The use of Earth’s resources affects humans, other species, and the environment.

SECTION 1
Natural Resource Use
Main Idea Earth has a limited supply of natural resources.

SECTION 2
People and the Environment
Main Idea Humans significantly impact Earth’s natural resources and the environment.

SECTION 3
Protecting the Environment
Main Idea Reduce, reuse, and recycle are three ways to conserve natural resources.

Panels of Power
The Sun provides Earth with an abundant supply of energy but most of it is unused. Solar panels, like these in California, capture the Sun’s energy and transform it into electrical energy. This helps to conserve Earth’s limited supply of other energy resources.

Science Journal Use library or online resources to learn about other uses of the Sun’s energy. In your Science Journal, describe how you could use one of them.
Start-Up Activities

What are natural resources?
Could you live without plastic bags or wooden pencils? How about an automobile or a TV? Everything you need or use, from food and clothing to school supplies and transportation, is made from natural resources. This activity gives you a chance to think about the kinds of resources you use every day.

1. In your Science Journal, make a table with five columns: Plastic, Paper, Metal, Glass, and Wood.
2. Think of things you use every day at home or in your classroom that are made of each material. List as many as you can think of in each column.
3. Think Critically Write a paragraph in your Science Journal explaining which category you depend on most, and why. Include an explanation of where you think these materials come from.

Natural Resources Make the following Foldable to help you distinguish between renewable and nonrenewable resources.

STEP 1 Fold a sheet of paper in half lengthwise.

STEP 2 Fold paper down 2.5 cm from the top. (Hint: From the tip of your index finger to your middle knuckle is about 2.5 cm.)

STEP 3 Open and draw lines along the 2.5 cm fold. Label as shown.

Classify Before you read the chapter, list examples of each type of natural resource you already know about in the appropriate column. As you read the chapter, add to your lists.

Preview this chapter’s content and activities at red.msscience.com
1 **Learn It!** A *cause* is the reason something happens. The result of what happens is called an *effect*. Learning to identify causes and effects helps you understand why things happen. By using graphic organizers, you can sort and analyze causes and effects as you read.

2 **Practice It!** Read the following paragraph. Then use the graphic organizer below to show what happened when oil and coal are burned for energy.

Many factories and power plants burn coal or oil for the energy they need. The burning of fuel releases pollutants into the air that can cause health problems. Air pollution can make your throat feel dry or your eyes sting. Many people have trouble breathing when air pollution levels are high. For people with lung or heart problems, air pollution can be deadly. In the United States it is estimated that 50,000 to 120,000 deaths each year are linked to air pollution.

—from page 660

3 **Apply It!** As you read the chapter, be aware of causes and effects of using Earth’s resources. Find five causes and their effects.
**Target Your Reading**

Use this to focus on the main ideas as you read the chapter.

1. **Before you read** the chapter, respond to the statements below on your worksheet or on a numbered sheet of paper.
   - Write an A if you **agree** with the statement.
   - Write a D if you **disagree** with the statement.

2. **After you read** the chapter, look back to this page to see if you’ve changed your mind about any of the statements.
   - If any of your answers changed, explain why.
   - Change any false statements into true statements.
   - Use your revised statements as a study guide.

<table>
<thead>
<tr>
<th>Before You Read A or D</th>
<th>Statement</th>
<th>After You Read A or D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>More than half of the known plant species on Earth can be found in rain forests.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>All of Earth’s living things use natural resources.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Trees are nonrenewable resources.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Coal, oil, and wind are three examples of nonrenewable resources.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Some landfills are lined with plastic to prevent pollutants from escaping.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Water is a nonrenewable resource.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Automobiles are not a large source of air pollution.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Donating unwanted clothing is one way to reduce solid waste.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Leftover food cannot be recycled.</td>
<td></td>
</tr>
</tbody>
</table>

Print out a worksheet of this page at red.msscience.com
News Flash: Trouble in the Rain Forest

For months, you’ve been saving your money, and today you’re going shopping for a CD player. On the way to the mall, you turn on the car radio. The news reporter is saying that rain forests are being destroyed at the rate of about a football field a day, or 117,000 km² every year. That’s a lot of land! Figure 1 shows how much rain forest already has been lost in South America.

The news reporter explains that once a rain forest is cut down, it might never grow back. Removing rain forests means losing wildlife. More than half of Earth’s known plant species and one-fifth of the known bird species can be found in rain forests. If a species’ home is destroyed, the species might die out. Some important medicines, including anti-cancer drugs, originally came from rain forest plants. Destruction of rain forests could mean that many medicines might not be discovered.

Many people who live in rain forest areas clear land to grow crops or graze cattle. To get money for food and supplies, these people sell the wood to companies that use it for paper, furniture, and other products. The news reporter ends by saying that positive actions by people worldwide can help save Earth’s rain forests.

Figure 1 South America’s Amazon River basin contains the world’s largest area of tropical rain forest.
**Things You Use Affect the Environment**  You think about this news report as you reach the shopping mall. When you walk into the different stores, you can’t help but notice that many products and the packages they come in are made of cardboard, a wood product. Even though this wood may not have come from a rain forest, it did come from a forest somewhere. Could these products have been packaged in a different way?

Let’s take a look at the CD player that you might want to buy, like the one in Figure 2. It is made of plastic and often comes in a package made of cardboard. Its wires, screws, and some inside parts are made of metal. Metal and plastic aren’t made from trees. So where did they come from?

**Natural Resources**

Most of the items that you buy or use are made of materials that come from natural resources. **Natural resources** are things found in nature that living organisms use. Figure 3 shows some examples of natural resources. Organisms use natural resources to meet their needs. Vegetables that you eat are natural resources. They fill your need for nutrients. The trees and the minerals that were used to make the lumber, plastic, and metal in your house are natural resources. They fill your need for a place to live. Natural resources are also used to make other items in our lives, such as CD players.

**Figure 2**  The parts of a CD player come from different resources.

**Figure 3**  Cotton, gold, trees, and water are examples of natural resources. **Infer which of these natural resources have a limited supply on Earth.**
What goes into making a CD player? You already know that the cardboard box the CD player came in was made from trees, and that trees are a natural resource. What about the plastic used to make the CD player? Where did it come from? Plastic is made from crude oil, a resource that’s usually found underground. Crude oil is a thick, dark liquid. Deep holes are drilled in Earth to reach crude oil underground. Substances taken from crude oil can go to factories where they can be made into products, such as plastic, gasoline, inks and dyes, or linoleum.

What about the metal parts of the CD player? Where did the metal come from to make the screws that hold the CD player together? Figure 4 answers this question.

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**Figure 4**
The screws used in your CD player are usually made of steel. Iron ore is a natural resource used to make this steel.

Iron ore is a mineral that contains iron. It is found below Earth’s surface and must be mined.

Railroad cars carry iron ore to factories where the ore is melted down and the impurities are removed.

The iron is then trucked to a factory where various iron and steel products are made, including the screws used in CD players.
More Natural Resources  Trees, crude oil, minerals—were any other natural resources used to make the CD player? Cutting down trees, drilling for crude oil, mining, and getting natural resources to factories all require energy. Once the natural resources are at the factories, it takes energy to make them into plastic, cardboard packaging, and metal wires and screws. Where does all this energy come from?

If you guessed natural resources, you’re right. Trucks that take the natural resources to the factories use gasoline or diesel fuel, which are made from crude oil. The electricity used to power machines that make natural resources into materials for CD player parts often comes from burning coal. Like crude oil, coal is a natural resource that forms underground. It takes energy to mine the coal, and this energy comes from natural resources.

Different parts used in making electronic equipment are transported to a factory where the parts are assembled into products.

The final product—the CD player—is packaged and then trucked to a store, where it is sold.
All Organisms Use Resources  As you’re beginning to see, it takes a variety of natural resources to make one CD player, doesn’t it? Think of all the natural resources that are used to make something large like a house or apartment building. Materials used in building construction include wood, metal, stone, glass, and plastic. Tools, machinery, and fuel are used during construction. Each building contains light fixtures, flooring, window coverings, plumbing, and electrical wiring. After completion, the building is filled with furniture, appliances, food, books, and all the other things people use. Now think of all the houses and apartments in the world. Are there enough natural resources to meet everybody’s need for a place to live?

Maybe. But people use natural resources to meet other needs, too. In fact, all living things on Earth use natural resources. Animals use natural resources for food and shelter. Will we ever run out of natural resources? That may depend on the particular resource.

Availability of Resources

Imagine that you’re riding your bike on a warm spring day. Your destination: the city park, such as the one shown in Figure 5. When you get to the park, you head straight for the pond. You hop off your bike, take an apple out of your backpack, and lean against a tree. Later, you might take a walk around the pond. For now, you’re content just to watch the sunlight sparkling on the water.

Sunlight, water, trees, apples . . . These are all natural resources. They have something else in common, too. They will likely be around for a long time. Why? Because they are all renewable (ree NEW uh bul).

Figure 5  Natural resources are found everywhere—in national parks and in the middle of large cities like Boston.
**Renewable Resources** Resources that can be replaced by natural processes in 100 years or less are called **renewable resources**. Look at Figure 6. Energy from the Sun is a renewable resource because the Sun gives off light energy every day, and it will continue to do so every day for millions of years. Light energy powers the process of photosynthesis, which plants use to make food. You and all other animals on Earth depend on plants for food. Have you ever used a solar-powered calculator or radio? These devices use light energy to produce the electricity they need to operate.

Trees are renewable resources because most trees will grow back and be cut again in less than 100 years. People use wood from trees to build houses and furniture, and to burn as fuel. Can you think of other uses for wood?

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**Reading Check** *Why is a tree a renewable resource?*

Water is another renewable resource. Did you know that the water you drink has existed on Earth for billions of years? Heat from the Sun evaporates water from lakes, streams, and oceans, turning it into gaseous water vapor that rises into the atmosphere. Later, the water vapor condenses back into liquid and falls as rain, sleet, hail, or snow. Through this cycle, the same water is reused over and over again.

Wind is also an example of a renewable resource. The sails on a sailboat use wind energy to push the boat across the water. Old-fashioned windmills used wind energy to pump water from underground wells. Today, large windmills are used to generate electricity.
Nonrenewable Resources  Do you see coal or crude oil among Earth’s energy sources in Figure 7? Coal, natural gas, and crude oil take millions of years to form inside Earth. They are examples of nonrenewable resources. Nonrenewable resources are resources that cannot be replaced by natural processes within 100 years. After all the coal and crude oil that we can recover is used up, there won’t be any more available for use for millions of years. Unless we can replace them with other energy resources, energy use will have to be reduced.

List some energy sources you use in your home.

As you can see, because nonrenewable resources form slowly over long periods of time, they need to be used wisely. Figure 7 shows how the world’s energy needs are being met today. If world crude oil supplies were to run out, in what ways would the circle graph change?
Conserving Resources  Conservation is the practice of protecting and preserving natural resources so they will always be available. As you read the rest of this chapter, you’ll find out that both renewable and nonrenewable resources need to be conserved. Protecting the quality of air, water, and land is just as important as preserving supplies of coal, crude oil, and other nonrenewable resources. Figure 8 shows one of the ways people are trying to conserve crude oil supplies.

The gasoline engine shuts off when the car is idling. The electric motor boosts engine power when the car climbs hills or accelerates.

Figure 8  Hybrid gasoline/electric vehicles like this one help reduce crude oil use because they consume much less gasoline than other cars do. The hybrid car has both a small gasoline engine and an electric motor.

Summary
Trouble in the Rain Forest
- Rain forests are being cut down at a very rapid rate.
- The removal of rain forests can result in the loss of wildlife species and the destruction of plants that might provide useful medicines.

Natural Resources
- Natural resources include everything that living organisms need for survival.

Availability of Resources
- Renewable resources can be replaced in 100 years or less.
- Nonrenewable resources take more than 100 years to replace.

Self Check
1. List six examples of natural resources.
2. Classify each item in your list of natural resources as renewable or nonrenewable. Explain your reasoning.
3. Describe how a squirrel uses natural resources for its survival.
4. Think Critically Is a rain forest a renewable or nonrenewable resource? Explain your answer.
5. Sequence the steps that are needed to make a tree into a baseball bat displayed in a store. Describe any energy use or packaging that might be required.

Applying Skills
Water is an important resource that we use every day. You use it to wash dishes and clothes, bathe, and brush your teeth. You also use water to cook meals. Many daily activities require water.

**Real-World Question**
How much water does your family use in three days?

**Goals**
- **Calculate** how much water the people in your household use in three days.
- **Make a plan** to control the amount of water used.

**Materials**
calculator

**Procedure**

1. **Record Data** For three days, have the people who live in your house keep a record of when they do the activities listed in the table.
2. **Calculate** how much water your family uses based on the data in the table.

**Conclude and Apply**

1. **Use Numbers** The numbers in the table describe approximately how many liters one person uses in a single day for the activity listed. Multiply these numbers by the number of people who did these activities.
2. **Add** up the totals for each day. The final sum will be the total amount of water used for these activities in three days.
3. **List** ways in which you and your family could control the amount of water you use.

**Home Water Use**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Conditions</th>
<th>Amount of Water Used*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washing dishes by hand</td>
<td>Water is running all the time</td>
<td>113 L/person/day</td>
</tr>
<tr>
<td>Washing dishes by hand</td>
<td>Sink is filled with water</td>
<td>19 L/person/day</td>
</tr>
<tr>
<td>Washing clothes in machine</td>
<td>Small load with high water setting</td>
<td>68 L/person/day</td>
</tr>
<tr>
<td>Washing clothes in machine</td>
<td>Full load with high water setting</td>
<td>45 L/person/day</td>
</tr>
<tr>
<td>Taking a shower</td>
<td>10 minutes long</td>
<td>150 L/person/day</td>
</tr>
<tr>
<td>Taking a bath</td>
<td>Bathtub is full of water</td>
<td>113 L/person/day</td>
</tr>
<tr>
<td>Flushing the toilet</td>
<td>Water-saving toilet</td>
<td>23 L/person/day</td>
</tr>
<tr>
<td>Brushing teeth</td>
<td>Water is running all the time</td>
<td>17 L/person/day</td>
</tr>
</tbody>
</table>

*3.8 L equals 1 gallon
Exploring Environmental Problems

Look at Figure 9. Have you ever seen a construction site for a new highway? Sometimes, hillsides have to be dynamited to make room for the highway. The trees and plants that grew on the hillside are destroyed. The animals that lived on the hillside depended on the trees and plants for food and shelter. Some might die if their food source is destroyed, but many survive and find new habitats to live in. Construction companies now have to restore land that they dynamite so that plants and animals can continue to live there.

What if there isn’t another place to live? Many plants and animals lose their natural habitats because people use land for growing crops, grazing animals, or building homes. That’s what’s happening in many rain forests. Because large areas of rain forest are being destroyed at a rapid rate, certain species in the rain forest lose their habitat. They cannot find enough food, shelter, and other resources. They might be threatened with extinction.

Frequently, human activities affect the quality and availability of some of our most precious natural resources: land, water, and air. Let’s see how this happens.

Figure 9 Construction destroys some parts of the environment. Laws in the United States and many other countries help reduce the amount of destruction that takes place.
Our Impact on Land

How much space do you need? You will need to think about more than just your home. Think about where your food comes from, your school, and other spaces you use. If you start adding it all up, the amount of spaces you use is much larger than you may think. A simple peanut butter-and-jelly sandwich requires land to grow the wheat needed to make bread, land to grow the peanuts for the peanut butter, and land to grow the sugarcane and fruit for the jelly. A hamburger? Land is needed to raise cattle and to grow the grain that the cattle eat.

Using Land Wisely

All of the things we use in our everyday lives take some amount of land, or space, to produce. That means that every time we build a house, a mall, a road, or a factory in a city, as shown in Figure 10, we use a little more land. All you have to do is look at a globe, however, to see that the amount of land available for us to use is limited.

People need food, clothing, jobs, and a place to live, and each of these things takes land. But preserving natural habitats also is important. Remember, a habitat is the place where an organism lives. Once a wetland is filled in to build an apartment building, the wetland and the organisms living there are lost.

Figure 10  Land is used for many purposes other than growing food. Identify the land uses that take up space in the city of Pittsburgh, pictured below.
**Land Use Laws** More and more, there are laws to help protect against habitat loss and to help us use land wisely. Before major construction can take place in a new area, the land must be studied to determine what impact the construction will have on the natural habitat, the living organisms, the soil, and water in the area. If there are endangered organisms living there, or if the impact will be too great, construction may not be allowed. These are important studies. At stake are jobs, homes, and habitats.

**Landfills** Each day, every person in the United States produces about 2.1 kg of garbage. Where does it go? About 57 percent of our garbage goes to landfills. A landfill, shown in Figure 11, is an area where garbage is deposited.

Any material that can harm living things by interfering with life processes is called a pollutant (puh LEW tunt). Modern landfills are lined with plastic or clay to keep chemical pollutants from escaping. However, some chemicals still find their way into the environment. If these pollutants get into the food that we eat or the water that we drink, they can cause health problems.

![Figure 11](image)

*Figure 11* Each day, trash is put in a sanitary landfill. This trash is later covered with a thin layer of dirt and then watered down to keep the trash from blowing away.

**Reading Check** What is hazardous waste?

Most of the trash we throw into landfills is not particularly dangerous to the environment. However, potentially dangerous items such as batteries, paints, and household cleaners sometimes end up in landfills. Many of these items contain harmful chemicals that could leak into the soil and eventually find their way into rivers and oceans. Garbage that contains dangerous chemicals or other pollutants is called hazardous waste. Many communities ask people to separate out hazardous wastes to prevent them from being deposited in landfills. Hazardous wastes can be taken to a special site where they are collected and disposed of safely.
Our Impact on Water

Did you know that you cannot live long without water? You need clean water for drinking, as well as dozens of other uses, from washing clothes to watering plants. The average person in the United States uses about 397 L of water each day. Though water is a renewable resource, in some places it is being used up faster than natural processes can replace it.

Only a small amount of Earth’s water, as shown in Figure 12, is freshwater that people can drink or use for other needs. Many places around the world are running out of usable freshwater. How do you think your life would change if your area were running out of clean water?

Water Pollution Many everyday activities can cause water pollution. How? When you scrub a floor with a mixture of water and a household cleaner, what do you do with the mixture afterward? You pour it down the drain. The polluted water usually goes to a water-treatment plant, where it is cleaned before being used again.

Figure 12 Although 70 percent of Earth’s surface is covered by water, less than one percent of it is freshwater.
What if you poured the mixture of water and household cleaners outside on the grass or in the street? This polluted water would soak into the ground where it could contaminate the soil or seep into a well that others use for drinking water. Or, it might be washed away by rain and carried into rivers and lakes. If too many people do this, it could pollute our drinking water. Figure 13 shows where most of our drinking water comes from.

There are many other ways that water can become polluted. Rain can wash pesticides and fertilizers from farmland into lakes, streams, or oceans. Rain falling on roads or parking lots washes oil and grease onto soil or into nearby waterways. Factories and industrial plants sometimes release polluted water into rivers. The dumping of litter and garbage into rivers, lakes, and oceans is another source of water pollution.

Cleaning Up the Water Countries are working together to reduce water pollution. For example, the United States and Canada have agreed to clean up the pollution in Lake Erie, a lake that borders both countries. The U.S. government has also passed several laws to keep water supplies clean. The Safe Drinking Water Act is a set of U.S. government standards that makes sure that our drinking water is safe. The Clean Water Act gives money to the states for building water-treatment plants. Wastewater is cleaned at such plants.

Remember, Earth has a lot of water, but only a small amount of it is freshwater that people can use. The best way people can protect Earth’s water is by being aware of how they use it and taking steps to control their water use.
Our Impact on Air

If you live in a city, you may have noticed that on some days, the air looks hazy. Pollutants such as dust and gases in the air cause this haziness. Air pollution can be caused by natural events, such as a volcano eruption that releases smoke and ash into the air. But people cause most air pollution. Figure 14 shows some sources of air pollution.

Sources of Air Pollution The two biggest sources of air pollution are cars and factories, including power plants that produce electricity. One source of pollution is the fumes that come from cars. Cars need gasoline to run. When gasoline is burned, pollutants are released into the air. The polluting fumes of cars and other vehicles cause more than 30 percent of all air pollution.

Many factories and power plants burn coal or oil for the energy they need. The burning of fuel releases pollutants into the air that can cause health problems. Air pollution can make your throat feel dry or your eyes sting. Many people have trouble breathing when air pollution levels are high. For people with lung or heart problems, air pollution can be deadly. In the United States, it is estimated that 50,000 to 120,000 deaths each year are linked to air pollution.
**Acid Rain** People aren’t the only living organisms harmed by air pollution. Acid rain causes a lot of damage to other organisms. Acid rain happens when the gases released by burning oil and coal mix with water in the air to form acidic rain or snow. When acid rain falls to the ground, it can harm trees and other plants. When acid rain falls into rivers and lakes, it can kill fish and other organisms that live in the water.

**Spare the Air**

The best solution for all types of pollution, including air pollution, is prevention. Reducing the number of pollutants in the environment is easier to do than cleaning up pollution. Automobiles produced today release fewer harmful gases and use less fuel than did vehicles in years past. Governments around the world are looking for ways to reduce the amount of air pollutants released into the atmosphere by factories.

*How would riding a bicycle instead of driving a car help the environment?*

It may seem that you have no control over sources of pollution, but think again. Think about what power plants produce. They produce electricity. When power plants burn oil or coal to make electricity, harmful pollutants enter the atmosphere and cause smog, acid rain, and other problems.

You can help protect the atmosphere by limiting the amount of energy you use at home. Conserve electricity by turning off lamps, radios, fans, and other appliances that you aren’t using. Keep doors and windows closed to save heat energy in the winter or to reduce the need for air conditioning in the summer. Encourage your family to buy energy-efficient lightbulbs like the one shown in **Figure 15**.

**Figure 15** Turning down your home’s thermostat in the winter is one easy way to reduce energy use. Energy-efficient lightbulbs use one-quarter of the energy of standard incandescent lightbulbs, and they can last up to ten times longer.
To maintain the health of the environment, everybody needs to think about how their actions will affect the land, water, and air that we share. People living in the houses shown in Figure 16 use a renewable energy source—sunlight—to help reduce air pollution and conserve supplies of nonrenewable coal.

Figure 16 The roofs of these houses are covered with solar cells, which use sunlight to produce electricity. On sunny days, the people living in these homes help preserve natural resources by using electricity generated by the Sun instead of a power plant.

Summary

Exploring Environmental Problems
- Human activities can destroy the habitats of other organisms.

Our Impact on Land
- Land is a nonrenewable resource.
- Most of our garbage is buried in landfills.

Our Impact on Water
- Less than 1 percent of the water on Earth can be used for drinking.
- Human activities can cause water pollution.

Our Impact on Air
- Most air pollution results from the burning of fuels.

Spare the Air
- Pollution is easier to prevent than to clean up.

Self Check

1. Define the term pollutant. Give five examples.
2. Describe two ways in which human activities affect land.
3. Explain how human activities can cause water pollution and air pollution.
4. List three actions you could take to reduce pollution.
5. Think Critically Fumes from burning gasoline cause air pollution. Explain how gasoline could cause water pollution.

Applying Math

6. Calculate A regular showerhead puts out 15 L of water per minute. A water-saving showerhead puts out 9.5 L. If you take a five-minute shower every day, how much water would you save in a week by using a water-saving showerhead?
Cutting Down on Waste

The United States faces a huge waste problem. Litter gathers along highways. Landfills leak and overflow with garbage. Five billion tons is the estimated amount of solid waste thrown away each year in this country. Solid waste is whatever people throw away that is in a solid or near-solid form. Look at Figure 17 for examples.

Most waste is produced when coal, oil, and other natural resources are taken from the ground. Households and businesses produce only about four percent of this country’s waste. However, household and business waste is still a lot of solid waste—nearly 200 million tons each year.

Most of the waste from our homes, schools, and businesses is paper and cardboard products. In the cafeteria at school, it’s easy to see why this is so. School lunch programs all over the country depend upon paper plates, straw wrappers, milk cartons, paper bags, drink boxes, and napkins. What if individuals just tried to reduce the amount of trash they throw away each day?

Solid-waste management for individuals can be summed up by the three Rs—reduce, reuse, and recycle.
Reduce Most people would agree that there are no simple solutions to the problem of too much solid waste. The simplest and most effective way you can help solve the solid-waste problem is to reduce the total amount of solid waste that you throw away.

One method of reducing waste is to buy products with little or no packaging. For example, suppose you go to a toy store to buy a gift for a young child. If you select a toy that has no packaging, you’ve reduced your use of paper made from wood, or plastic made from oil. If you select a toy made from wood rather than plastic, you’ve reduced your use of a nonrenewable resource.

The other two Rs of conservation—reuse and recycling—also provide ways to reduce the amount of solid waste that goes into landfills.

Reuse Think again about the toy purchased as a gift. Instead of wrapping it in paper, you could put it in a cloth gift bag. The cloth bag can be used over and over again before it wears out and has to be thrown away. Think about the amount of wrapping paper that would not have to go into the landfill as a result! Reuse means using an item again rather than throwing it away and replacing it.

How does reuse help reduce the amount of solid waste that goes into landfills?

There are many examples of reuse. Worn-out clothes can be used as cleaning rags. Old newspapers can be used to line pet cages, wrap gifts, or cover the floor when painting. Perhaps you’ve been to a garage sale, a flea market, or a used clothing store like the one shown in Figure 18. Books, magazines, clothing, computers, video games, glass jars, and cardboard boxes are some of the many items that can be reused. When you no longer need them, you can give them to someone else who may want or need them, instead of sending them to a landfill by throwing them away.

Figure 18 Secondhand stores are great places to find bargains. Like-new clothing and other items are being reused—a good way to help protect the environment.

Making Models

Procedure
1. Collect several items that would normally be thrown out. Such items could include newspapers, clean cans or glass, packaging, etc. Do not collect any food items or items that could be harmful. Do not take any items out of the garbage.
2. Using glue, string, or tape, create an item of artwork.
3. Give your piece of art a name.

Analysis
1. What items did you use to make your piece of artwork?
2. Is this activity an example of reducing, reusing, or recycling? Explain.

Try at Home
Recycle When you finish lunch in the school cafeteria, do you have paper cups and plates, cans, glass bottles, plastic containers, and leftover food to throw out? As Figure 19 shows, many communities provide special bins that allow you to separate your garbage so that certain items can be recycled. Recycling (ree S1 kling) means reusing materials after they have been changed into another form. Used paper can be reprocessed to make recycled paper. Glass can be melted and reformed into new containers made of recycled glass. Even leftover food can be recycled by putting it in a compost pile. The food decomposes into rich compost that gardeners can use to boost plant growth.

Figure 19 Everyone can help save energy, reduce solid waste, and conserve natural resources by recycling paper, plastic, glass, and metal.

Applying Science

Reusing Plastic

Have you ever seen aluminum beverage cans sold in packs of six in grocery stores? The six cans usually are held together with a plastic collar. Once the cans are released from this plastic collar, what do you do with it? Thrown away in one piece, it is dangerous to wildlife. Fish and birds can get caught in the plastic collars. Some animals mistake them for food and choke on them.

Identifying the Problem
Make a list of the types of products that are packaged using plastic collars. How are these collars usually disposed of?

Solving the Problem
1. Are there other ways to deal with these plastic collars? Can you think of helpful ways to reuse the plastic collars?
2. Can you think of some other ways to package six aluminum cans of beverage together that won’t hurt the environment?
Recycled Products Did you know that plastic soft-drink bottles might have been used to make the carpeting in your home or the fleece jacket that keeps you warm in winter? It’s true. As Table 1 shows, many items people normally throw out can be recycled into other useful products.

Think about what would happen if recycled products piled up on store shelves because no one purchased them. Recycling means not only separating your garbage, but also buying recycled goods when you can.

Recycling can save a lot of energy compared to manufacturing new materials, as Figure 20 shows. Keep in mind that reducing and reusing use even less energy, because they do not require the reprocessing of materials.

What is the difference between reusing and recycling?

Table 1 Recycled Products

<table>
<thead>
<tr>
<th>Items to Be Recycled</th>
<th>Resulting Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newspapers, telephone books, magazines, and catalogs</td>
<td>Newsprint, cardboard, egg cartons, building materials</td>
</tr>
<tr>
<td>Aluminum beverage cans</td>
<td>Beverage cans, lawn chairs, siding, cookware</td>
</tr>
<tr>
<td>Glass bottles and jars</td>
<td>Glass bottles and jars</td>
</tr>
<tr>
<td>Plastic beverage containers</td>
<td>Insulation, carpet yarn, textiles</td>
</tr>
</tbody>
</table>
Habits for a Healthier Environment

By practicing the three Rs of solid waste management, you contribute to a healthier environment. You can see how changing your everyday habits—the way you pack your lunch, the transportation choices you make, the way you dispose of your trash—helps reduce solid waste and pollution, and helps conserve natural resources. The best way for everyone to protect the environment is to develop habits that promote a healthy environment.

Summary

Cutting Down on Waste

- Creating less garbage is the best way to help solve the problem of too much solid waste.
- Using things over again, rather than throwing them away, helps reduce solid waste.
- Recycling is a type of reuse that requires changing the material into another form.

Habits for a Healthier Environment

- You can be part of the solution to solid waste by getting in the habit of reducing, reusing, and recycling.

Self Check

2. List five items you use every day that could be reused instead of being thrown away.
3. Describe how recycling a plastic bottle can help protect the environment.
4. Think Critically How could a person buying food at a take-out restaurant practice reducing waste?
5. Recognize Cause and Effect Explain how keeping a TV on when no one is watching affects the environment.

Making new glass from old glass cuts energy usage by 80 percent.
**Real-World Question**

Imagine planning a small town. People need homes in which to live, places to work, and stores from which to buy things. Children need to attend schools and have parks in which to play. How can all of these needs be met when planning a small town? Your job in this lab is to draw up a master plan to decide how 100 square units of land can be turned into a town.

**Form a Hypothesis**

How should the town’s land resources be used?

**Test Your Hypothesis**

**Make a Plan**

1. A 100-square-unit piece of land can be represented as a square divided into 100 blocks. One way to represent this is to make a square graph ten blocks across and ten blocks down.

2. The table on the next page shows the different parts of a town that need to be included in your design. The office buildings and industrial plant are places where the people of the town will work. They are each six blocks in size. These two blocks cannot be divided and must be treated as one group. The landfill is four blocks in size and also cannot be broken up.

3. All the other town parts can be broken up as needed. Stores and businesses are areas in which shops are located as well as medical offices, restaurants, churches, and cemeteries.

4. As a group, discuss how the different parts of the town might be put together. Should the park be in the center of town or near the edge of the town? Should the school be near the offices or near the houses? Where should the landfill go?

5. How will you show the different town parts on your grid paper?
### Amount of Land Needed for Town

<table>
<thead>
<tr>
<th>Parts of Your Town</th>
<th>Number of Blocks Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office buildings</td>
<td>6 blocks in one group</td>
</tr>
<tr>
<td>Industrial plant</td>
<td>6 blocks in one group</td>
</tr>
<tr>
<td>School</td>
<td>1 block</td>
</tr>
<tr>
<td>Landfill for garbage</td>
<td>4 blocks in one group</td>
</tr>
<tr>
<td>Houses and apartments</td>
<td>44 blocks—can be broken up</td>
</tr>
<tr>
<td>Stores and businesses</td>
<td>19 blocks—can be broken up</td>
</tr>
<tr>
<td>Park</td>
<td>20 blocks—can be broken up</td>
</tr>
</tbody>
</table>

### Follow Your Plan

As a group, design your town. Check over your design to make sure that all of the town parts are accounted for.

### Analyze Your Data

1. Where did you place the office buildings and the industrial plant? Why were they placed there? Where did you place the houses, school, stores, and businesses? Explain why you placed each one as you did.

2. Did you make one park or many parks with the land designated for park use? What are the advantages of your park design?

3. Where did you place your landfill? Will any of the townspeople be upset by its location? What direction does the wind usually blow from in your town?

### Conclude and Apply

Where would you put an airport in this town? Keep in mind safety issues, noise levels, and transportation needs.

### Communicating Your Data

Compare your town design with those of other members of your class. Discuss the advantages and disadvantages of each design.
Are you an environmentally friendly shopper? When you buy things, do you think about how they affect the environment? Scientists have developed a tool to help them figure out the environmental impacts of products. The tool is called life-cycle analysis. Life-cycle analysis is a way of estimating the environmental impact of a product through its entire life.

**Life Stages of a Product**

Most scientists break down the life cycle of a product into six stages:
1. getting the natural resources to make the product;
2. manufacturing the product;
3. transportation to a home, store, or business;
4. use and reuse;
5. recycling; and
6. disposal in a landfill or by burning.

During each stage of a product’s life, natural resources and energy are used. Each stage also has an impact on the environment. Environmental impacts might include air or water pollution, human health problems, use of nonrenewable resources, or habitat loss. A life-cycle analysis considers all of these factors.

Once a life-cycle analysis is complete, the product can be compared with others to see which one is better for the environment. Companies can use these results to reduce the environmental impact of the products they make. You can use life-cycle analyses to become an environmentally friendly shopper.

**Research Information**

Think of a product you would like to buy. Research the life cycle of the product. Share the results of your life-cycle analysis with your classmates in a multimedia presentation.
Section 1  Natural Resource Use

1. Natural resources are the parts of Earth’s environment that supply the materials necessary or useful for the survival of living organisms.

2. Renewable resources are natural resources that can be replaced in 100 years or less. They include trees, water, and sunshine.

3. Nonrenewable resources are natural resources that cannot be replaced or take more than 100 years to replace. They include coal, oil, natural gas, land, and some ores and metals.

Section 2  People and the Environment

1. Human activities affect land, water, air, and other natural resources in many ways.

2. The construction of roads and buildings may destroy the habitats of many organisms.

3. A landfill is an area where garbage is buried.

4. A pollutant is a material that harms organisms by interfering with life processes.

5. Acid rain is caused by air pollution.

Section 3  Protecting the Environment

1. Much of the garbage people produce is in the form of solid waste.

2. Reduce, reuse, and recycle are the three Rs of solid waste management.

3. The three Rs help people produce less solid waste and can help conserve natural resources.

Copy and complete this concept map about energy conservation.
Using Vocabulary

Give the vocabulary word that best fits each of the following definitions.

1. a material that harms living things by interfering with life processes
2. reusing materials after they have been changed into another form
3. an area where garbage is deposited
4. things people throw away that are in solid or near-solid forms
5. formed when gases released by burning oil and coal mix with water in the air
6. a part of the Earth that living organisms need or use

Checking Concepts

Choose the word or phrase that best answers the question.

7. Which of the following is an example of a nonrenewable resource?
   A) sunlight  
   B) water  
   C) oil  
   D) a tree

8. What is using an old newspaper to line a pet cage an example of?
   A) reusing  
   B) recycling  
   C) reducing  
   D) buying

9. What is collecting used paper and sending it to a factory to be made into new paper an example of?
   A) reusing  
   B) recycling  
   C) reducing  
   D) buying

10. What could be caused by breathing polluted air?
    A) acid rain  
    B) health problems  
    C) solid waste  
    D) water pollution

11. What does a life-cycle analysis of a product indicate?
    A) daily use  
    B) production time  
    C) all resource and energy use  
    D) decay time

12. Turning off unneeded lights is an example of which of the following actions?
    A) reusing  
    B) reducing  
    C) recycling  
    D) polluting

13. What are the paper, apple, and wood pencils examples of?
    A) renewable resources  
    B) pollutants  
    C) nonrenewable resources  
    D) packaging

14. Dumping used motor oil on the ground could create
    A) air pollution.  
    B) water pollution.  
    C) solid waste.  
    D) acid rain.
15. **Infer** why, if people use so many paper products, we don’t run out of trees.

16. **Explain** why almost 70 percent of Earth’s surface is covered by water, but less than one percent can be used by people.

17. **Describe** When a landfill can’t hold any more solid waste, it is closed down. How can a landfill be an environmental problem even though people are no longer depositing trash there?

18. **Evaluate** Some people take their own bags with them when shopping. How might this affect natural resources?

19. **Sequence** Use the following phrases to make a concept map showing the life-cycle analysis of an aluminum can: refine the aluminum; mine ore; use the can; shape aluminum into cans; recycle the can; melt the ore in a factory; transport the can to where it will be used.

20. **Classify** the following resources as renewable or nonrenewable: sunlight, water, oil, trees, air, coal, soil.

**Use the table below to answer question 21.**

**Recycling Possibilities**

<table>
<thead>
<tr>
<th>Items for Recycling</th>
<th>Recycled Product</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Do not write in this book.</td>
<td></td>
</tr>
</tbody>
</table>

21. **Make and Use Tables** Record the items your family throws away for one week. Make a table listing the items that can be recycled and the products that can be made from them.

22. **Design an Experiment** Lemon juice is an acid. Design an experiment showing the effects of lemon juice on a plant. Relate the results of your experiment to acid rain.

23. **Technical Writing** Write a newspaper article describing an environmental problem in your own community and possible solutions.

24. **Display** Create a poster that lists household hazardous wastes, such as paints and pesticides, and explains how to dispose of them safely.

25. **Saving Trees** If everyone in the United States recycled their newspapers, 500,000 trees would be saved each week. How many trees would be saved in one year?

**Use the illustration below to answer question 26.**

**Conventional car** gets 28 mpg

**Hybrid car** gets 50% better gas mileage

26. **Math in Advertising** The advertisement shown here compares the gas mileage of a conventional compact car with a hybrid gasoline/electric vehicle. What is the gas mileage of the hybrid car?

27. **E-waste** Used computers, TVs, and other electronics contain hazardous materials. Properly disposing of this electronic waste, or e-waste, costs about $52 per ton. In the year 2000, about 4.6 million tons of e-waste ended up in U.S. landfills. How much would it cost to dispose of that much e-waste properly?
1. Which of the following statements is true?
   A. Only the cardboard used to package the CD player comes from natural resources.
   B. Only the metal used to make the screws and wires in the CD player comes from natural resources.
   C. Everything except the plastic used to make and package the CD player comes from natural resources.
   D. The trees and minerals used to make the cardboard, plastic, and metal in the CD player are all natural resources.

2. Which part of the CD player is made from crude oil?
   A. the screws that hold it together
   B. the plastic case
   C. the cardboard packaging
   D. the electrical parts that make it work

3. A nonrenewable resource is a resource that cannot be replaced by natural processes in what amount of time?
   A. within any amount of time.
   B. within 100 years.
   C. within 1,000 years.
   D. within 1 million years.

4. Which of the following could be considered a renewable resource?
   A. water
   B. coal
   C. iron ore
   D. land

5. According to the graph, what type of waste makes up the greatest amount of solid waste?
   A. paper products
   B. glass
   C. yard waste
   D. other waste

6. About how many millions of tons of solid waste come from plastics?
   A. 28
   B. 17
   C. 12
   D. 23

**Process of Elimination** If you don’t know the answer to a multiple-choice question, eliminate as many incorrect answers as possible. Mark your best guess from the remaining answers before moving on to the next question.
7. Give three examples of natural resources.

8. Why are coal, natural gas, and oil not considered renewable resources?

Use the graph below to answer questions 9 and 10.

9. Which natural resource supplies more of the world’s energy than any other resource? Which section of the graph represents it?

10. According to the graph, what two sources of energy are indicated by sections B and C? What total percentage of the world’s energy do they represent?

11. What kinds of human activities are responsible for the destruction of land as a natural resource?

12. Is soapy water or water with household cleaner in it best disposed of by pouring it down the drain or on the ground?

13. What is the source of most air pollution?

14. How does acid rain form?

15. Name three examples of solid waste.

16. Compare and contrast renewable resources with nonrenewable resources.

17. Draw and label a diagram showing a side-view of a landfill.

18. Draw a diagram showing how rainwater that washes down a city drain ends up as clean drinking water.

19. Discuss why you might expect to find more air pollution in a city area than a rural area.

Use the illustration below to answer questions 20 and 21.

20. Describe one way you can reuse each of the items shown above.

21. Describe ways you can reduce your use of one or more of the items shown above.

22. Describe how you and your friends can decrease the amount of solid waste that goes into your local landfill. In your answer, discuss how you would handle empty plastic soda bottles, cardboard packaging, food scraps, and used notebook paper.

23. You are planning a picnic. What are the advantages and disadvantages of using paper plates and cups and disposable plastic forks and spoons? What are the advantages and disadvantages of using washable, reusable plastic dishes, forks, and spoons?