occurs at a faster rate in the presence of oxygen and heat, and if oxygen is available from the atmosphere, where does the heat come from? *(The working organisms produce heat.)* When would the compost eventually slow down? *(When all available nutrients are consumed.)*

2. What would you conclude about a pile of decaying vegetation if it began to smell like rotten eggs? *(It does not have enough oxygen and has gone anaerobic.)* Why do you think landfills smell? *(They are compacted, not aerated).*

3. How does a system become anaerobic when our atmosphere contains 21% oxygen? *(The material is compacted or too wet, inhibiting exchange of oxygen with the atmosphere).*

4. If I wish to speed up decomposition, what would I do? *(Add oxygen by turning the pile).*

5. An anaerobic system can reach temperatures near 160 degrees F. How could this be beneficial? *(It kills some weed seeds and pathogens.)*

You can build a compost pile bin easily by constructing a frame out of wood or chicken wire and filling it with leaves, yard clippings, and even food wastes. Do not include meats, fats, or milk products because they will attract animal pests.
Two essential ingredients for your compost pile are oxygen and moisture. To provide oxygen, turn your pile every week or so, especially if you smell a rotten egg odor or if the compost feels cool to the touch. Moisture could be provided naturally or artificially, but do not soak the compost pile. Soaking fills up air spaces and can cause the pile to become anaerobic quickly.

The optimal size for a compost pile is at least 3 feet x 3 feet x 3 feet. This provides enough mass to maintain proper temperatures for composting.

Another important ingredient is nitrogen, which may be provided from the atmosphere, or usually from organic matter. Nitrogen is an essential element with which bacteria make amino acids, and therefore, enzymes. Enzymes enable the bacteria to break down organic matter faster.
Another idea is to shred leaves, kitchen waste etc., making them smaller. This increases the amount of surface area which can be colonized by the microorganisms, therefore increasing the rate of decomposition.

PROCEDURE: Design a "controlled" experiment by comparing decomposition rates between two compost piles. A controlled experiment is one which enables you to answer a specific question by testing only one criterion while leaving all other criteria constant. For example:

Question	Experiment
Which environment results in faster decomposition rates: aerobic or anaerobic?	Turn one compost pile periodically, while leaving the other pile to rest.
Does an increase in surface area result in a faster decomposition rate?	Shred materials before adding to one compost pile, while adding materials to the other pile whole.
Does an increase in nitrogen result in a faster decomposition rate?	Add nitrogen fertilizer between layers of compost material in one pile only, or add more nitrogenous material such as grass clippings or food wastes.
Does atmospheric temperature affect decomposition rate?	Measure the rate of decompositionin a compost pile in the early fall compared with the winter.
Does the pile generate heat? How does the temperature change when the pile is turned?	Using a glove, insert a thermometer deep into the compost pile.

FOLLOW-UP:
Start a school composting project, or encourage students to compost at home.
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Light My Fire

Adapted from Waste Management Awareness Attitudes Activities, St. Lawrence County, NY

Back to Trash Goes to School

GRADE LEVELS: 9-12

SUBJECT AREAS: chemistry, physics, earth science

CONCEPT: Energy is created when objects are burned.

OBJECTIVE: To determine the numbers of calories in various products.

MATERIALS:

- graduated cylinder
- metal cup
- burner
- sparker
- clamp and stand
- thermometer
- tongs
- corn products (snack food)

KEYWORDS: endothermic, exothermic, isothermic

BACKGROUND: By burning food, one can determine the calories produced. The calories equal the mass of the water multiplied by the change in temperature. A kilocalorie = 1000 calories. 1 ml. of water has an approximate mass of 1 gram. A calorimeter is a device to do this process. Exothermic means produces energy, endothermic means absorbs energy.

PROCEDURE:

1. Determine the mass of a JAX (a snack food). Record on table.
2. Clamp the sides of the metal cup to the stand.
3. Measure out 50 ml. of tap water and put it into the cup.
4. Determine the temperature of the water and record it below.
5. Light the burner. Hold a JAX at one end with the tongs.
6. Ignite the other end and then quickly place it under the metal cup. Keep it there until all the JAX is burned. (Note: if the flame goes out, reignite it and continue.)
7. Determine the highest temperature for the water and record it.
8. Calculate the number of calories produced.
(# cal. = t x mass of water)
where t = temperature change
9. Repeat the procedure with fresh tap water and a DOODLE, then a BUGLE.

Data	Food Mass (g)	Temperature Initial Final	Temp. Change	Mass Water	#Cal. Produced	cal./g (food)
JAX						
DOODLE						

BUGLE						

Analysis:

1. Which product produced most calories/g.? _____

2. What is the number of kilocalories produced by the JAX?_____; the DOODLE?_____; the BUGLE?_____.

3. If a bag has 200 JAX, how many kilocalories will be produced? _____; 200 DOODLES? _____; 200 BUGLES? _____.

4. All the reactions were (exothermic, endothermic or isothermic). Circle answer.

Landfill Leachate

Adapted from materials by the Conservation & Environmental Studies Center, Burlington County, NJ

Back to Trash Goes to School

GRADE LEVELS: 9-12

SUBJECT AREAS:
English composition
science
social studies
earth science

CONCEPT: All landfills produce some leachate. Whether the leachate contaminates groundwater depends on how the landfill is built, as well as on characteristics of the site.

OBJECTIVE: To become aware that everything we do on and to the surface of the earth affects our water.

MATERIALS: Local land use maps, soil maps, land use planning documents, solid waste reports (see agencies listed below for sources of these documents).

KEYWORDS: leachate, permeability, aquifer, water table

BACKGROUND: Groundwater, the source for wells and springs, supplies drinking water to over half of the people in this country and over 90 percent of the residents in rural areas. Of the population served by public water supplies, close to 40 percent rely on groundwater. Geological formations which yield significant amounts of groundwater are called aquifers. The top of the groundwater layer is called the water table.

Although traditionally groundwater has been assumed to be free from contamination, numerous discoveries in recent years of toxic chemicals in well water have proven this assumption to be false. Groundwater contamination from chemical dumpsites tends to attract the greatest public attention, but a number of other sources including landfills, septic systems, pesticides, and underground storage tanks also can be significant sources.

Water percolating through landfills produces leachate, which may contain undesirable or toxic chemicals. Modern sanitary landfills are constructed to prevent leachate contamination of groundwater or surface waters. The bottom of the landfill is lined with impermeable layers, and the leachate is collected and treated before being released to the environment.

Factors affecting the composition of landfill leachate include:

Landfill material. Is it biodegradable or non-biodegradable? Is it soluble or insoluble? Organic or inorganic? Liquid or solid? Toxic or nontoxic?

Landfill conditions. The pH, temperature, degree of ongoing decomposition, moisture content, climate, and landfill age.

Characteristics of entering water. The pH, temperature, and amount.

Soil characteristics under the landfill. Permeability, depth and thickness of geologic strata, and mineral content.

The risk of groundwater contamination by any leachate that is not caught by collection systems is determined by the

following factors:

Depth of the water table. If the water table is low (far below the ground surface), water will become partially filtered as it percolates downward through the soil. If the water table is high (close to the ground surface), contaminants can enter the groundwater directly, without filtration by soil.

Concentration of contaminants. A high concentration of contaminants in leachate will make groundwater pollution more likely.

Permeability of the geologic strata. Highly permeable geologic strata allow water to quickly percolate through, receiving little filtration along the way. Strata consisting of relatively impermeable materials such as silt and clay impede the downward percolation of water.

Type of geologic strata. Some earth materials, such as clay, are more effective at filtering out contaminants, not just because they are impermeable but because chemicals can bind to their particle's surfaces.

The toxicity of the contaminants. Leachate is produced when water filters downward through a landfill, picking up dissolved materials from the decomposing wastes. Depending on characteristics of the landfill and the wastes it contains, the leachate may be relatively harmless or extremely toxic. Generally leachate has a high biochemical oxygen demand (BOD) and high concentrations of organic carbon, nitrogen, chloride, iron, manganese, and phenols. Many other chemicals may be present, including pesticides, solvents, and heavy metals.

The direction of groundwater flow. Groundwater moves slowly and continuously through the open spaces in soil and rock. If a landfill contaminates groundwater, a plume of contamination will occur. Wells in that plume will be contaminated, but other wells, even those close to the landfill, may be unaffected if they are not in the plume.

PROCEDURE:
Have the students write a report about the sanitary landfill your community uses, including how the leachate is collected and treated, and whether any groundwater or surface water contamination problems have been found. This could be a group project. There are many old town landfills, so individuals or small groups could address different landfills.

As part of the research for this project, the students should contact some of the following organizations:

- the local department of solid waste
- the New York State Dept. of Environmental Conservation
- the local planning board
- the local health department
- the local Environmental Management Council
- the regional office of the U.S. Geological Survey, for information on aquifers and groundwater
- the Soil Conservation Service, for local soil data

The students' research should address questions such as the following:

1. Where are the local landfills? (Plot them on a map.) How long will they continue to take waste?

2. Does the landfill have a leachate collection system? If so, how is the leachate treated? What other measures have been taken by the landfill operators to prevent groundwater contamination?

3. Have any water quality problems (either groundwater or surface water) been identified in the area surrounding the landfill?

4. Is there an aquifer near the landfill? If so, is it used for any community water supplies? Where are the nearest wells?

5. What is the depth of the water table below the landfill? Are there any impermeable layers between the landfill and underlying groundwater?

6. What water quality regulations apply to the landfill operations? What types of water quality testing are performed?
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The Cornell Waste Management Institute
http://cwmi.css.cornell.edu

Testing Leachate

Adapted from Waste Management Awareness Attitudes Activities, St. Lawrence County, NY

Back to Trash Goes To School

GRADE LEVELS: 9-12

SUBJECT AREAS: biology, chemistry, earth science

CONCEPT: Landfills, compost piles, or any other concentration of waste produces leachate.

OBJECTIVE: To realize what leachate is, where it comes from, and what its properties are.

MATERIALS:

- waste materials
- 50 ml. graduated cylinder
- water
- separatory funnel
- pH paper
- hardness paper
- turbidity tester
- bunsen burner
- sparker
- platinum wire
- test tubes
- handout: **Leachate Data Table**

KEYWORDS: turbidity, hardness

BACKGROUND: Students will know what makes up a landfill. In the lab an artificial landfill will be set up and tested.

Landfills do not contain just solids, but also liquids and gases. Leachate is liquid that may leak from a landfill. Leachate forms from a combination of liquids that are dumped, liquids that form through decomposition of wastes, and precipitation filtering through the wastes.

In older, unlined landfills, leachate drains into nearby streams or into the underlying groundwater. Modern, lined landfills are designed to include systems for leachate collection and treatment to prevent such contamination problems. You may want to try to obtain a leachate sample from a landfill, or you can create your own leachate (See **How Do Landfills Work?**, levels 7-8).

PROCEDURE:
1. Students will define leachate, pH, turbidity, hardness, flame test.

2. Students will use the following correctly: a separatory funnel, graduated cylinder, and other laboratory materials.

3. Students will determine the pH, turbidity, hardness and some ions in the leachate.

4. Students will discuss why it is necessary to cap landfills on the top and have a liner on the bottom to minimize environmental problems.

5. To make a landfill, add representative samples from your lunch to the separatory funnel until it is approximately half full. Add 50 ml. of water (this represents rain water) and put on the top and shake for 1 minute.

6. Wait ten minutes and then draw off 10 ml. of leachate into the graduated cylinder.

7. Do the following tests: pH, hardness, and turbidity. Record the results on the **Leachate Data Table**. Repeat procedures over a period of days, using new samples each time.

FOLLOW-UP:
Test stream, lake, pond, and tap water, and compare the results to those from leachate.

Leachate Data Table

Test Results

	Day 1	Day 2	Day 3	Day 4	Day 5
pH					
hardness					
turbidity					

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It's A Gas

Adapted from Recycle Reuse, by Cornell Cooperative Extension of Rockland County

Back to Trash Goes to School

GRADE LEVELS: 9-12

SUBJECT AREAS: physical science and earth science

CONCEPT: Gases are produced when waste degrades.

OBJECTIVE: To build an organic waste methane generator. To learn by running a scientific experiment, and to see what happens when people alter nature's way of recycling.

MATERIALS:

- Copies of attached data recording sheet and graph for each member
- Measuring cup
- Wax pencil
- 3 one-gallon jugs, glass or plastic (1 painted black or dark-colored)
- 1 rubber stopper with one hole
- 1 rubber stopper with two holes
- 2 three-inch long pieces of glass or copper tubing
- 2 18-inch lengths of rubber tubing that will fit over the glass or copper tubes
- 1/2 gallon of vegetable food wastes, chopped fine
- graph paper for charting
- handout: Data Sheet: Methane Generation

KEYWORDS: methane, landfill

BACKGROUND:
The teacher should:

1. Collect materials necessary to build a model digester.
2. Paint one of the jugs before the meeting.
3. Involve members in discussing what methane gas is, how it is generated and how it can be used.
4. Assign tasks independently or plan to do together as a group.
5. Discuss where the digester should be kept once it is built

The students should:

1. Discuss how methane gas is produced and how it can be either a hazardous or valuable by-product of landfills.
2. Discuss how to build a model methane digester.
3. Follow the steps to build the digester.
4. During the next 12 weeks, keep track of the water level in the third jug. Record your findings on the data recording sheet.
5. Use the data you gather from the experiment to draw a line or bar graph on graph paper. (Graph the gas generated vs. time). What factors influence the speed, amount and concentration of gas generation?

PROCEDURE:
1. Fill the painted jug at least half full of vegetable material. Finish filling to the top with water.

2. Fill the second gallon jug with water.

3. The third jug should be clear enough to see the water level. Use the measuring cup to fill this jug with water one cup at a time. After each cup, mark the water level on the outside of the jug with a wax pencil. When the jug is filled and marked, pour the water out. Number the cup markings from bottom to top. (The experiment begins with this jug empty).

4. Fit the glass or copper tubing into the stoppers:
The first stopper has one hole, and the tubing extends through the hole into the gas layer at the top of the jug. The second stopper has two holes: one for the tube coming from the first jug, and the other for the tube connecting the second and third jugs. The tube from the first jug extends into the gas layer at the top of the second jug. The tube leading to the third jug extends down into the water of the second jug, reaching almost to the bottom of the jug. The third stopper has just one hole, for the tube coming from the second jug.

5. Insert the stoppers and connect the bottles.

6. Place the entire apparatus where it will not be disturbed or moved for 12 weeks, but where it can be examined regularly by the group.

7. At the end of the 12th week use a methane gas meter to measure the methane concentration in the second bottle.

8. Hints:

- A methane gas meter is helpful but not necessary to measure the amount of gas generated at the end of 12 weeks. Check to see if you can borrow one from a local gas company.
- The amount of gas can be measured without a meter. Note that the methane generated in the dark jug moves as a gas to the second jug where it displaces water. That water flows into the third jug. Each cup of water that collects in the third jug represents 14 cubic inches of methane gas.
- Factors that influence the amount of methane produced include:

    light
    temperature
    availability of oxygen
    presence of water
    type of organic material
    amount of prior decay

FOLLOW-UP:
Find out if your community landfill is collecting methane for use, or venting it to prevent explosions.
Repeat the experiment, varying environmental conditions to see how they affect methane generation.

- Change the composition of the waste used.
- Place the model generator in a location where the temperature is different.
- Don't add water to the waste.
- Replace the painted jug with a clear one, and put the generator in a well-lit spot.
- Compost some wastes before putting them into the generator.

A model digester, accompanied by copies of the data sheet, could be used as a fair project.

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Data Sheet: Methane Generation

Date of Measurement	# Days Since Experiment Started	Water Collected This Day	Total Water Collected	Gas Displaced (1 Cup water = 14 in.^{3} methane

The Daily Waste Times

Adapted from Waste - A Hidden Resource, by Keep America Beautiful

Back to Trash Goes to School

GRADE LEVELS: 9-12

SUBJECT AREAS:
language arts
English
social studies
journalism

CONCEPT: Using the newspaper to increase awareness of waste management issues.

OBJECTIVE: Students will be able to:
(1) describe qualities of a newspaper article that make it effective,
(2) define waste and identify local waste problems and practices, and
(3) select one component of a newspaper which communicates about the issues of waste management.

MATERIALS: newspaper articles on waste management

KEYWORDS: issue, waste management

BACKGROUND: The expression "The pen is mightier than the sword" means that an idea can be advanced and attitudes can be changed more effectively through the written word than through battles. Historically, newspapers have played an important role in social issues. On almost any given day there are references in the newspapers to the issue of waste. Citizens are becoming more concerned about what is happening to the tons of waste generated every day and how this affects our environment. The major purpose of this activity is to provide an opportunity for students to respond to the issues of waste management through journalism.

PROCEDURE:

1. With the students, analyze the components of a newspaper (editorial, short article, photo story, etc.) in terms of the qualities that contribute to the newspaper's effectiveness or appeal.

a. Assign to each student (or team of students) one of the discussed components of a newspaper. Each student (or team) will be responsible for producing an example of the newspaper component assigned to him/her (or the team).
b. Explain to the students that they will be writing and publishing a special edition of a mini-newspaper focusing on the issues of waste management.

2. Review with the students the definition of "waste" and discuss our attitude toward waste.

a. Discuss waste management in terms of waste disposal. Discuss current disposal methods (usually dumping into a landfill); costs; regulatory agencies (Environmental Protection Agency and State agencies); options that can reduce the amount that must be landfilled (reuse, recycling, composting, incineration); and the responsibility for managing waste (everyone's responsibility).
b. Ask each student or team of students to read resource materials pertaining to waste and to read and clip newspaper articles about waste problems. Post the newspaper articles as they are clipped and brought in.

3. Have each student write a short article or editorial, or produce a photo story (or other newspaper component) on an aspect of waste management.

a. Compile the students' articles into a mini-newspaper.
b. Reproduce the mini-newspaper for distribution in the school and/or community.

FOLLOW-UP:

1. Interview people who are involved in waste management (e.g., elected officials, sanitary landfill operators, recycling center personnel, representatives of industries that use recycled materials) and write an article about your findings.

2. Collect photographs related to waste (landfill sites, home waste ready for pick up, activities that generate waste, recycling centers, etc.) and use the pictures for other assignments or projects.

3. Plan a class project of collecting data and photographs concerning waste management and writing an article for publication in a local or regional newspaper.

4. Invite a reporter who has written a waste management story to visit the class and discuss the article he/she wrote.

5. Critique some of the articles that were collected from newspapers. What statements are misleading? What do they make the reader think about?

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Time For Action

Adapted from A Citizen's Guide to the New Recycling Law, Sponsored by the Oneida-Herkimer Solid Waste Management Project and developed by Cornell Cooperative Extension of Oneida County

Back to Trash Goes to School

GRADE LEVELS: 9-12

SUBJECT AREAS: social studies, science, language arts, environmental education

CONCEPT: Students can get involved in their community.

OBJECTIVE: To help students understand the process of taking environmental action and to help them develop a plan to get involved in a community problem. Have students identify a specific waste management problem in their community, design research questions to address it, conduct the research and decide how and whether to take action to help solve the problem.

MATERIALS:
- newspaper
- telephone
- resource people i.e.:

Department of Public Works
Planning Department
Recycling Coordinator
Environmental Management Council
Department of Health

KEYWORDS: Environmental Management Council, Planning Dept.

BACKGROUND: Living in a democratic society, we have many opportunities to get involved in our community. However, few people know how to get involved and make a difference with their suggestions. In this investigation, students will learn about the key environmental actors and how they can fit in to the decision-making process.

PROCEDURE:
1. What are several key solid waste management issues in your community? Find out about them by reading local newspapers, attending meetings of solid waste planning groups, talking to municipal or state solid waste managers, finding out the viewpoints of local environmental groups or reviewing local budgets for hauling and disposing of trash.

2. Select a local waste issue to investigate individually or as part of a small group. Focus on an issue that can be investigated within a reasonable amount of time. Topics for investigation:

How can you reduce the amount of waste you produce?

a. What steps could you take to reduce the amount of solid waste you make at home?
b. How can people be informed about changing their buying and living habits to reduce the amount of waste they dispose of?
c. How do various restaurants compare in what and how much waste they generate?

If you have a recycling plant:

a. How much waste has to be disposed of in an incinerator or landfill?
b. Waht are some of the pollution problems associated with recycling?
c. How could recycling rates be increased in your community?

If you have an incinerator:

a. How much reduction is achieved by burning?
b. Discuss any political or environmental problem the community has confronted.
c. Is incinerating waste for energy an economically and environmentally sound management option?

If you have a landfill:

a. What can be done if the local landfill is almost full?
b. Is methane gas a problem in the landfill? What are possible solutions?
c. How much water falls on a landfill during the year? How much of this becomes runoff and leachate? Find out how leachate is managed. How often are leachate collection tanks pumped at different times of the year?
d. What are the pollutants in leachate? What are the sources of these pollutants? Which are the most harmful?

3. Define your issue as precisely as possible; develop a research question(s) and conduct the research to answer your question. Possible research techniques for collecting data to help answer your question could include telephone interviews, development and use of surveys and questionnaires, and use of both primary and secondary references.

4. Prepare a research report to present in class. The report should include a description of:

a. the issue
b. the research question
c. the method of investigation
d. the data gathered
e. how you analyzed the data
f. what conclusion you made from the study (both the knowledge gained and what value that knowledge has)
g. what concepts, values and beliefs influenced why you asked the question, why you selected the research method and how you interpreted the results.

You may want to speak or interview the following people for information:

- Town Supervisor
- Environmental Protection Agency
- Department of Environmental Conservation
- Department of Public Works
- Local Health Department
- Recycling Coordinator
- Environmental groups
- League of Women Voters
- Cooperative Extension Agent
- Environmental Management Council

FOLLOW-UP:
Questions to consider as you investigate your issue and before you decide to take action include:

a. Who is involved in the issue and what are their beliefs, values and attitudes?
b. What are my beliefs and values on this issue?
c. What specific types of action will I take ? (persuasive, consumer, political, legal, direct, and/or personal action?)
d. Is there sufficient evidence to warrant action on this issue?
e. Are there alternative actions that I could take?
f. What are the legal, social and economic consequences of this action?
g. Do my personal values support this action?
h. Do I understand the procedures necessary to take this action?
i. Do I have the skills necessary to take this action?
j. Do I have the courage to take this action?
k. Do I have the time needed to take this action?
l. Do I have all the other resources needed to make this action effective?
m. What are the ecological consequences of this action?

If you decide to take action, choose strategies for which there is a likelihood of success within a realistic amount of time. For example:

- Survey litter production on your block, instead of surveying litter production in your entire town.

Add a conclusion to your report that describes the action you took and any results.

Speak to community groups about your findings. Write an article or letter to the newspaper about your findings.

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Investigate Your Community

Adapted from Woodsy's Wastewise, Cornell Cooperative Extension, Broome County

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GRADE LEVELS: 9-12

SUBJECT AREAS: social studies, English, government

CONCEPT: Students can get involved in their community.

OBJECTIVE: To practice research skills and gain access information in your local community.

MATERIALS:
- Pen
- Paper
- Telephone
- Brochures on topic (if available)

KEYWORDS: community

BACKGROUND: In this exercise students will collect data on recycling and solid waste in their local community. To get this information it may be necessary to contact the recycling coordinator, county government (Department of Public Works), and other educators in your county.

PROCEDURE:
Find the answers to the following questions:
1. What is the population in your county?

2. How many townships or municipalities are there?

3. How much garbage is produced?
[While the national average is 3.5 pounds per day, New York State residents produce about 6 pounds per day.]

4. How is garbage disposed of? Possibilities include putting it in a landfill, recycling, waste-to-energy, composting, and shipping to other places.

5. How much does it cost per ton to dispose of waste per ton? This may include:

a. tipping fees (cost per ton to dispose of garbage at the landfill or waste-to-energy plant)
b. cost per household if using a public or private hauler, including collection and transportation
c. cost per ton if your county ships garbage to a location outside the county

6. Is there a recycling and/or composting program in your area?

a. Is it run by a public or private organization?
b. How can citizens participate in the program?
c. What types of resources are being recycled?
d. How much is being recycled?

7. Compile this information into a fact sheet, write articles for the school or local newspaper, or in any way possible share it with your school, family, community, church, and other groups.

8. You may want to do this exercise once or twice each year to record the changes that have occurred.

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Mock Trial: Roadside Dumpers

Adapted from Waste Management Awareness Attitude Activities
St. Lawrence County, NY

Back to Trash Goes to School

GRADE LEVELS: 9-12

SUBJECT AREAS: social studies, government

CONCEPT: Waste management and the legal system.

OBJECTIVE: To encourage students to understand our legal system and note the seriousness of environmental crime.

MATERIALS:
- classroom set up like a court room
- costumes (optional)
- gavel
- library
- handout: **Description of Characters**

KEYWORDS: defendant, prosecutor

BACKGROUND: It is illegal to dump garbage or hazardous waste along roadsides or in other inappropriate places. Roadside dumping is on the increase for many reasons: it has become harder to dispose of some garbage, it is becoming more costly to dispose of, and some people just don't care. We need to be aware of these problems and encourage people to dispose of their garbage properly. If not, they will have to deal with the legal system.

PROCEDURE:
As you proceed, the students will participate in a mock trial, including the following characters: defendant, Reelie Sneaky; Judge, Hand D. Shaker; Prosecutor, B. Goodenough; defendant's attorney, D. Vide; other witnesses as needed (at teacher's discretion). The class will act as the jury (the jury will write questions on 3x5 cards to assist the prosecutor and defendant).

1. Assign students to find out how a trial proceeds (visit a courtroom if possible).

2. Define the roles of the:

    judge
    defendant
    prosecutor
    defendant's attorney
    witnesses

3. Read about courtroom procedure.

4. Discuss what a roadside dumper is and what motives exist for illegal dumping.

5. Have students read the appropriate character descriptions, then judge, in a mock trial, Reelie Sneaky, charged with being an illegal dumper.

6. Have students write an essay discussing the harm caused to society by illegal dumpers.

7. What woul be appropriate punishment for Reelie Sneaky if he is found guilty (fines, jail, clean-up, etc.)?

FOLLOW-UP:

- Find out more about environmental crimes.
- Research the Superfund Act.
- Follow an environmental crime case in your area.

Description of Characters

Reelie Sneaky - Defendant
You really know better than to dump garbage on the roadside because you have been caught before. This time while you were visiting Grandma Jones out in the back 40 you didn't think anyone could possibly see you, so you unloaded your pickup truck into an area that was already messy.
You claim to be innocent and an outstanding citizen of Rose County.

Hand D. Shaker - Judge
You are an O.K. judge who doesn't want to make too many waves. You know Reelie Sneaky from the softball league and around town. You listen to the case and then poll the jury to make a final decision.
You will decide the sentence if one is needed.

B. Goodenough - Prosecutor
You know the defendant and you know or strongly suspect that he has gotten away with this before. You are going to do your best in questioning him to make sure the truth comes out. Reelie forgot to check his garbage and threw out a letter addressed to himself that was found by the investigators.

Witnesses - Sam and Mary Flack and their two kids
You were having a family picnic on this nice sunny day. You saw something unusual happening about 200 yards away. While driving back home, you saw the new pile of trash and realize that the blue and white pickup must have left it there. He apparently didn't see you picnicking.

Character Witness - Joe James
You have known Reelie for 10 years, and you don't think he would do such a thing.

Jury
The class will act as the jury. You need to listen to the facts that are uncovered and make a judgment whether or not Reelie is guilty.

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The Cost Of The Toss

Adapted from Recycling Study Guide
by Hallowell et al., Wisconsin Department of Natural Resources

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GRADE LEVELS: 9-12

SUBJECT AREAS:
social studies
mathematics
environmental education
science
health

CONCEPT: Cost of disposal.

OBJECTIVE: To have students develop a better understanding of what options exist for managing solid waste, and the cost and benefits of each option.

MATERIALS:
students to play roles
handout:

Managing Garbage From Homes: Options and Impacts - Part I
Managing Garbage From Homes: Options and Impacts - Part II
Managing Garbage From Homes: Options and Impacts - Part III

KEYWORDS: criterion, value

PROCEDURE:
1. Imagine yourself as the mayor of Noteworthy, New York. Yours is a pleasant city of 65,000 people. Unfortunately, Noteworthy is in the midst of a crisis: your landfill must be closed because it doesn't comply with present standards for protecting the environment. What is Noteworthy going to do with all its garbage?

As mayor, you're responsible for investigating new options for managing Noteworthy's solid waste. You begin by forming a solid waste committee to study the options. Who do you think should sit on this committee (town treasurer, public works director, citizen representative, landfill developer, etc.)? Assign fellow classmates to play these roles and decide on a name for your committee.

You will want to involve the whole class or group and if time permits, carry out the committee meetings over several days or one day a month for several months. It can serve as a great research learning experience to come together, ask questions, form subcommittees to answer the questions (as follows), and come together with new information on which to base decisions. If students already have done research on this topic, they may be able to make the decision in one day.

2. Call a meeting of the committee. Prepare a chart to help members see some options and the impacts of managing garbage from Noteworthy' homes and businesses. Include for each disposal alternative factors such as the number of employees needed, the landfill needs per year, the net cost per year, the amount of energy used and/or produced, environmental concerns and the type of citizen participation required. Study your chart and, as a group, consider the following questions:

- At first glance, which waste disposal option seems best? Why? Do you all agree? Is there one best option? (reduce, recycle, compost, incinerate, or landfill?)

- What criteria and values are you using to judge options? Are you pro-business, pro-taxpayer, pro-environment, pro-convenience? Discuss how your personal point of view might influence how you judge the importance of each potential impact.

- Would you feel differently if a facility were located near your home?

- How do the options relate to state or federal laws and regulations?

- For how many years into the future are you planning? (Plan for a 10-year term, at least). Why is this an important consideration (population growth, long-term economic and environmental impacts, etc.)?

- How would transportation requirements affect your choices?

- Compare the pros and cons of citizen convenience and environmental impacts for each option. Do you consider citizen convenience more important then environmental impacts or vice versa? Why? How does your view affect which option you think is better?

- What is the relationship between net cost and citizen convenience? Is what's convenient the least/most expensive? Should saving money be a major concern?

- Does your chart calculate in the "costs" of each option's long-term environmental impacts or use of natural resources? What might these "costs" be? How much should the committee be concerned about these "costs" in making a decision?

- If creating jobs is high on your list of priorities, which option would you choose?

-You have read somewhere about composting municipal solid waste. Where can you find out more about composting? Why might your community consider composting as a valid option for managing part of the waste stream? Which wastes could be composted? About how much of the waste stream could be composted? What will you do with the compost?

- What are the pros and cons of incineration? Do you think the benefits (landfill space saved, energy produced, convenience) outweigh the costs? How much ash will be produced, and where will it go? How much energy will be generated? What are the experiences of other communities that already have installed incinerators?

- What are the pros and cons of recycling? What wastes could be recycled? What percentage of the waste stream could be recycled? What will happen to the rest? Where will the recyclables go?

3. Investigate what is required by your local, state, and federal governments for choosing the waste management option(s) for Noteworthy (e.g. public hearing, citizen referendum, DEC approval, environmental impact statement).

4. Do you feel you have enough information to make a wise decision for your town? If not, where can you find this information?

5. Now that your committee has investigated and discussed the options for Noteworthy's solid waste management plan, make a decision about which option(s) the town should enact.

6. List suggestions for what you can do to ensure the success of Noteworthy's new waste management plan (e.g., community education, providing containers for recycling).

Waste-to-Energy

Adapted from A-way with Waste: A Waste Management Curriculum for Schools
2nd ed., Dept of Ecology, State of Washington

Back to Trash Goes to School

GRADE LEVELS: 9-12

SUBJECT AREAS: social studies, civics, government

CONCEPT: Solid waste can be used to create energy.

OBJECTIVE: To learn what resource recovery plants are and basically how they operate. Students will consider the positive and negative aspects of resource recovery as a solid waste management option.

MATERIALS:

- telephone
- local incinerator
- handout: Solid Waste Options

KEYWORDS: bottom ash, waste-to-energy, refuse-derived fuel

BACKGROUND: We must look at all our options for safe and proper disposal. One of these options is the use of resource recovery facilities (also known as waste-to-energy plants).
Resource recovery facilities are an expensive, highly technological method of dealing with large volumes of solid waste. The basic operating principle of resource recovery plants is to burn refuse. Recyclables may be separated out by mechanical means before burning ("front-end processing") or after burning, or they may not be separated out at all. In any case, 20 to 30 percent of the original refuse is noncombustible and nonrecyclable and must be disposed of in a landfill.

Intense heat from burning is used to create steam, which in turn may be used to generate electricity. Solid waste managers hope that a continuing rise in the cost of electricity will help pay off the cost of energy recovery plant construction. Given the enormous volumes of solid waste produced in urban areas, some solid waste managers have come to see energy recovery facilities as necessary components of solid waste management systems, along with landfills and recycling.

Critics of energy recovery plants, however, raise objections. Some of these are the high cost of construction, the air pollution caused by refuse burning, and the ash which contains heavy metals and must be disposed of in landfills. Critics also point out that energy recovery plants require a steady flow of garbage. Maintaining that flow, critics say, will discourage recycling and will allow people to avoid their individual responsibility to generate less waste. This objection can be answered by taking recycling into account when sizing the incinerator.

PROCEDURE:
Consider the following solid waste management options:

- prevention
- reduction (selective buying to reduce waste)
- recycling
- composting
- energy recovery facilities

- landfills

Research and discuss each of these options (these are listed in order of national priority). Discuss the pros and cons of each, and list on the following table.
Remember that each community is unique and needs its own waste management plan. There are no master blueprints for waste disposal.

After researching and discussing the options, put together a plan for your community, taking into consideration the following:

- pounds of garbage produced
- community water supply
- population
- rural vs. urban land available
- air quality
- the environmental effects of the disposal method
- roads and bridges (adequacy for transport of wastes)
- presence of materials that don't burn or are dangerous in landfills or incinerators.

Ask:

- Which combination of options would best serve your community in the long term?
- Is any one of these options adequate on its own to handle your community's solid waste?
- If you were the city official with responsibility for dealing with solid waste, which options would you choose?
- Who in your local government makes decisions about the management of solid waste?

After this exposure, you may want to get involved in your community's planning process.

FOLLOW-UP:
Organize a debate around the following proposition: Our city/county should build a waste-to-energy plant to incinerate our garbage. Call solid waste managers, recyclers, leaders of environmental groups, and representatives of a burn plant construction company for various points of view on this subject.

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Potential Hazards in Your Home

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GRADE LEVELS: 9-12

SUBJECT AREAS: science, home economics

CONCEPT: Many products we use in our homes consist of hazardous chemicals, but less hazardous alternatives do exist.

OBJECTIVE: To increase awareness of how many hazardous chemicals we come into contact with.

MATERIALS:

- 3 to 5 household cleansers, pesticides, disinfectants, or deodorizers
- telephone
- handouts: Pre-test/Post-test, List of Products, Table 1, Table 2

KEYWORDS: carcinogen, hazardous chemical

BACKGROUND: We tend to assume that our homes are safe places. Are they really safe? In a household or school investigation, find out what types of cleansers, pesticides, disinfectants, and deodorizers are used. NOTE: Some hazardous chemicals present an acute danger only (if used properly, they present little risk). Others such as carcinogens cause chronic risk, and even short exposures may cause a problem over time.

PROCEDURE:
1. Do pre-test.

2. Find 3 to 5 substances that you suspect might have harmful effects. Good places to look would be in the medicine chest, under the kitchen sink, or in the garage or basement.

3. Read the labels on each product and call the information number if one is available (NOTE: If it is not a toll-free number, ask for permission.) Get as much information about the product as available.

4. For each product, list the ingredients, potential health effects, and possible substitutions.

5. Check Table 1 to see if there are harmful effects from the listed ingredients.

6. Check Table 2 for a less harmful substitution that you could use.

7. Do the post-test to determine whether knowledge and attitudes have changed as a result of these investigations.

Answers to Pre-test/Post-test:
1-F, 2-F, 3-F, 4-T, 5-F, 6-F, 7-T, 8-F

FOLLOW-UP:
Explore types of substitutions that can be used in homes and schools to make the environment safer.

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Search A Word

Adapted from Here Today, Here Tomorow...Revisited: A Teacher's Guide to Solid Waste Management, by New Jersey Dept of Environmental Protection, Division of Solid Waste Management

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Cornell Waste Management Institute

GRADE LEVELS: 9-12

SUBJECT AREAS: science, social studies, English

CONCEPT: Solid waste management includes many options, with varying costs and environmental impacts.

OBJECTIVE: To become familiar with some of the vocabulary involved in solid waste management.

MATERIALS: handout: **Search a Word**

KEYWORDS: energy recovery facility, refuse-derived fuel

Groundwater Model: Where Does Our Water Come From?

by Cornell Cooperative Extension, Broome County, NY

Trash Goes To School
Cornell Waste Management Institute

GRADE LEVELS: 9-12

SUBJECT AREAS: science, ecology

CONCEPT: All water is interconnected.

OBJECTIVE: To demonstrate where groundwater is located and how we get it to the surface. To visualize the movement of polluted groundwater through the earth.

MATERIALS:

- 1 clear plastic tumbler
- 8" piece of plastic tubing
- disposable plastic syringe
- beach sand
- coffee filter
- pebbles
- 1/2" square piece of cloth
- red food coloring
- spray bottle

KEYWORDS: groundwater, leach

PROCEDURE:

1. Fasten piece of cloth over one end of plastic tubing with tape or a rubber band -- this acts as a filter.
2. Place covered end of plastic tubing against the bottom of the cup and tape to the side of the cup.
3. Place pebbles or large gravel in the bottom third of the cup (this represents bedrock).
4. Cover gravel with filter paper cut from a coffee filter.
5. Fill rest of cup (1" from the top) with white or light colored sand -- this represents soil layers.
6. With a spray bottle, rain on the sand until water visibly filters into the gravel.
7. Place syringe in open end of plastic tube and draw the plunger out. As water fills the syringe, your model is working. The syringe represents a pump. The ground water model is complete.

FOLLOW-UP:
Place food coloring on the ground surface (sand) -- this represents contamination. Rain on the soil. Again, try to pull the colored water out, repeat raining and pumping the water.
NOTE: It is extremely difficult to leach some contaminants out of soil. Some chemicals will leach readily, while others will not.

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Sewage Treatment Tour

Adapted from Critical Issue: Water. You Can Make a Difference!, Water Resources Education Kit, Grades 4-6, by Cornell Cooperative Extension of Nassau County, NY, and Water Wise: Lessons in Water Resources, Cornell Cooperative Extension

Trash Goes To School
Cornell Waste Management Institute

GRADE LEVELS: 9-12

SUBJECT AREAS: biology, chemistry

CONCEPT: How do we clean up our wastewater?

OBJECTIVE: To understand how our wastewater is treated and to make a connection between what is put down the drain and where it goes.

MATERIALS:

- paper
- pen or pencil
- set up a tour of a wastewater treatment plant

KEYWORDS: leachate, permeability, aquifer

BACKGROUND: The following information gives teachers sufficient background knowledge to inform students about modern wastewater treatment. It is up to the discretion of the teacher to cover as much on this topic as he/she wants. Class ability and time available will be the deciding factors. The important concept is not the water treatment process itself, but rather the fact that most wastewater needs to get treated before it can be recycled or reused and that this treatment results in a sludge which must be disposed of.

In rural areas, wastewater exits the house and enters cesspools or septic tanks. These are tanks in the ground where sewage is partially purified through decomposition by bacteria. The water slowly percolates back to the groundwater supply which can then be pumped to the surface as it is needed.

In more densely developed areas, sewers are used. These are underground pipes connected to a wastewater treatment facility. Once in the treatment plant, wastewater goes through a series of actions which will help to clean up the water. A wastewater treatment plant's basic function is to quicken the natural processes by which water purifies itself.

Wastewater treatment is vital to the purification of our water and the health of the population. At present, two basic stages exist in the treatment of wastes: primary and secondary.
In the primary stage of treatment, solids are allowed to settle and are removed from the water. Here's how it works: as sewage enters a plant for treatment, it flows through a screen. The screen removes large floating objects such as rags and sticks that may clog pumps and small pipes. After the sewage has been screened it passes into what is called a grit chamber where sand, grit, cinders and small stones are allowed to settle to the bottom.

The unwanted grit or gravel from this process is usually disposed of by filling land near a treatment plant. With

screening completed and the grit removed, the sewage still contains dissolved organic matter along with suspended solids. In a sedimentation tank the suspended solids will gradually sink to the bottom, forming sludge. Then, the sludge is mechanically removed from sedimentation tanks.

The secondary stage of treatment removes up to 90% of the organic matter by making use of the bacteria in it. Two techniques are used in this stage: trickling filters and the activated sludge process.

A trickling filter is a bed of stones from 3-6 feet deep through which sewage passes. Bacteria gather and multiply on these stones until they can consume most of the organic matter in the sewage. The cleaner water trickles out through pipes in the bottom of the filter, then flows to another sedimentation tank to remove the bacteria. To complete the process, the water gets chlorinated for disinfection purposes.

The other technique which is being used more today is the activated sludge process. After the sewage leaves the settling tank in the primary stage, it is pumped to an aeration tank where it is mixed with air and sludge loaded with bacteria. It is allowed to remain here for several hours. During this time, the bacteria break down the organic matter. The sludge can be reused by returning it to the aeration tank and mixing it with new sewage and an ample amount of air.

Meanwhile, the sewage flows from the aeration tank to another sedimentation tank to remove the bacteria. The final step, as with the first technique, is the addition of chlorine.

In some cases, tertiary treatment also is used. In this final step, chemical treatment is used to remove specific compounds such as phosphates. This allows the water to be in better condition before it is put back into the water cycle system.

As our water supply demands are increasing, tertiary treatment allows us to use wastewater to recharge the groundwater supply. However, most wastewater plants do not employ this procedure due to cost and feasibility.

PROCEDURE:

1. Take a tour of a wastewater treatment plant, following the path of the water as it gets treated. Find out how many gallons of wastewater are treated per day, and how many people the plant serves.

2. Discuss questions such as the following:

- What steps does the water go through in wastewater treatment?
- What is the role of microorganisms?
- Where does the water go after leaving the wastewater treatment plant? How often is it tested, and for what pollutants?
- How much sludge is produced? How is it treated or disposed of?

FOLLOW-UP:
Students may wish to study and contrast a leach field with a sewage treatment plant.
If sludge from the wastewater treatment plant is composted or spread on land, the class might also want to visit the site of these operations.

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You're Eating More Energy Than You Think!

Adapted from A-way with Waste: A Waste Management Curriculum for Schools, 2nd ed., by State of Washington, Dept of Ecology

Trash Goes To School
Cornell Waste Management Institute

GRADE LEVELS: 9-12

SUBJECT AREAS: home economics, math

CONCEPT: Every product we make or use has "hidden" energy and environmental costs.

OBJECTIVE: Students will understand that different forms of packaging require different amounts of energy.

MATERIALS: several products to analyze

handouts: Tables 1 and 2, Table 3

KEYWORDS: calorie, British Thermal Unit (BTU)

BACKGROUND: About 1550 calories are needed to make the aluminum can that holds diet soda. Zero calories are in the soda, so...if you wanted to get maximum energy, you would eat the can!

The unit of heat used in science is the calorie (cal.), also called gram-calorie or small calorie. It is defined as the amount of heat energy needed to raise one gram of water 1 degree centigrade.

In nutrition, the unit of food energy is the Calorie (Cal.), also called kilogram-calorie, or great calorie. It is defined as the amount of heat needed to raise one Kilogram of water 1 degree centigrade. It is equal to 1000 calories.

The small c, capital C difference is important. Only the nutritional calorie uses capital C.

Engineers use a different heat energy standard called the British Thermal Unit (BTU). It is defined as the amount of energy required to raise one pound of water 1 degree fahrenheit. One BTU = 252 calories.

*EXTRA NOTES:

1 pound = 454 grams
degree C = 5/9 (degree F - 32)
1 kilogram = 2.2 pounds

PROCEDURE:

1. Using information from Table 1, determine and compare the energy necessary to package the sample foods.

2. In Table 2, fill in the price (current value) of the foods and compare the prices with the amount of energy required.

3. Determine the amounts of energy required for the individual containers. Where necessary, divide the energy per pound by the correct weight of the container being examined.

4. By referring to Table 3, discuss the environmental impacts of container manufacturing and disposal. Ask: What are some advantages of recycling as compared to disposal in a landfill (saves disposal costs, conserves energy, reduces waste of nonrenewable resources).

FOLLOW-UP:
What are some different types of packaging commonly used for your favorite foods?

Which packaging material uses the most energy to produce? Least?

How can we, as careful consumers, reduce waste and the use of energy and resources while we consume?

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