Science Ch. 11

Earth’s Resources

Career

Web Editor

How would you like to spend each day learning from NASA scientists what they have discovered about the changes in Earth's surface? You would meet with scientists to hear about exciting things they have found. You would also see fantastic images from all over the world taken by satellites in space.

As a writer or editor for a Web site like NASA's, you might help everyone understand what scientists are discovering every day. Your stories might be about events on the Earth's surface that can only be seen in their entirety from space. You might select the best satellite image to include on the Web page and explain the image with a caption.

Editing for a scientific Web site is just one of the many areas in which Web editors are needed. You could also be a Web site editor in the areas of history, technology, music, or sports, to name just a few.

Rebecca Lindsey wrote an article for NASA's Earth Observatory Web site about how a landslide blocked a river in Tibet and formed a new lake.

Lab zone

Take-Home Activity

Research an image on NASA's Earth Observatory Web site at http://earthobservatory.nasa.gov. Write a short article that explains what the image shows.

Chapter 11

Earth's Resources

You Will Discover

- what renewable and nonrenewable resources are.
- how land, air, and water provide resources.
- how resources are connected.
- what some energy resources are.
- how fossil fuels form.
- how the harmful effects of using fossil fuels can be reduced.

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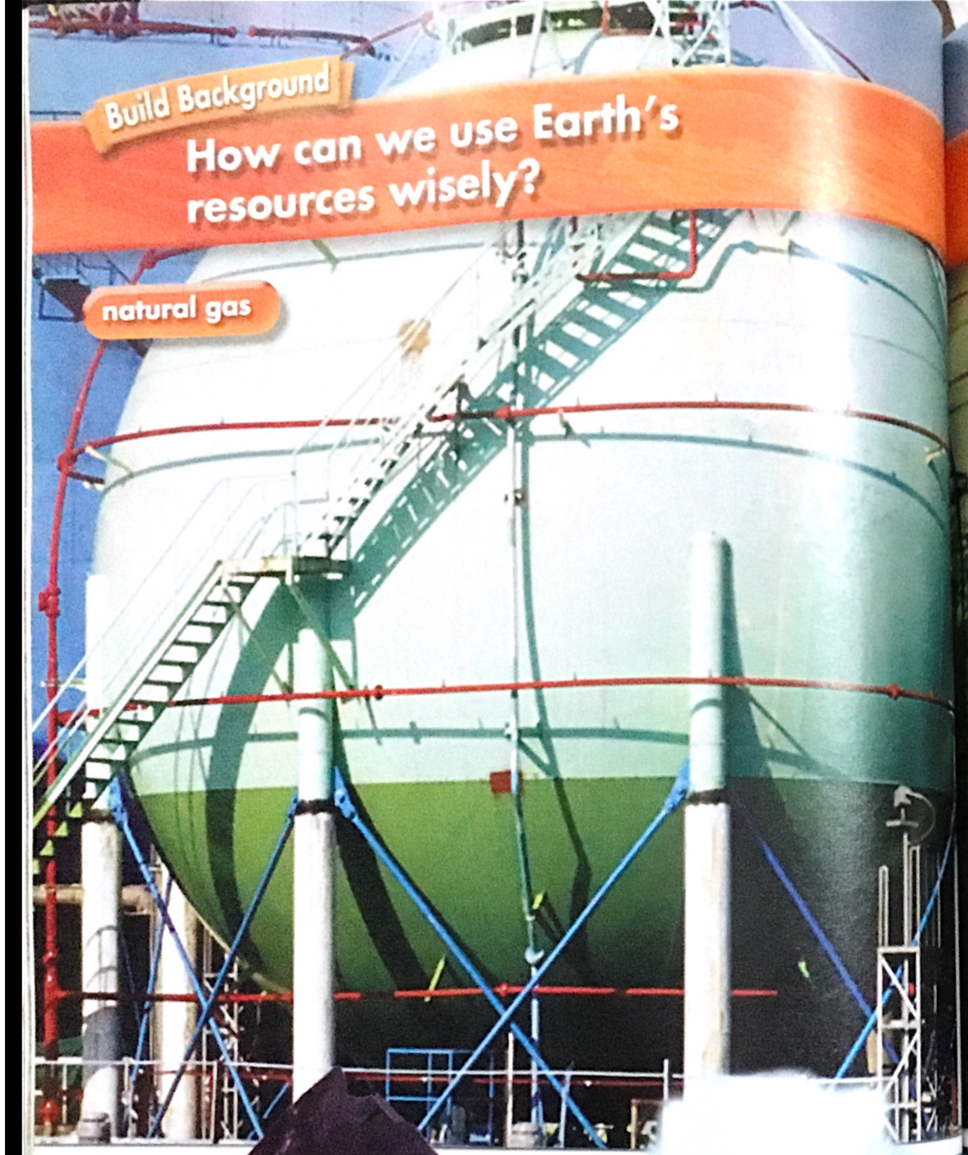
Build Background

How can we use Earth's resources wisely?



Chapter 11 Vocabulary

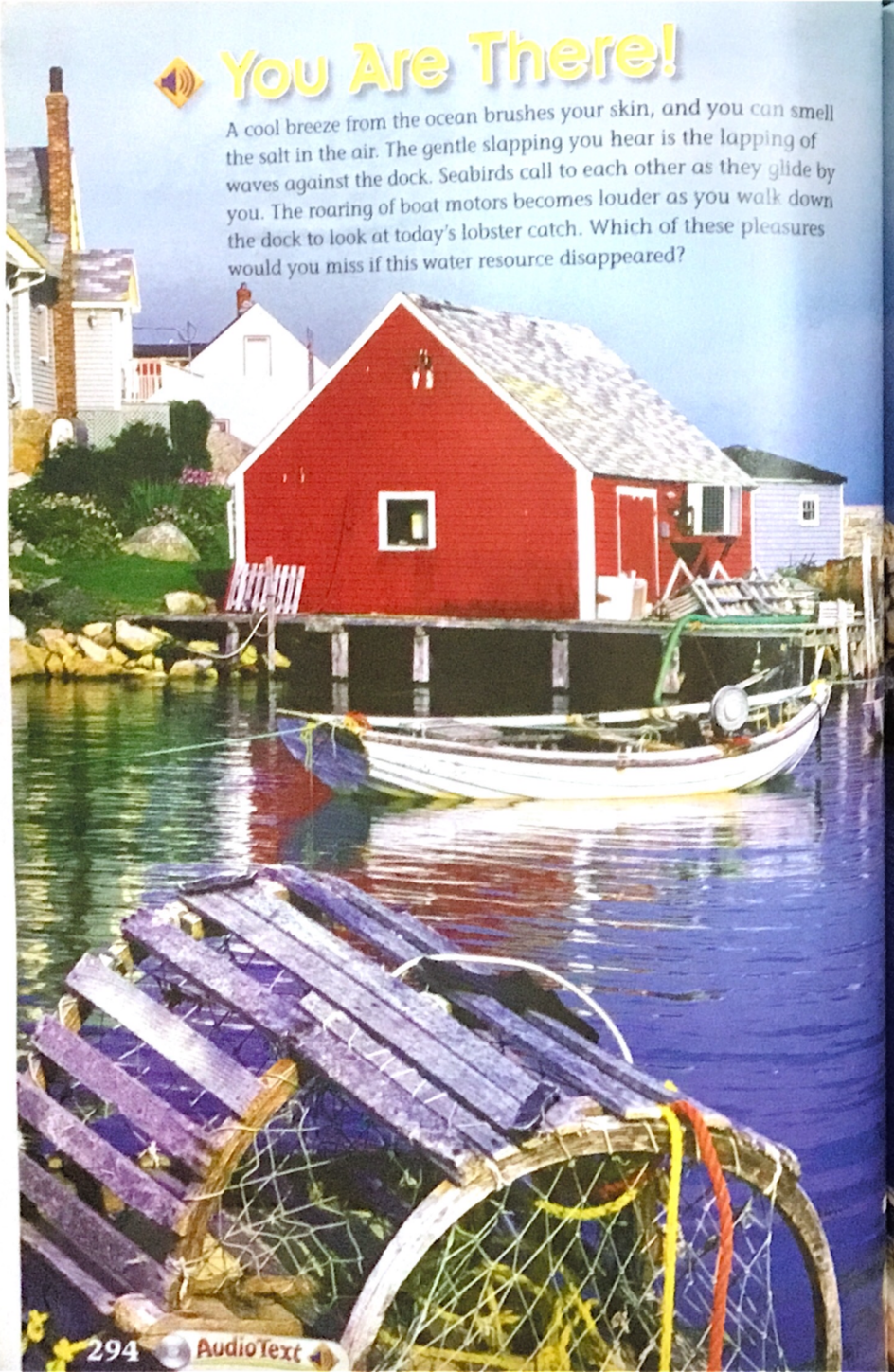
- **renewable resource** page 295
- **nonrenewable resource** page 295
- **fossil fuel** page 304
- **geothermal energy** page 304
- **coal** page 306
- **petroleum** page 306
- **natural gas** page 306
- **acid precipitation** page 307

acid precipitation

Rain or snow that is more acidic than normal precipitation

You Are There!

A cool breeze from the ocean brushes your skin, and you can smell the salt in the air. The gentle slapping you hear is the lapping of waves against the dock. Seabirds call to each other as they glide by you. The roaring of boat motors becomes louder as you walk down the dock to look at today's lobster catch. Which of these pleasures would you miss if this water resource disappeared?



Lesson 1

What are Earth's natural resources?

All living things share resources that can be renewable or nonrenewable. The way in which we use one resource can affect other resources.

Renewable and Nonrenewable Resources

How often do you think about the air, water, and land around you? Try to imagine what life would be like without a seemingly endless supply of these resources. Air, water, and land are just a few of the many resources on Earth.

Some resources, called **renewable resources**, can be replaced through natural processes almost as fast as they can be used. Sunlight and wind are examples of renewable resources. Trees and cotton are also renewable resources. They can be replanted once they are used. If they are used wisely, renewable resources can last indefinitely.

Nonrenewable resources cannot be replaced as fast as they are used. Some nonrenewable resources, such as minerals and fossil fuels, take millions of years to form.

When using resources, consider the benefits and costs. For example, cutting trees to make lumber for homes may seem like a benefit. But the cost might be that certain organisms lose their habitats. Understanding how resource use affects Earth can help you make informed decisions.

1. **Checkpoint** How are renewable and nonrenewable resources alike and different?
2. **Main Idea and Details** Write a main idea statement about the use of Earth's resources. Then list at least three details to support your main idea.

Air Resources

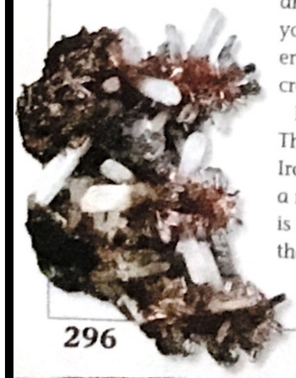
One reason that life on Earth is possible is because of the gases of its atmosphere. Nitrogen, oxygen, and carbon dioxide are gases that are essential to life. These gases are renewable resources because they cycle in the environment. But the air can become polluted.

Air pollution results when certain substances are put into the atmosphere. Many of these substances are produced when fuels such as coal, oil, and natural gas are burned. Air pollution can affect all living organisms, including humans. When air is polluted, some people have trouble breathing.

Each day the Environmental Protection Agency (EPA) lets people know how clean their air is. The EPA rates the air with an air quality index (AQI) color, which you can see below. The colors go from green to maroon. You can find AQI information in your local newspaper or on the EPA Web site.

Land Resources

The quartz in this rock can be used to make glass, cement, sandpaper, and electronic equipment.



If you think about all the ways we depend on land, you will realize how important it is. Land resources include farmlands, grazing lands, soil, minerals, forests, and wildlife. People build houses and other structures on land.

Soil covers much of Earth's land, and people use it to grow crops and other plants. Without soil, you wouldn't have much of the food you eat. Soil may take hundreds of years to form, and it can be easily eroded by wind and water. Many farmers take steps, such as rotating crops and limiting areas of bare soil, to reduce soil erosion.

Land also provides us with the many minerals we use every day. The automobile, bus, or bike you ride is made with the mineral iron. Iron also is used to build many buildings and machines. Limestone, a rock containing the mineral calcite, is used to make cement, which is used to make buildings, bridges, and sidewalks. Minerals take thousands of years to form, so they are nonrenewable resources.

What products do you use that come from forests?

Forests

Did you use paper today? Did you sit on furniture made of wood? Have you used anything made of rubber lately? If you did, you probably used a product that came from a forest. Many materials we use every day come from forests. Some nuts, fruits, and even medicines come from rain forests. Scientists are researching forest plants for other medicines that may be able to treat diseases.

Forests also provide a habitat for many species. When forests are cut down, these species may not be able to adapt to a new environment. Some species become extinct as large tracts of forests are cut down.

Forests play an important role in controlling carbon dioxide in Earth's atmosphere. Too much carbon dioxide in the atmosphere can trap heat, causing temperatures to get warmer. The result can be harmful to Earth's organisms that cannot adjust to the higher temperatures. Trees take in carbon dioxide and release oxygen during photosynthesis. When large portions of forests are cut down and burned, more carbon dioxide remains in the atmosphere.

Many of the forests in the United States are public lands. But others are owned privately—often by lumber and paper companies that cut trees to make their products. These companies provide valuable products that we use every day, and they employ many people. The United States Forest Service works with these companies to conserve forest resources by encouraging logging methods that maintain forests as renewable resources. Part of the process is figuring out how often and where to cut and plant trees to keep a constant supply.

Apples are a food crop that can be eaten raw or cooked. What are some food products made from apples?

1. **Checkpoint** Do you think soil is a renewable or nonrenewable resource? Explain why you think so.
2. **Main Idea and Details** Why are forests an important resource? Use a graphic organizer to answer the question.

Water Resources

How many different ways have you used water today? Could you have done the same things without water? Some of the ways we use water are obvious—bathing, cleaning, drinking, cooking, growing crops, or swimming. Many industries use water too. But many water uses aren't as easy to see. The cells of all living things need water for life processes. Without water, the cells would die. For this reason, all living things need a source of water.

Water is considered a renewable resource because it is recycled in the water cycle. But if water becomes polluted, it cannot be used safely. As water flows across land, it can pick up pollution, including fertilizers and pesticides. Chemicals from industry are another source of water pollution.

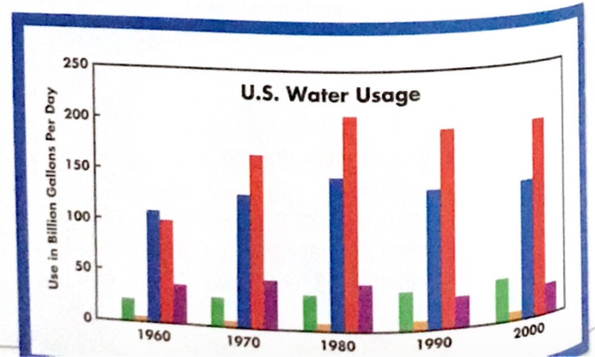
Some industries remove water from lakes and rivers. They use it to cool equipment that becomes hot. When the water is returned to the lake or river, its temperature is higher than it was originally. Even a small increase in temperature can lead to changes in an ecosystem and affect organisms.

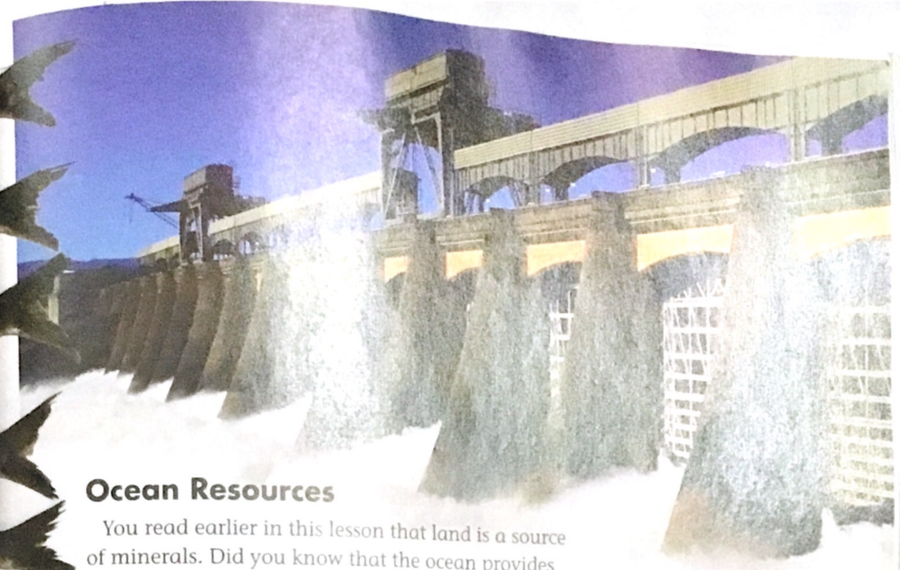
About 75 percent of Earth's surface is covered by water. So you might wonder why we should worry about some of it being polluted. Most of Earth's water is in the ocean's salt water. Many organisms—including humans—cannot use salt water. Fresh water makes up only about three percent of Earth's water, and much of that fresh water is frozen, such as in glaciers. Frozen water is not available for use. Because freshwater organisms can use so little of Earth's water, preventing pollution is important.

Although most places in the United States have enough water, some places have water shortages. The problem can result when populations grow. They need more water than the area can supply. People living in some areas must get fresh water from faraway sources or by removing salt from ocean water.

Many food products, including fish, come from water. What other food products do fresh and salt water produce?

How has the use of water for public supply changed from 1960 to the present?





The energy in running water can be used to provide electricity to homes, businesses, and industries.

Ocean Resources

You read earlier in this lesson that land is a source of minerals. Did you know that the ocean provides us with many minerals too? Salt is an ocean resource found in large amounts. Most of the salt in the ocean is sodium chloride—table salt. Salts can be removed from ocean water when the water evaporates.

Other minerals, such as tin, magnesium, iron, and copper, can be found in large amounts on the ocean floor. Many of these minerals form around a small object such as a shark's tooth. These lumps of minerals are called nodules.

Minerals aren't the only resources on the ocean floor. Deposits of oil and natural gas exist beneath the ocean floor. Wells can be drilled deep into the ocean bottom to remove these products.

Another source of energy can be found in Earth's oceans. Can you guess what it is? Moving ocean water has a lot of energy. Today we can capture the energy of the ocean tides and use it to generate electricity. Tidal energy is inexpensive and does not pollute the environment—and it is a renewable resource. Unfortunately, only a few places in the world have the right kind of coastline to produce tidal energy.

1. **Checkpoint** Why is water important to all living organisms?
2. **Math in Science** Approximately how many more gallons of water were used per day for irrigation than for other industries in 1990?

These tiny organisms are only one of the many species that form plankton. Plankton are important in both ocean and freshwater food chains. Because many plankton species can carry on photosynthesis, they form the base of some food chains.

Connections Among Resources

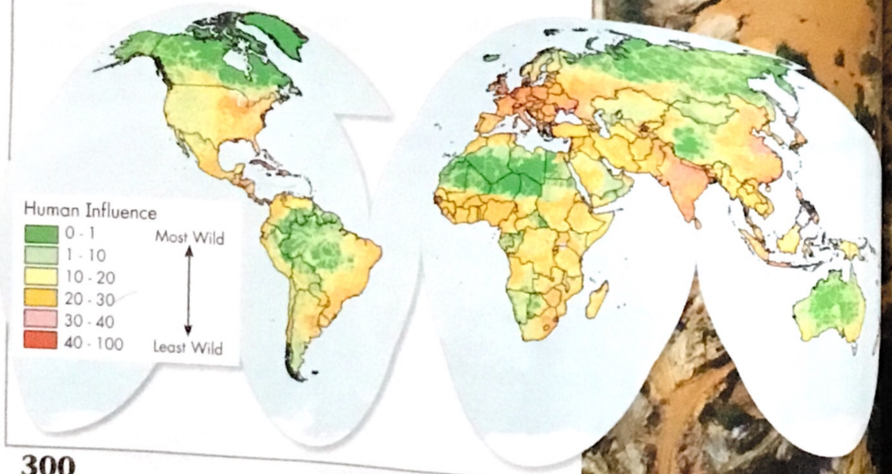
Although Earth has a plentiful supply of many resources, the supply can be affected by human activities. Air, land, and water can become polluted. Habitats can be changed or destroyed. Supplies can be used up more quickly than they can be replaced.

How much of Earth has been affected by human activities? In 1865, author and naturalist George Marsh asked a similar question. Since then, many other scientists have been trying to answer that question.

Recently a group of scientists got together to find an answer. The result is the map on this page, called the Human Footprint. It shows how much humans have impacted—or affected—Earth's ecosystems. Human impact is rated on a scale from 0 to 100. A score of 0 shows the least impact.

By studying the data, scientists found that 83 percent of Earth's total land has been influenced by human activity. They also discovered that 98 percent of the land where it is possible to grow rice, wheat, and maize—the world's three main crops—is directly affected by human activities. Some of the effects are harmless, but others are not. Scientists say that one reason they wanted to do the study is so that people will understand that they affect the environment. They want people to know that they can make choices that will enable them to lessen the harmful effects and increase the helpful effects.

Human Footprint Map



Three Rs

Reduce
- Turn off water when brushing your teeth.
- Turn out lights when you leave a room.
- Turn off your computer when not using it.

Recycle
- Participate in community recycling programs.
- Buy products made from recycled materials.

Reuse
- Find new ways to reuse products.

Reducing the Impact

Were you surprised to learn how much of Earth has been affected by humans? What can you and others do to reduce the harm done to Earth and its resources?

Knowing how all Earth's parts—its land, water, air, and living organisms—are interconnected can help people make good choices about their activities. For example, look at the photo to the left to see the chain of causes and effects that begin with clearing large areas of forest. The pollution that results affects all organisms that depend on water from the rivers. The resulting erosion can wash away valuable soil, which can make growing trees and other plants in those areas difficult or impossible. Any organisms that depended on the soil will have to move to new habitats or die. What would happen to organisms that depended on the soil organisms? Can you see how one act—cutting trees—can have many effects?

Recall that some resources are nonrenewable, including minerals, coal, oil, and natural gas. If humans don't manage these resources wisely, they will run out. Part of managing a resource includes conservation. To conserve resources, use them only when necessary.

One way you can practice conservation is to use the three Rs: Reduce, Recycle, Reuse. The chart gives you some ideas about how to use the three Rs. What other ways can you think of?

Lesson Checkpoint

1. Why is conserving resources important?
2. Explain how the use of one resource may affect other resources.
3. Writing in Science **Expository** Write a newspaper article about a series of events that result from carelessly using or polluting a resource. Your article can be real or one that you make up. For example, you might report about what happens downstream when a factory releases harmful chemicals in a river.

When large areas of forests are cleared for timber, topsoil is easily eroded and washed into nearby streams and rivers.

Lesson 2

Where do we get energy?

Every day humans use energy from a variety of sources. These sources include fossil fuels, wind, water, solar energy, nuclear energy, and geothermal energy.

Energy Needs

The picture on this page shows what Earth looks like at night. Hundreds of satellite images were put together to make the picture. You can see that human-made light shows up all across the planet. Can you see the areas that have the most light?

As you can guess from the picture, one of the largest uses of energy on Earth is to produce light. But energy is needed for many other uses. Each time you ride in a car, bus, or train, you are taking part in an activity that uses energy. When you use a computer, watch TV, or listen to a CD, you are using energy. Cooking, heating and cooling your home, and doing laundry require energy.

Businesses use energy to power computers, phones, fax machines, copy machines, and cash registers. Energy powers industrial machines that make products. Theaters use energy to show movies, and restaurants use it to cook food and to keep the food from spoiling. Ships, trucks, and trains need energy to transport goods around the world.

Earth at night

Energy Needs Over Time

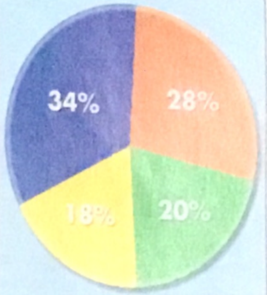
The need for energy resources in most areas of the world has changed over time. Early societies used some energy resources, such as wood, for light, heat, and cooking. Even early farming societies used energy, but compared to today's energy use, they didn't use much. They depended on animals to pull plows and other farm equipment.

In the late 1700s, people in the United States began to use industry to meet their needs. Tasks that in the past were done by people and animals were now done by machines. Factories began producing clothing, furniture, building equipment, farm machines, and later automobiles. Making these products required a source of energy, often electricity.

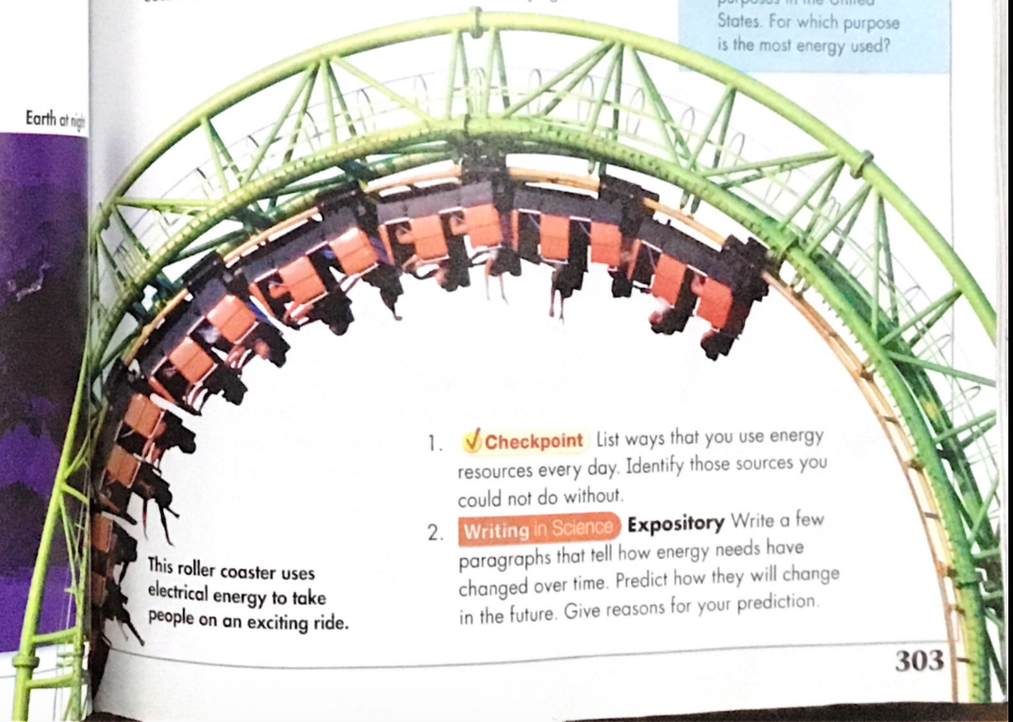
As the country's population grew, the demand for products also increased. New factories opened, and the need for energy increased. The demand for more energy continues today. Look at the graph to see how we use energy.

Much of the increase in the use of energy results from the use of more electricity. Except for lightning, electricity is not a resource found in nature. Where does the energy come from? You'll find out on the next few pages.

U.S. Energy Use



The graph shows how energy is used for different purposes in the United States. For which purpose is the most energy used?



This roller coaster uses electrical energy to take people on an exciting ride.

1. **Checkpoint** List ways that you use energy resources every day. Identify those sources you could not do without.
2. **Writing in Science** **Expository** Write a few paragraphs that tell how energy needs have changed over time. Predict how they will change in the future. Give reasons for your prediction.

Sources of Energy

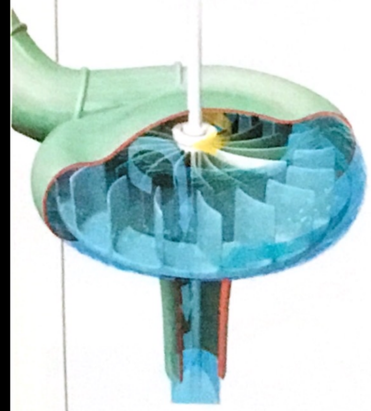
The world is full of energy sources. You probably are familiar with some, such as oil, natural gas, and coal. These energy resources are called **fossil fuels**—energy sources made from the remains of living organisms. You'll learn more about fossil fuels later in this chapter. Other energy sources may not be as familiar as fossil fuels even though they are all around you.

Electricity is generated when water behind this dam flows down through turbines like the one below. The energy of water is converted to electrical energy in this process.

Energy from Moving Water

Moving water can be used as an energy source. You read about tidal power earlier in this chapter. The water of moving rivers can also be used to produce electricity.

Hydroelectric power, also called hydropower, is produced when dams are built across waterways. Water flows against the blades of a turbine, causing the blades to turn. The energy of the turning blades is converted to electrical energy inside a generator. Advantages of hydropower are that it doesn't release pollution, and it is renewable. A disadvantage of hydropower is that wildlife habitats can be destroyed when a river is dammed and the land behind the dam floods. In 2002, about three percent of energy in the United States was generated by hydropower.



Energy from Atoms and Earth's Heat

Nuclear energy comes from the heat produced when atoms split apart. Nuclear energy is a nonrenewable resource. In 2002, about eight percent of the total energy used in the United States came from nuclear energy. Nuclear energy doesn't pollute the air. But waste materials from nuclear power plants can be harmful to many organisms, including humans. The wastes must be disposed of very carefully.

If you could go deep into Earth's interior, you would find that it is very hot. The energy of the heat inside Earth is called **geothermal energy.** In some places, geothermal energy heats water below Earth's surface. When scientists drill into certain parts of Earth's crust, the hot water is released in the form of steam. The steam can turn turbines. Inside geothermal power plants, the turbines run generators that make electricity. Geothermal energy, a renewable resource, is more available in some areas of the world than others.

Geothermal energy may cause some pollution when carbon dioxide and hydrogen sulfide gases are released into the atmosphere.

Energy from Sunlight and Wind

Energy that comes from the Sun is solar energy. It can be used directly to heat homes and buildings. Solar energy can be converted to electricity without using turbines. Solar energy is renewable and does not produce pollution. However, with today's technology, solar energy can't be used efficiently everywhere. In 2002, less than one percent of energy in the United States was supplied by solar energy.

Wind energy is used to turn the blades of large wind turbines, which generate electricity. Wind energy is a renewable resource that does not produce pollution. The use of wind as a source of energy may not be efficient in some areas where wind may not be steady or constant. Many states use wind energy as a source of electricity.

Water circulated through pipes in these solar collectors is heated by the Sun's energy. The heated water is pumped through radiators to provide heat and hot water to homes and other buildings.

An area where there are a large number of wind turbines is called a wind farm.

Clouds of water droplets are rising from the cooling towers of this nuclear power plant.

Lesson Checkpoint

1. Which sources of energy are nonrenewable, and which are renewable?
2. Make a three-column table. In the first column list the energy sources discussed in this lesson. In the second column, list advantages of each source. In the third column, list the disadvantages.
3. **Main Idea and Details** Give details to expand on this main idea: Moving water can be used as an energy source.

Lesson 3

How are fossil fuels formed and used?

Fossil fuels are nonrenewable energy resources. They take millions of years to form and exist in a limited amount. The burning of fossil fuels can result in air and water pollution.

Coal can be mined from below Earth's surface.

Oil from remote areas of the world, such as Alaska, is transported through a pipeline to areas where it is processed.

After natural gas is removed from underground, it is stored in large tanks.

Types of Fossil Fuels

When you ride in a car or cook on a gas stove, you are indirectly using energy from the Sun. How can that be? Fossil fuels form from organisms that lived long ago. Those organisms were either plants that captured the energy of sunlight, or they were organisms that got energy by eating plants or organisms that ate plants. When the organisms died, some of the energy stored in their bodies was changed into the energy of the fossil fuels. Today when we burn fossil fuels, we are releasing that stored energy—energy that plants captured from the Sun millions of years ago!

Coal is a solid fossil fuel. Until 1960, it was the world's primary energy source. At one time, it was the most common fuel used in the United States. It was burned to heat homes and to power trains. Today most coal is burned in power plants to produce electricity.

Petroleum, also called crude oil or oil, is a liquid fossil fuel. It has been used for more than 5,000 years. The ancient Egyptians used it as a medicine for wounds and as a fuel in lamps. Today we use petroleum products such as gasoline, jet fuel, home-heating oil, and kerosene.

Natural gas is a fossil fuel that is a mixture of gases. More than 2,000 years ago, the Chinese used bamboo poles to pipe natural gas from shallow wells. They burned the gas to heat large pans of seawater. As the water evaporated, the dissolved salt in the water remained.

Today natural gas is used to heat homes and produce electricity. The stove or clothes dryer in your home may use natural gas.

Oil and natural gas can both be found beneath the ocean floor. Large drills are lowered from ocean platforms to explore for oil and gas.

Using Fossil Fuels

Most of the energy used in the United States comes from fossil fuels. Although the United States has large amounts of coal, it is a nonrenewable resource. The supply of coal—and all fossil fuels—can run out. That's one reason scientists are trying to find alternate sources of energy. In addition, getting, processing, and using fossil fuels can cause problems.

When fossil fuels burn, gases are produced. Some of these gases—called greenhouse gases—trap heat in the air. The result is called the greenhouse effect. Some scientists are concerned because as more greenhouse gases are produced, more heat is trapped. The extra heat might cause Earth to become warmer. Organisms that cannot adjust to the warmer temperatures would die. Land could become too dry to grow crops.

Other gases released when fossil fuels burn can combine with water vapor in the air. The result can be **acid precipitation**—rain or snow that is more acidic than normal precipitation. Acid precipitation can harm living organisms, buildings, and statues. For example, many organisms that lived in some North American lakes have died because of acid precipitation.

Burning fossil fuels also leads to smog, a brownish-yellowish haze that settles over some areas on sunny days. Smog can be harmful to living organisms and can cause respiratory problems in humans.

Reducing Fossil Fuel Problems

What can you do to reduce the harmful effects of fossil fuel use? The obvious answer is to use less fossil fuel. But how? Carpool, ride a bike, use public transportation, walk—these are a few things you can do. Also, turn off lights and appliances when you aren't using them. As an adult you may have to make decisions about energy sources. Being informed will help you make better decisions. Prepare yourself by learning about other forms of energy, such as solar, wind, or water.

1. **Checkpoint** What are some ways to reduce the use of fossil fuels?
2. **Main Idea and Details** Write a main idea statement about the problems of using fossil fuels. Support your statement with at least three details.

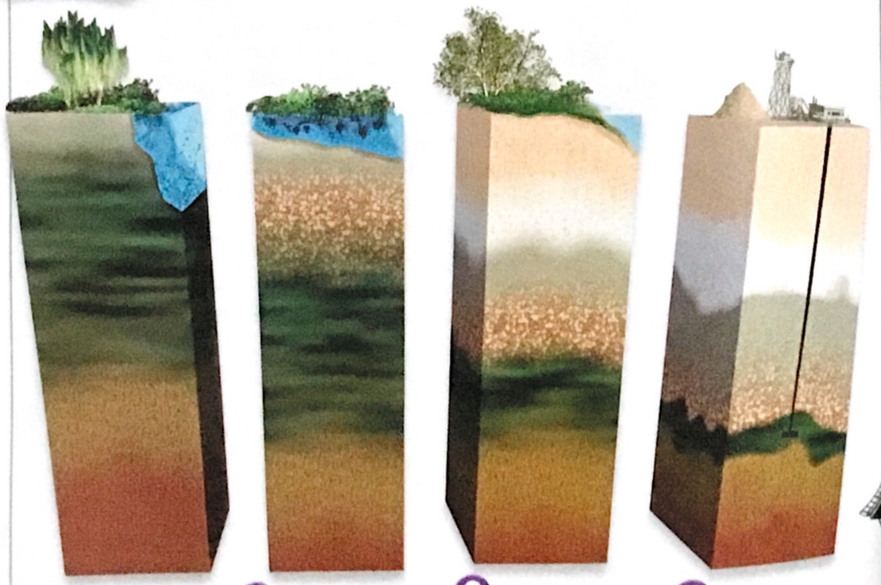
How Coal Forms

Coal, petroleum, and natural gas formed from the buried remains of organisms that lived millions of years ago. But each formed in a slightly different way and from different kinds of organisms. The processes are summarized in the diagrams.

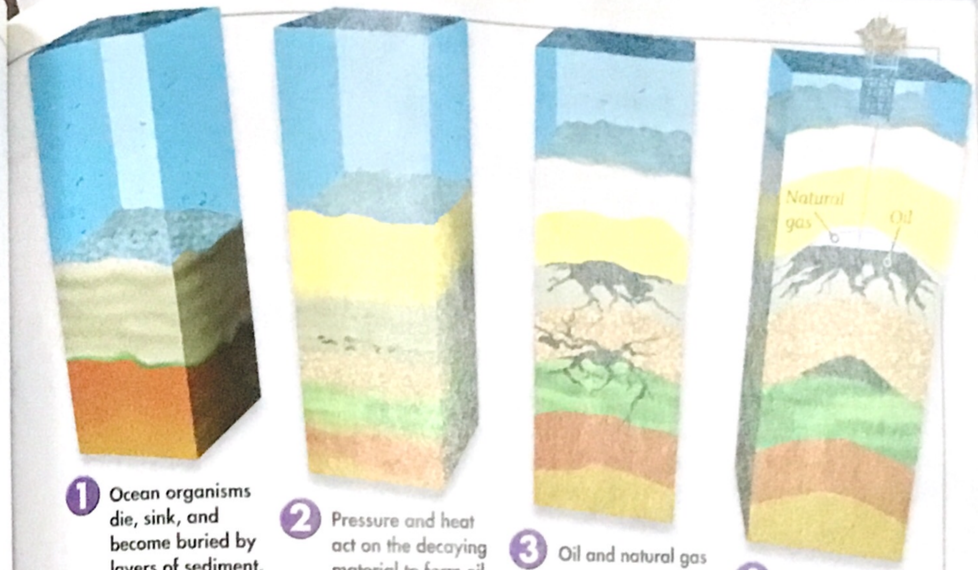
Coal formed from swamp plants. When the plants died, they were buried in the water and mud of the swamps. There the dead plants formed a layer of dead material, called peat. Over time more dead plants, mud, sand, and other sediments were deposited over the peat layer. Pressure from the layers of sediment above and heat within Earth changed the peat into lignite, a soft form of coal.

Notice in the diagram that more pressure and heat changes coal to a different form at each stage. Each type of coal has more carbon than the coal formed at the stage before it. The higher the percent of carbon, the cleaner the coal will burn. Anthracite, the hardest form of coal, is the cleanest burning. In the United States, 97 percent of anthracite is found in Pennsylvania.

Anthracite is the hardest form of coal and takes the longest to form.



1. Dead swamp plants sink to the bottom of the swamp water and form peat.
2. Heat and pressure from sediment layers above the peat slowly change it to lignite. Lignite is a brownish-black coal with a lot of water.
3. More heat and pressure change lignite to bituminous coal, the most common form of coal used in the United States.
4. Anthracite is the last stage of coal formation. It is the hardest form of coal.



1. Ocean organisms die, sink, and become buried by layers of sediment.
2. Pressure and heat act on the decaying material to form oil and natural gas.
3. Oil and natural gas move up towards Earth's surface.
4. Oil and natural gas become trapped when they cannot pass through the rocks.

Oil and natural gas are drilled for by offshore oil rigs.

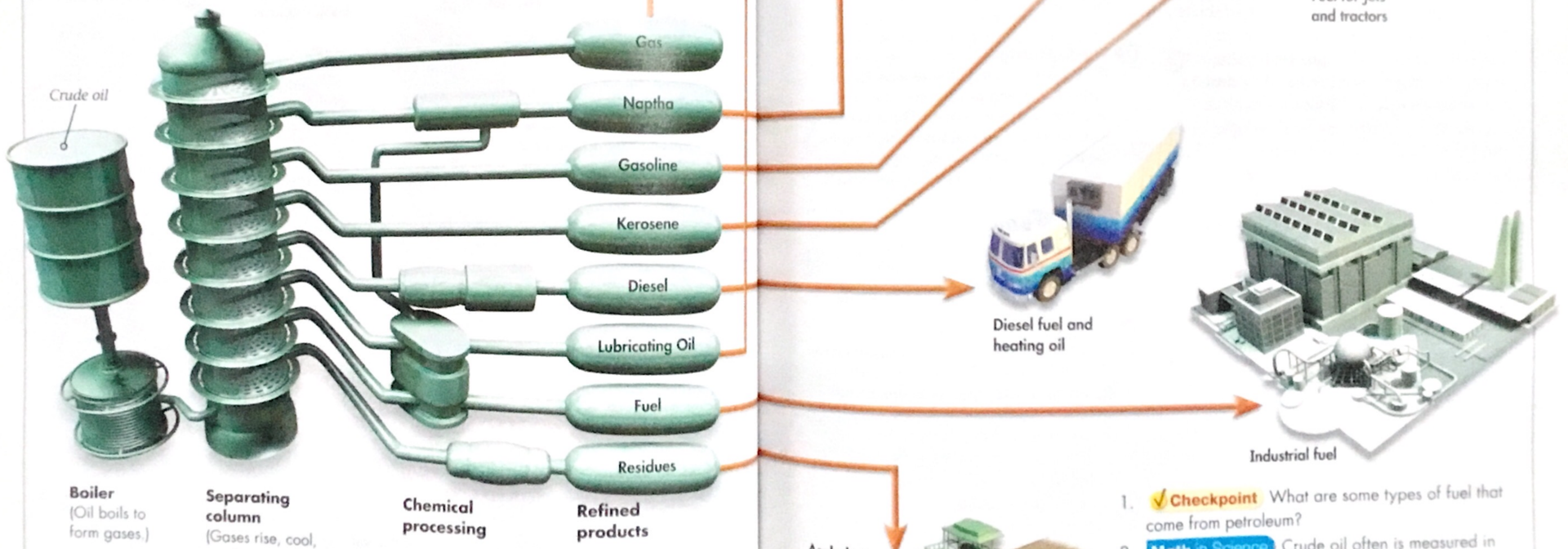
Oil and Natural Gas

Oil and natural gas formed in processes similar to those that produced coal. But they formed from the remains of tiny organisms that lived in ocean water. Since natural gas is lighter than oil, it is often found on top of oil. The areas of trapped oil and natural gas can be drilled into and the deposits recovered for energy use.

1. **Checkpoint** How does lignite differ from anthracite?
2. **Social Studies in Science** Use the Internet or an electronic encyclopedia to find out where large deposits of natural gas and petroleum can be found. Draw a world map that shows the location of those deposits.

Processing and Delivering Petroleum

When petroleum is removed from the ground, it is a mixture of many different kinds of products. These products can be separated at an oil refinery. There, the crude oil is heated. As the temperature of the oil rises, different parts of the oil can be removed at different temperatures. These substances are then processed to make them pure, removing materials such as water, salts, or oxygen. The finished products are often stored at the refinery until they are shipped to gas stations, airports, or factories. You can see how this process works in the diagram.



1. **Checkpoint** What are some types of fuel that come from petroleum?
2. **Math in Science** Crude oil often is measured in barrels. One barrel contains 42 gallons of crude oil. Of that, about 46 percent is gasoline. How many gallons of gasoline are in a barrel of crude oil?

Coal Mining and Reclamation

Because coal is a solid, it is removed from the ground in a process that is different than the one used to remove natural gas and petroleum. Coal that is buried deep below Earth's surface is removed by digging underground tunnels. The coal is removed and brought to the surface, leaving behind huge caves.

Coal that is within 30 meters of Earth's surface is usually removed by a process called strip mining. During strip mining, soil and rock are removed from Earth's surface to expose the coal.

Both methods of mining coal can have harmful effects on the environment and its organisms. When land is stripped of soil, plants cannot grow and animals lose shelter. Soil can erode and the land can become unusable. Deep coal mining can pollute water. The large caves produced by mining can cause the ground above to collapse.

Land that is mined can be reclaimed, or put to productive use. Both federal and state laws require reclamation of land disturbed by strip mining and deep mining. The pictures show how strip-mined land can be managed and reclaimed.

Lesson Checkpoint

1. How are coal, natural gas, and petroleum deposits removed for human use?
2. What are three problems caused by using fossil fuels?
3. Writing in Science **Persuasive** Write a letter to your state senator urging him or her to pass laws to help reduce the use of fossil fuels. Support your viewpoint with reasons why burning fossil fuels is harmful.

During Mining

A Water Management
Water is important to both the public and the mining process. To protect water quality, mine operators monitor water quality at all stages of the mining process. They develop methods to allow water to flow naturally and without pollution through mining areas.

B Water Treatment
Miners establish water treatment facilities at the mining site, such as settling ponds, to allow sediments and other solids to settle out of mining water before it is reintroduced to streams.

C Waste Storage
The correct handling of wastes produced during the mining process can make the reclamation process easier. The upper topsoil layer at the site can be saved for use after the mining operations are completed. Some wastes can safely be buried underground.

D Chemical Recovery
Chemicals that are used to remove minerals from rock can be collected and disposed of properly.

E Protecting Air Quality
State and federal laws and regulations have established strict guidelines for maintaining air quality at mining sites. Methods for maintaining air quality include using scrubbers and other devices to trap air pollutants and then recycling the pollutants.

F Ecosystem Protection
Care must be taken during the mining process and reclamation to ensure that wildlife populations are not permanently affected. Issues to be considered include ecosystem relationships and protections of wetlands and other habitats.

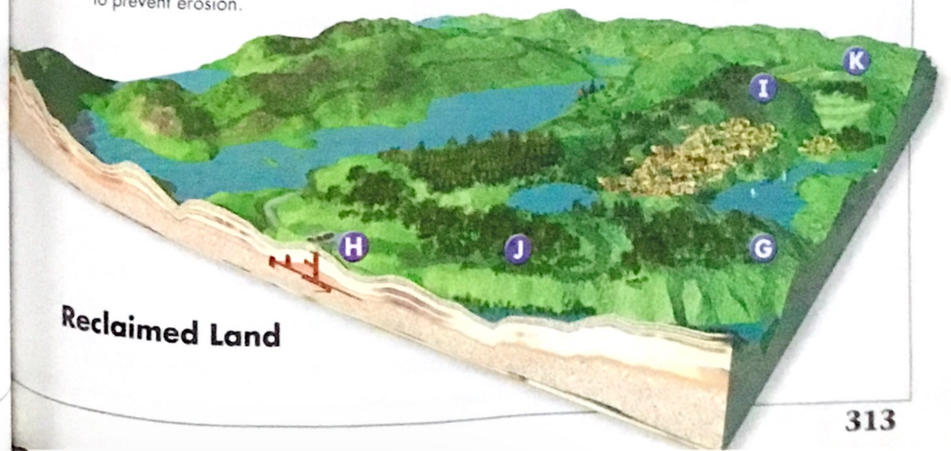
G Mining Laws
State and federal laws require the reclamation of land disturbed by mining both underground and on the surface. Miners must restore the land either to its original state or to a suitable, agreed-upon land use.

H Closing Mine Shafts
Mine shafts often are filled with the rock from which the minerals were removed. The shafts are sealed.

I Sculpting the Land
Earth-moving equipment is used to replace topsoil and to contour the land to prevent erosion.

J Planting the Land
Establishing a plant ground cover is important to prevent erosion. Species are selected for their ability to survive in the conditions of the reclaimed area.

K New Land Uses
Some reclaimed mining sites can serve new purposes. Stone quarries can be filled with water to form lakes. Other areas can be developed into wetlands, farms, ranches, and recreational sites.



Reclaimed Land

Math in Science

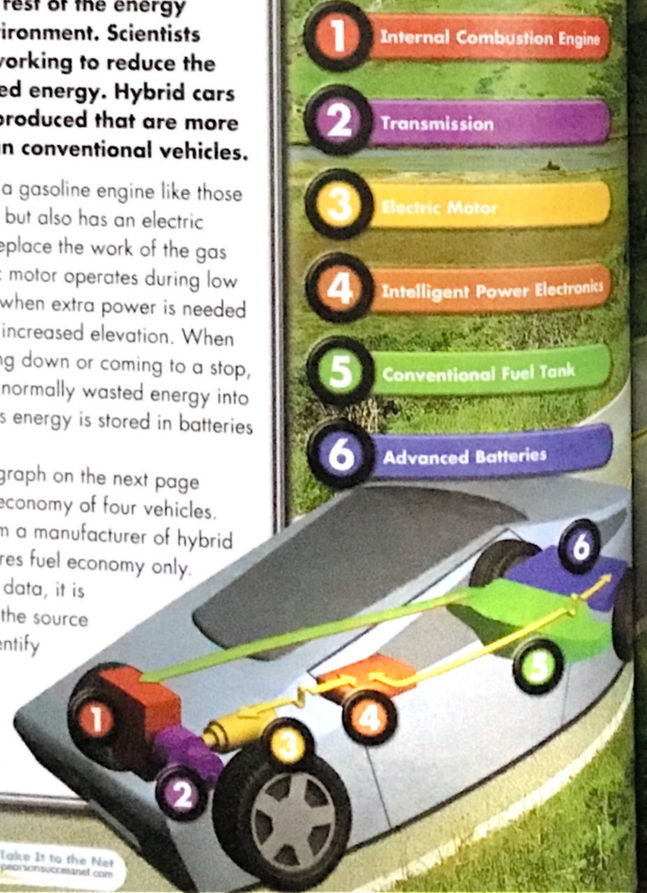
Hybrid Cars

While a car is being driven, only about 15% of the energy stored in the gasoline is used to move the car and to run accessories, such as an air conditioner. The rest of the energy is lost to the environment. Scientists are constantly working to reduce the amount of wasted energy. Hybrid cars are now being produced that are more fuel-efficient than conventional vehicles.

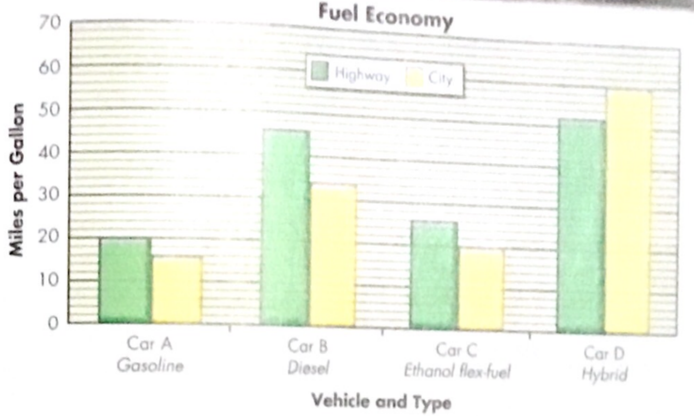
A hybrid car has a gasoline engine like those found in most cars, but also has an electric motor to assist or replace the work of the gas engine. The electric motor operates during low speed driving and when extra power is needed for acceleration or increased elevation. When the hybrid is slowing down or coming to a stop, the motor changes normally wasted energy into electric energy. This energy is stored in batteries for later use.

The double bar graph on the next page compares the fuel economy of four vehicles. The data came from a manufacturer of hybrid cars, and it compares fuel economy only.

When analyzing data, it is important to know the source so that you can identify any possible bias in the data or in the conclusions presented.



Tools Take It to the Net



Use the graph above to answer each question.

1. Notice that the fuel economy of the hybrid is higher than the others. In what other way is it different from the data for the other three vehicles?
2. Find the average fuel economy for each of the four cars.
3. A driver expects to pay $750.00 to purchase a year's worth of fuel for the hybrid. If fuel costs $2.80 per gallon, how many miles of driving are expected? (Hint: Use the average fuel economy you found for the hybrid in Question 2.)
4. The manufacturer says it is clear that a hybrid is the cheapest car to own and it will solve our energy problem. Why is the information presented not enough to support these conclusions? What other information would you want?

Lab zone Take-Home Activity

Use a library or the Internet to do additional research on fuel-efficient vehicles. What other alternatives are there? What are the pros and cons of each type? Does the information reflect any bias by the source of the information? Write your conclusions and present them to the class.

Chapter 11 Review and Test Prep

Use Vocabulary

acid precipitation (p. 307)
coal (p. 306)
fossil fuel (p. 304)
geothermal energy (p. 304)
natural gas (p. 306)
nonrenewable resource (p. 295)
petroleum (p. 306)
renewable resource (p. 295)

Use the term from above that best completes each sentence.

1. A liquid fossil fuel that formed from ocean water organisms is _____.
2. Rain or snow that has a large amount of acid is _____.
3. A solid fossil fuel that formed from swamp plants is _____.
4. A renewable resource that is generated from the heat in Earth's interior is_____.
5. A resource that can be replaced as fast as it is used is a _____.
6. An energy source made from once-living organisms is a _____.
7. A fossil fuel found in the form of a gas is _____.
8. A resource that cannot be replaced as fast as it is used is a _____.

Explain Concepts

9. Explain why air is an important resource.
10. Minerals and fossil fuels are both resources. How are they alike and different?
11. How are fossil fuels and acid precipitation related?

Process Skills

12. **Interpret Data** The table shows the amounts of two greenhouse gases released into the air in the United States for three different years. How would you describe the change in the amount of carbon dioxide released from 1990 to 2000? How does this compare to the amount of methane released?

Released Greenhouse Gases
(million metric tons)

Gas	1990	1995	2000
Carbon dioxide	4,900	5,200	5,800
Methane	31.7	31.1	28.2

13. **Classify** A biomass fuel is a fuel formed from the products of living organisms. Wood is a biomass fuel. Would you consider biomass fuels renewable or nonrenewable? Why?
14. **Predict** A company is built along a river that has large populations of fish and other organisms. The company plans to draw water from the river to cool its machinery that heats up as it cuts large pieces of metal. The company will release the heated water back into the stream. What is likely to happen to some of the organisms living in the river? Explain your answer.

Main Idea and Details

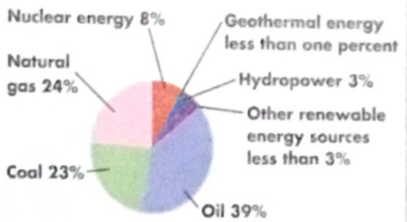
15. Make a graphic organizer like the one shown below. Fill in some details for each main idea.

Main Idea	Details
A variety of land resources exist on Earth.	
Water resources are essential for life.	
Plants and animals use air resources.	

Test Prep

Choose the letter that best completes the statement or answers the question.

16. Which is a nonrenewable resource?
Ⓐ solar energy Ⓒ wind
Ⓑ hydropower Ⓓ nuclear energy



17. According to the above graph, what percent of energy came from renewable energy sources?
Ⓕ 24 percent Ⓗ 8 percent
Ⓖ 23 percent Ⓘ 6 percent
18. Strip mining coal can affect all of the following resources EXCEPT
Ⓐ water. Ⓒ the Sun.
Ⓑ land. Ⓓ wildlife.
19. Explain why the answer you chose for Question 18 is best. For each of the answers you did not choose, give a reason why it is not the best choice.
20. Writing in Science **Persuasive** Using alternate sources of energy sometimes costs more than using fossil fuels. Would you support laws that require the use of alternate sources? Write a letter to persuade others to agree with your opinion.