

Chapter One
Lesson Three:

**Recycling is Not
The End, It's Only
The Beginning**

**Concepts and Skills
Addressed:**

Social Science
The Environmental Cycle
Arithmetic



Materials Needed:

Trash bag filled with recyclable and nonrecyclable items weighing about 3.5 pounds (1.6 kilograms)

Materials Supplied:

Glossary of Terms
"Recycle Cycle" cartoon (Found in worksheet packet)

Students will learn how waste is generated, where waste goes and how to reduce it through recycling.

A. Procedure:

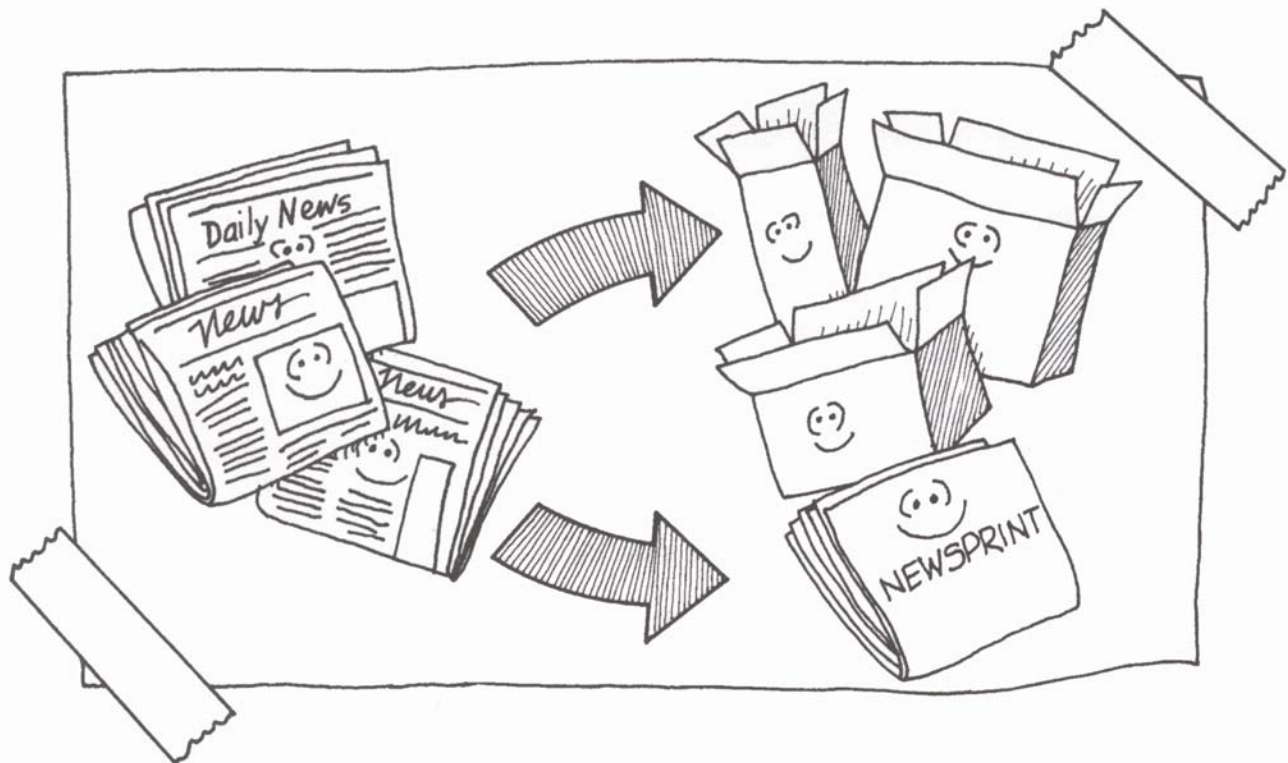
- 1) Read the background information on recycling.
- 2) If your class has not yet seen the two cartoons provided in the worksheet packet at the back of the notebook (one introduces MOBIUS, the other explains the "Recycle Cycle"), show them now. Refer to the Recycle Cycle as an example of the environmental cycle mentioned in the discussion questions for this lesson.

- 3) Refer to the pre-quiz taken earlier and explain that the class is going to discuss some of the issues involved with recycling. Make it clear that usually there are many possible answers to your questions.
- 4) You may want to gather some visual aids to help you discussion: paper, a beverage can, a glass jar, a plastic milk jug, etc. You can involve students by handing these items out and asking students to show them when the time comes.

B. Background on Recycling

To recycle means to separate waste resources and process them to make new products from the same materials. For example, newspapers can be recycled into cardboard boxes, and beverage cans can be made into new beverage cans.

We advise a class discussion to explain the process and advantages of recycling and its role in controlling the solid waste overflow. With the background provided on landfills, composting and incineration, we have shown where trash goes when it leaves our homes. Recycling is best described by looking first at where trash comes from.



Class Discussion

What is an 'environmental cycle'?

Answer: An environmental cycle is a continuous chain of natural events that happens all around us every day. For example, a new tree sprouts from the ground in your back yard. Over the years, its roots draw water and minerals from the soil and make food using sunlight. This process is called **photosynthesis**. While it grows, the tree's leaves help purify the air we breathe. Each year it drops seeds to the ground that sprout into seedlings. When it is old, the tree dies, falls down and decays. Nutrients from its wood enrich the soil so the saplings can grow into healthy new trees. Over the years, the young trees that grew from your tree's seeds become mature trees and the cycle begins all over again.



What does the environmental cycle have to do with recycling?

Answer: Products that we use every day come from plants and minerals found in nature. Recycling makes new things from the materials in these products. (See Recycle Cycle.) The environmental cycle is nature's way of recycling. Recycling bottles may become jars, drinking glasses or new bottles. Recycled aluminum beverage cans may become aluminum foil used in cooking and so on. Originally these things were made from raw materials. This gives us the recycle cycle.

Where does paper come from?

Answer: Paper is made from **wood pulp**, which is manufactured when trees are cut down and ground into small pieces. Mixed with starch and water, the pulp forms a paste, which is squeezed through rollers to make paper. Most paper is recyclable. It doesn't have to be thrown away after it's been used. It can be broken down and made into new paper products.

What is glass made of?

Answer: **Glass** is actually sand - tiny rocks that are cleaned of impurities and then heated. The rocks melt into a liquid that turns into glass when cooled. Glass is also recyclable. Five billion glass bottles and jars are recycled annually by being crushed into **cullet** and melted down to make new glass containers. Cullet is also used to make **fiberglass** and is mixed with **asphalt** to make "glassphalt," a paving material.

What is used to make beverage cans?

Answer: Most beverage cans are made of aluminum. Lightweight and flexible, aluminum is perfect for products like beverage cans. It is also a recyclable product. Aluminum foil and trays, along with beverage cans, can be melted down and made into new cans, foil or trays many times before they have to be thrown away for good. Like paper and glass, they can't be recycled forever. Just as your pants wear out at the knees or your sneakers get holes in the bottoms, recyclable items wear out, too. But they can last much longer than they do today. Usually, some new aluminum is added during remanufacture to preserve the strength and lengthen the life of the product.

Each of these materials - glass, paper and aluminum - comes from raw materials found in nature. They are made into products we use every day, such as cereal boxes, beverage cans and cookie jars. When we use these products and are finished with them, we usually throw them into the trash. But nature can't supply the resources to make beverage cans and pickles jars forever.

What about plastic? Is it recyclable?

Answer: Yes, but only 1% of plastic is recycled each year. Statistics show that there is much room for growth in recycling plastic. To increase plastic recycling, the chemical industry is sponsoring research into recycling technology and is finding new uses for "post-consumer" **resins**. Most research is focused on recovering beverage bottles.

When the trash truck comes and takes away our trash, where does it go?

Answer: When people participate in a recycling program, glass, paper, beverage cans and plastic are picked up separately and taken to a recycling center. There the materials are sorted by **grade**, baled, crushed or otherwise processed for transport, and sold to companies that will make new products out of them.



Materials such as paper and plastic are manufactured in different grades. Newsprint, for instance, is a different grade of paper than computer print-out paper. Each grade is recycled separately. Some communities and waste disposal companies burn part of the trash in incinerators. Steam is produced and can be used to make electricity. Most often, trash is taken to a landfill where it is covered with dirt and left to decompose.

What is a landfill?

Answer: A landfill is an engineered method for disposing of waste on land. (For more information see glossary and Chapter One, Lesson Two.)

How do we protect the environment at the landfill?

Answer: Modern landfills are dug out and coated with one or more thick liners before the solid waste is deposited. This liner helps protect the environment, especially the groundwater. After the waste is deposited, it is covered with earth, which also protects the environment.

What would happen if there were no place to put all the solid waste?

Answer: We would see trash everywhere and our homes and communities would become very unhealthy because of improperly discarded waste.

We've talked about recycling and landfills. In what other ways can we dispose of solid waste?

Answer: Incineration and composting. (These processes are described in detail earlier in Chapter One.)

What does 'incineration' mean and how does it work?

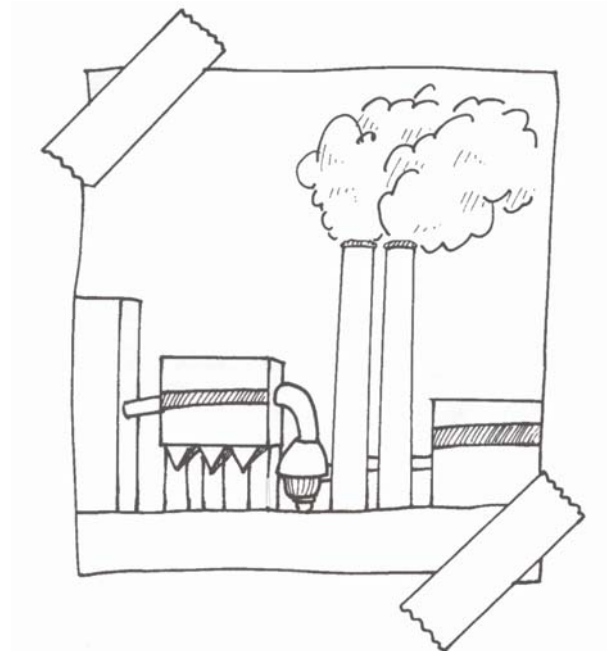
Answer: To incinerate means to burn to ashes. Garbage is placed in a huge furnace, or fireplace, and burned until nothing is left but ashes. The heat given off by incineration can generate electricity for lights, electric toys, television, heat and so on.

What does 'composting' mean and how does it work?

Answer: Composting is a process in which organic materials, such as grass clippings, food scraps, tree branches and leaves are gathered together in a big pile and left to decompose into a rich soil additive called humus.

Long ago, before heavy trucks and big machines, what did people do with their garbage? What kind of garbage did they have?

Answer: We'll talk about this when we look at "Fitting Trash into Yesterday."



Science Activity

Make a Simulated Landfill

Objective

Students will observe that some materials decompose in a landfill, while others do not. They will learn the difference between organic and inorganic materials and understand how a landfill works.



Vocabulary

Landfill
Decompose
Organic
Inorganic

Time Need for Activity

20 days

Materials Supplied

Worksheet for recording observations

Materials Needed

A shoe box or aquarium, foil or plastic to serve as a liner, soil (NOT POTTING SOIL - it doesn't have the necessary microorganisms), toothpicks, water, a magnifying glass or microscope and slides, cardboard. Choose several organic and inorganic materials to be burned in the

landfill. Two sets of identical materials will be needed. Suggestions: orange peel, apple core, newspaper, glossy magazine paper, cardboard, glass, cotton cloth, aluminum foil, etc.

Procedure

- 1) Describe a landfill to students, noting that landfills not only hold waste but also allow some materials to partially decompose.
- 2) Have students look at the materials under a magnifying glass or microscope and predict which materials will partially decompose and which will not decompose by writing a hypothesis in the space provided on the worksheet.
- 3) Line the container with foil or plastic. This simulates the liner or liners in a sanitary landfill and should be done in a waterproof container. Fill it half full with soil. Make two parallel rows of materials by placing one complete set in each row. Then cover them with two inches of the remaining soil.
- 4) With toothpicks, mark the location of the buried objects.
- 5) Have students date their worksheets and note the objects they buried.
- 6) Keep the simulated landfill in a sunny place and water as needed to keep the soil moist.
- 7) After 10 days, uncover the objects from one row. Place them on a piece of cardboard and observe them with a magnifying glass, and/or place samples on a slide and observe them under a microscope. Log observations.
- 8) After 10 more days, uncover the remaining row of objects and repeat the above procedures.
- 9) Have students write their conclusions, comparing objects to each other and noting the changes between identical objects in the simulated landfill for 10 and 20 days.

Name _____ Date _____

Simulated Landfill Worksheet

Hypothesis:

Observations

After 10 days

After 20 days

Objects

1.

2.

3.

4.

5.

6.

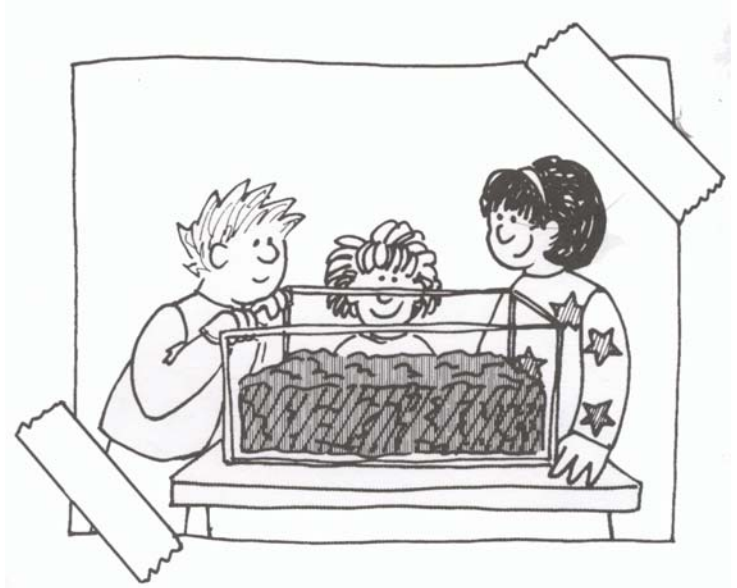
Conclusion:

Science Activity

Feeding Your Garden

Objective

Students will observe and record the results of decomposition in a contained compost pile. While students won't be able to see the microscopic activity at work in the process of decomposition, teachers can enhance students' understanding by explaining the "unseen" world.



Yard waste decomposes when exposed to air, water, bacteria, and other microorganisms. Students will observe that the temperature of the composting mixture rises. Bacteria and microorganisms generate temperatures of about 150 degrees Fahrenheit (65 degrees Celsius), thereby "cooking" the yard waste.

Finally, students should learn that composting creates a natural fertilizer rich in carbon and oxygen called humus. This fertilizer provides nourishment for growing plants.

Vocabulary

Yard waste
Decomposition
Bacteria
Microorganisms
Humus

Time Needed for Activity

Three weeks or longer

Materials Supplied

Sample worksheet for recording observations

Materials needed

A 10-gallon aquarium or similar container, yard wastes (grass clippings, leaves) to fill the container $\frac{1}{2}$ to $\frac{2}{3}$ full, a large spoon or yardstick to stir the mixture, a ruler or yardstick to measure the height within the container, a thermometer to measure the temperature of the mixture.

Procedure

1. Tell students that they are going to observe how nature returns leaves, grass and other plant and animal life to the soil through the process of decomposition.
2. Have students place the grass clippings, leaves, etc., in the aquarium. Do not compact the material; make sure there is sufficient air to help the decomposition process. Add water as needed to keep the material moist.
3. At the start of the activity, ask each student to write a hypothesis about the outcome of the activity in the space provided on the worksheet.
4. Record any initial observations on the worksheet: color, smell, height, temperature. This may be done individually or in groups. Record observations periodically for three weeks.
5. After three weeks, discuss your findings at each stage of observation and empty the container in an appropriate location outside.
6. Using the worksheet, ask students to write in their conclusions. They should summarize the changes they observed over the course of the experiment.
7. Have students match their hypotheses to their conclusions. Ask them if they were surprised by the results of composting.

Name _____ Date _____

Feeding Your Garden Worksheet

Hypothesis:

Day	Date	Temp.	Height	Smell	Appearance and Changes
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1.

2.

3.

4.

5.

6.

7.

8.

Conclusion: