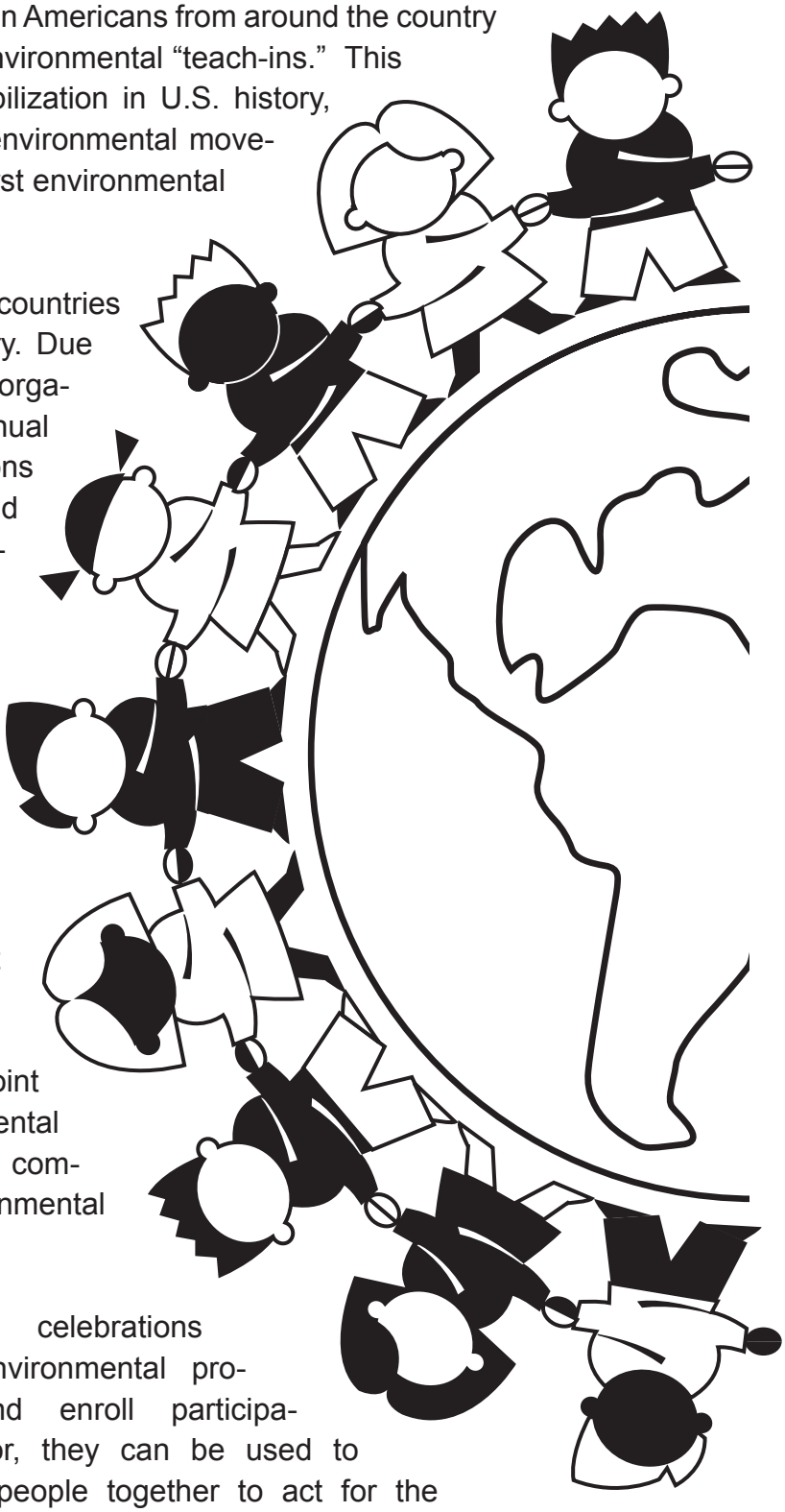
National Aeronautics and Space Administration

GO GREEN

children's 2009 earth day activity book

History of Earth Day

Earth Day was founded in 1970 by former Governor and Senator of Wisconsin, Gaylord Nelson. The first Earth Day in 1970 rallied over 20 million Americans from around the country and on college campuses to get involved in environmental "teach-ins." This event, which was the largest grassroots mobilization in U.S. history, created what has come to be known as the environmental movement. It was out of this event that came the first environmental legislation—the Clean Air and Water acts.



In 1990, more than 200 million people in 141 countries participated during Earth Day's 20th anniversary. Due in large part to the efforts of hundreds of local organizers, "Earth Day" is now an anticipated annual event. Earth Day observances and celebrations now include all social sectors, nationalities, and cultural groups. Earth Day has become perhaps the most prominent catalyst for ongoing environmental education, action, and change.

In response to this groundswell of activity in hundreds of U.S. communities, Gaylord Nelson, Bruce Anderson, and Claes Nolel incorporated Earth Day USA to help facilitate the contribution of the Earth Day process. In doing so, they advance the environmental agenda to include year-round activities that would "make every day Earth Day."

Earth Day celebrations offer an important point of entry to address worldwide environmental concerns as well as the opportunity for communities to focus on their unique environmental problems.

Because Earth Day observances and celebrations broaden the base of support for the environmental programs, rekindle public commitment, and enroll participation from every social and business sector, they can be used to implement wide-scale programs that bring people together to act for the common good.

. . . Earth Day USA

The Earth Day Committee of NASA Glenn Research Center was created in 1993. Its purpose is to help educate and enhance the awareness of Glenn employees and the general public regarding NASA's environmental activities, issues, and concerns. The committee comprises GRC employees all working together to achieve our mission.

Glossary of Environmental Terms

Environment: Our environment is everything around us, living and nonliving, including air, water, soil, trees, rocks—even other people and animals. Our environment includes the conditions under which we live, such as weather and altitude. For any living thing, its environment means all of the living and nonliving things around it.

Ecology: Studying how living (or nonliving) things interact with and affect their environment. For example, ecology means finding out what happens when human activity such as releasing toxins into a stream, or why a certain insect pollinates a flower.

Global: Global means the whole world.

Greenhouse effect: Greenhouse gases (carbon dioxide, water, vapor, methane, and others) make the Earth warmer by holding the Sun's warmth in our atmosphere like a blanket. We need the greenhouse effect in order to survive on Earth. Without it, our Earth's climate would be about 60 °F cooler! Greenhouse gases are produced by the natural processes, such as trees exchanging oxygen for carbon dioxide. But human activities, such as burning petroleum (as we do in our cars), can increase these gases. Increasing greenhouse gases increases the greenhouse effect, warming the Earth more.

Global warming: A gradual increase in the world's average temperature (on the ground and in the air). Warming can cause changes in climate, such as changes in rainfall patterns or a rise in sea level. These weather changes or the warming itself can affect plants, wildlife, and humans. Usually when global warming is discussed, scientists are talking about increases of greenhouse gases from human activities such as burning fossil fuels like coal or petroleum and deforestation.

Climate change: A climate is all of the typical weather events over a long time in whatever region of the Earth you choose. For example, in northern Ohio, a winter's day can be sunny and warm. But over many years, Ohio's average winter days are cold and snowy—that is our climate. Climate changes means a change in these long-term average weather patterns. The changes can be warmer or colder, or can be rainy or less rainy. When people are concerned about climate change, it means they are worried that many climates seem to be changing all over the world.

Recycle: To take back materials for human use that would have been thrown away. For example, making picnic tables or fleece sweaters from recycled pop bottles: or donating old clothing to others, or using them as reusable rags instead of nonreusable paper towels. We mainly recycle to keep useful materials from becoming garbage in our landfills or as litter. But recycling and reusing (like giving away clothes you've outgrown) also saves money, energy, and water, since we don't have to pull new materials out of the ground and make new products.

Mission to Planet Earth Careers

1. **Atmospheric chemist:** I study the air surrounding the Earth over time to understand what is natural and what has changed because of pollution. I take samples from aircraft or balloons, conduct laboratory experiments, and create computer models.

2. **Climatologist:** I study weather on a big scale over a long period of time—even centuries. I gather samples that show long-term histories, like those taken from the bottom of the ocean or from polar ice cores. I also study the growth rings of trees, and then I predict the future climate.

3. **Mathematician/computer scientist:** I invent and improve computers and programs to study about Earth. I know how to create programs on computers that are more complicated than computer games. I make the work of many scientists possible by keeping all the satellite information easy to access and understand.

4. **Sociologist:** I study people in large populations—how they live, grow food, and manufacture things. From what I learn about large numbers of people, I can help predict what people could do to the environment. My work helps decision makers make policies that help prevent damage to the environment.

5. **Ecologist:** I study various forms of life on Earth and how they interact. I study entire ecosystems such as wetlands, prairies, and forests. Sometimes I go out in ships or use aircraft and satellites to observe and gather data about plants and animals in their habitat. We can learn from observing the abundance of life what changes are occurring environmentally on Earth.

6. **Geologist/geophysicist:** I study how Earth is formed, what has happened to it since it formed, and what might happen to it in the future. I study volcanoes, earthquakes, and landslides. I can study rocks and rock formations and determine the geological history of an area.

7. **Climatologist:** I study glaciers in the Arctic and Antarctica as well as those formed in the tallest mountains. I study satellites and ground measurements to predict the weather. I am like a meteorologist, but I study long-term weather patterns.

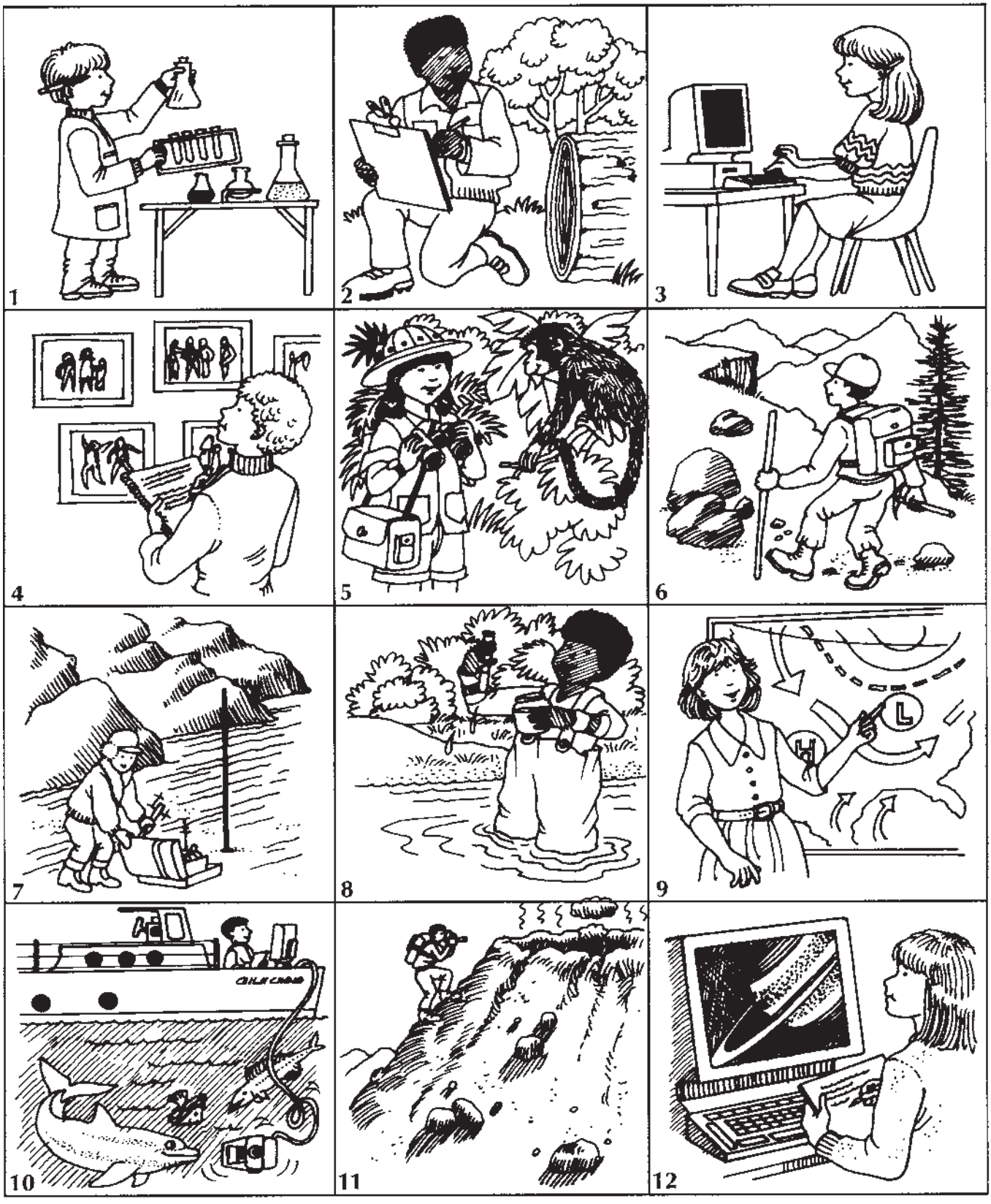
8. **Hydrologist:** I study the water cycle. I study where the water goes below ground, on the Earth's surface, and in the air. I study what elements it contains, and whether its chemistry has changed. My research often is used to determine where droughts may occur or how pollutants travel.

9. **Meteorologist:** I study the weather, the local short-term changes that affect how we live every day. I use satellites and ground measurements to predict the weather. You can see some meteorologists on television news programs.

10. **Oceanographer:** I study oceans and how they change. I analyze the chemical makeup of ocean water, ocean floor geography, currents, waves, tides, and ocean plants and animals. I work on ships, in laboratories, or in aircraft and use floats and satellites to obtain some of my data.

11. **Volcanologist:** Using ground instruments, I study volcanoes and how they influence the climate. I use satellites and robots to gather data when the volcanoes are active and become too dangerous to go near.

12. **Planetologist:** I study planets, moons, meteoroids, and other objects in space. When I compare planets like Mars, which is a very dry planet compared to Earth, I can learn more about what could happen to our planet. I can study Mars by observing the planet with large telescopes by using data collected by satellites, such as that obtained by Voyager, and by data collected by rovers on the planet itself.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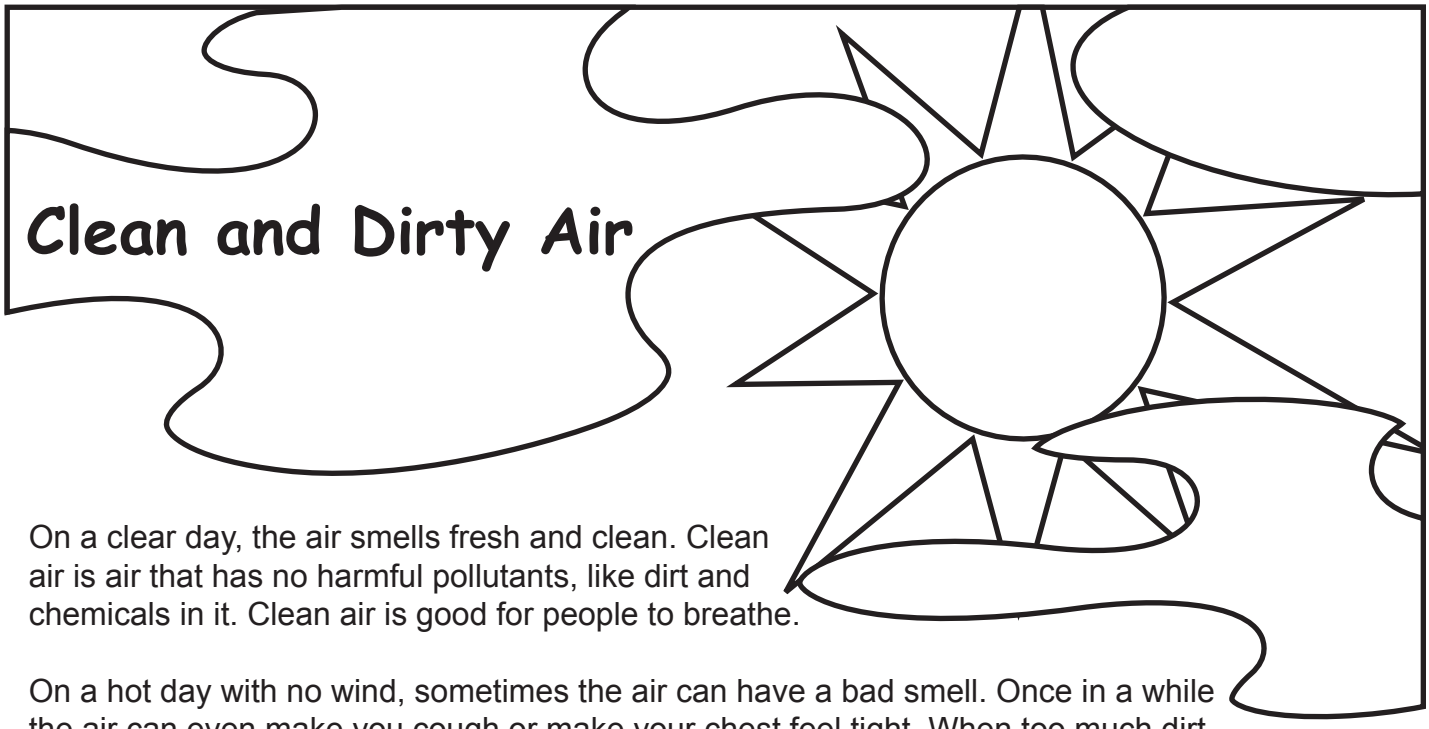
Clean and Dirty Air



On a clear day, the air smells fresh and clean. Clean air is air that has no harmful pollutants, like dirt and chemicals in it. Clean air is good for people to breathe.

On a hot day with no wind, sometimes the air can have a bad smell. Once in a while the air can even make you cough or make your chest feel tight. When too much dirt and chemicals get into the air, the air is dirty and is not good for people to breathe.

How does air get dirty?
Air gets dirty from very lightweight pollution. Pollution is another word for kinds of dirt that is not healthy. The dirt in your garden in probably clean and healthy. The dirt (pollution) that ends up in the air is usually unhealthy. This pollution mostly comes from burning fuels; gases float into the air from gasoline or chemicals. The pollution in the air is made up of many kinds of very fine particles, gases, and chemicals.

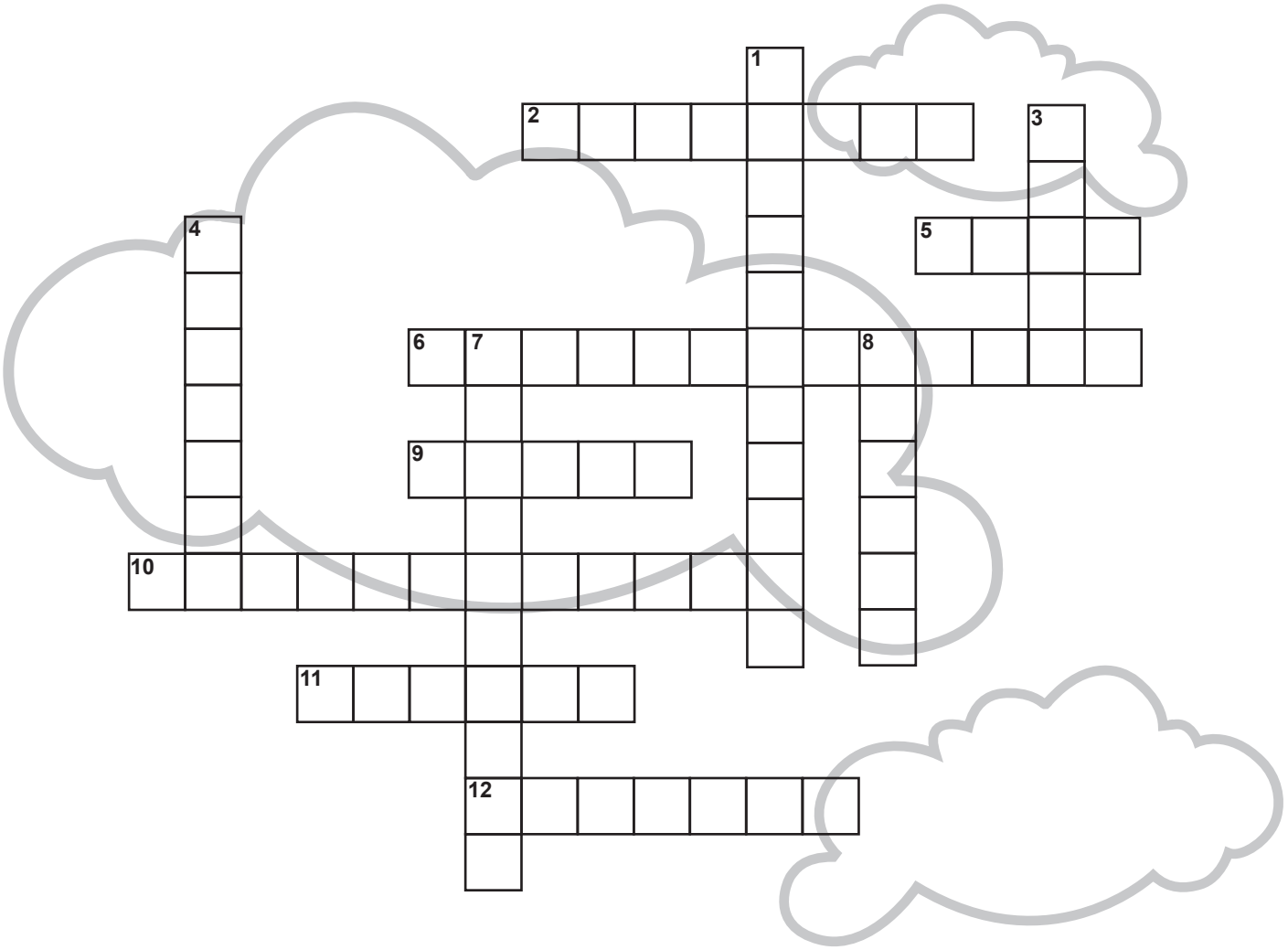
Who dirties or pollutes the air? We all do. Some examples are

- Driving cars, trucks, motorcycles, airplanes, and motorboats
- Burning paper, plastic, leaves, and trash
- Heating homes with wood, coal, and oil
- Using air conditioners
- Smoking cigarettes, pipes, and cigars
- Using lighter fluid to start outdoor grills

Can we stop polluting the air? Not completely if we want to eat, drive, and stay warm. But there are many ways we can reduce our pollution

- Plant a tree. We breathe oxygen in and we breathe out carbon dioxide. All leaves make oxygen from carbon dioxide, which is why it is so important to take care of our trees and plants.
- Try to use water-based paints instead of oil-based paints—water-based paints have less toxic fumes.
- Keep the thermostat down in the winter.
- Conserve electricity by turning off lights, computers, and televisions when not in use.
- Ride your bike for short trips instead of taking the car.

Clean Air Crossword Puzzle



Across

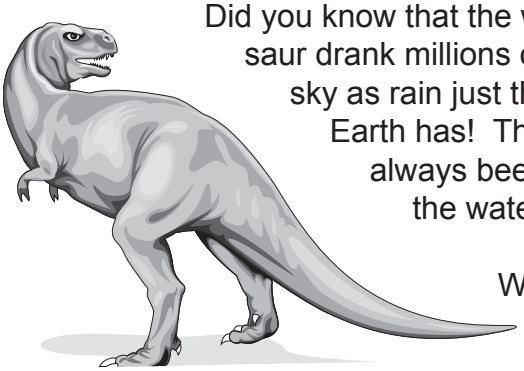
2. Rain contaminated by air pollution
5. Hazy form of air pollution that is a combination of smoke and fog
6. Trees need this to breathe and it is exhaled by people (two words)
9. Air pollution from a campfire
10. Where is the ozone good?
11. People with this disease are sensitive to unhealthy air
12. Colorful display when Sun shines through the rain

Down

1. Where is ozone bad? (two words)
3. White water vapor accumulation in the sky
4. Air pollution from the family car
7. Another name for the air around us
8. We need this to breathe

Answers on page 47

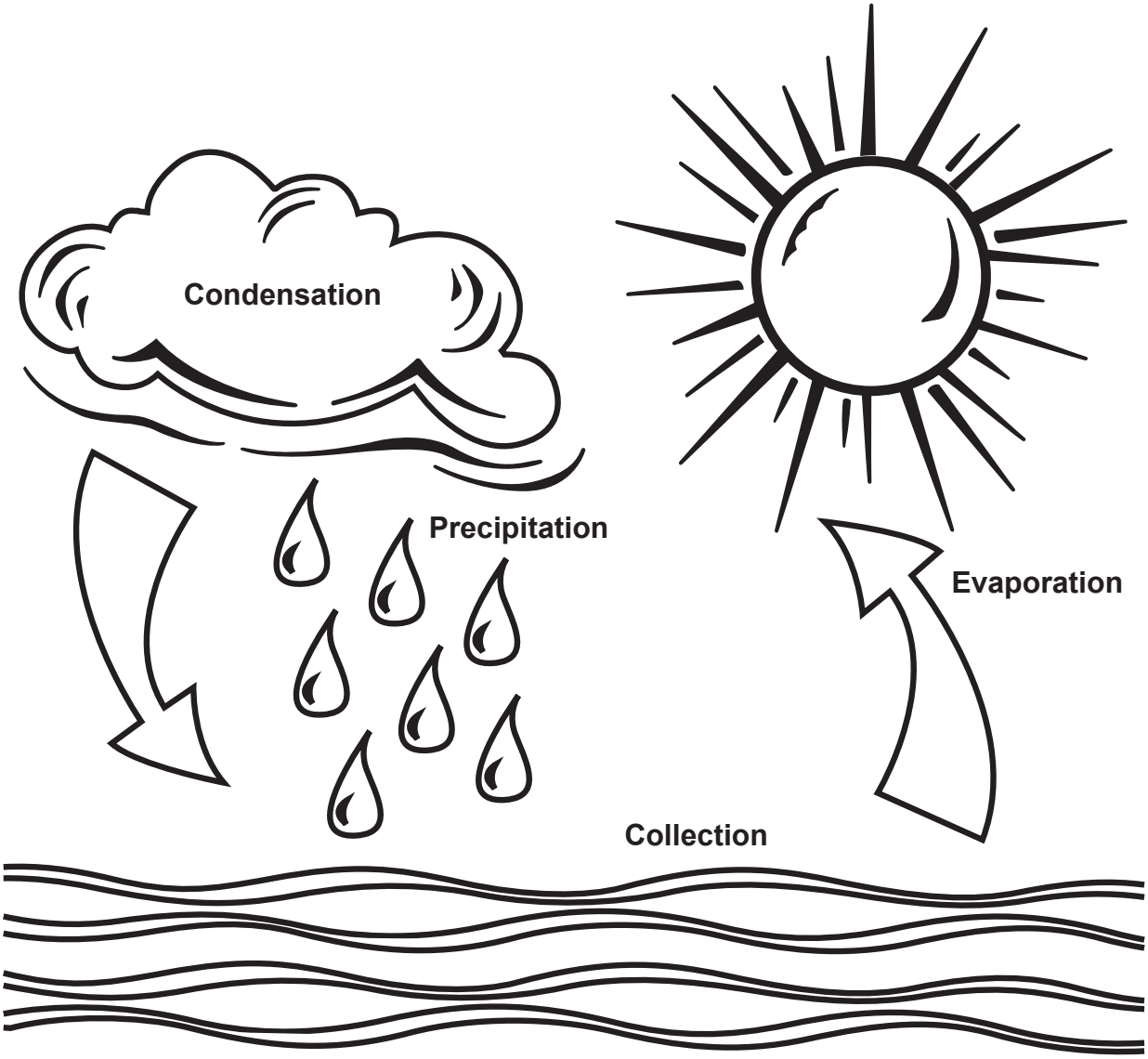
The Water Cycle



Did you know that the water you drank today might have been the same water a dinosaur drank millions of years ago? The water in your glass may have fallen from the sky as rain just this week, but the water itself has been around as long as the Earth has! There is the same amount of water on Earth today as there has always been. The water keeps moving around in an endless cycle called the water cycle.

Water itself is the only substance that exists in liquid, gas, and solid form—the keys to the water cycle. Here's how the cycle works:

Water evaporates from oceans, rivers, and lakes (water in its liquid form) and rises into the atmosphere (water in its gas form) where it condenses to form clouds. Precipitation then falls to the Earth in the form of rain (water in its liquid form) or snow (water in its solid form) where it flows into oceans, rivers, and lakes and the process begins again.



What Can You Do To Help Save Water?

You can help preserve and protect water. Use these helpful tips at home and school.

1. Don't leave the water running while you're brushing your teeth or washing the dishes.

2. Take shorter showers. Keep an egg timer in the bathroom and see who in your family can shorten their showers to 3 minutes.

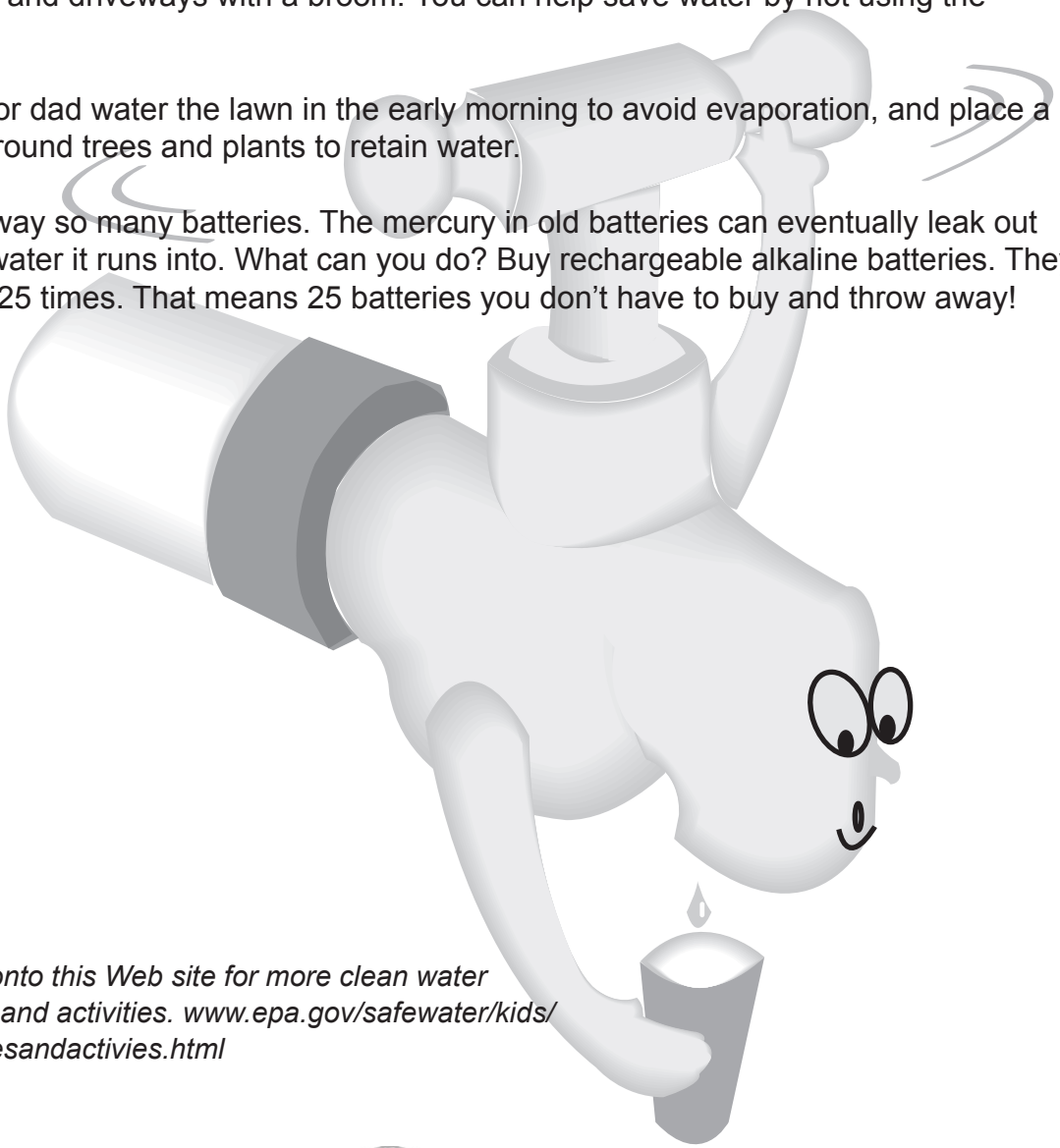
3. Help your mom or dad fix a dripping faucet. Did you know that it can waste 20 gallons of water a day?

4. Fill a pitcher with tap water and put it in the fridge, rather than running the tap every time you want a cold drink.

5. Clean sidewalks and driveways with a broom. You can help save water by not using the garden hose.

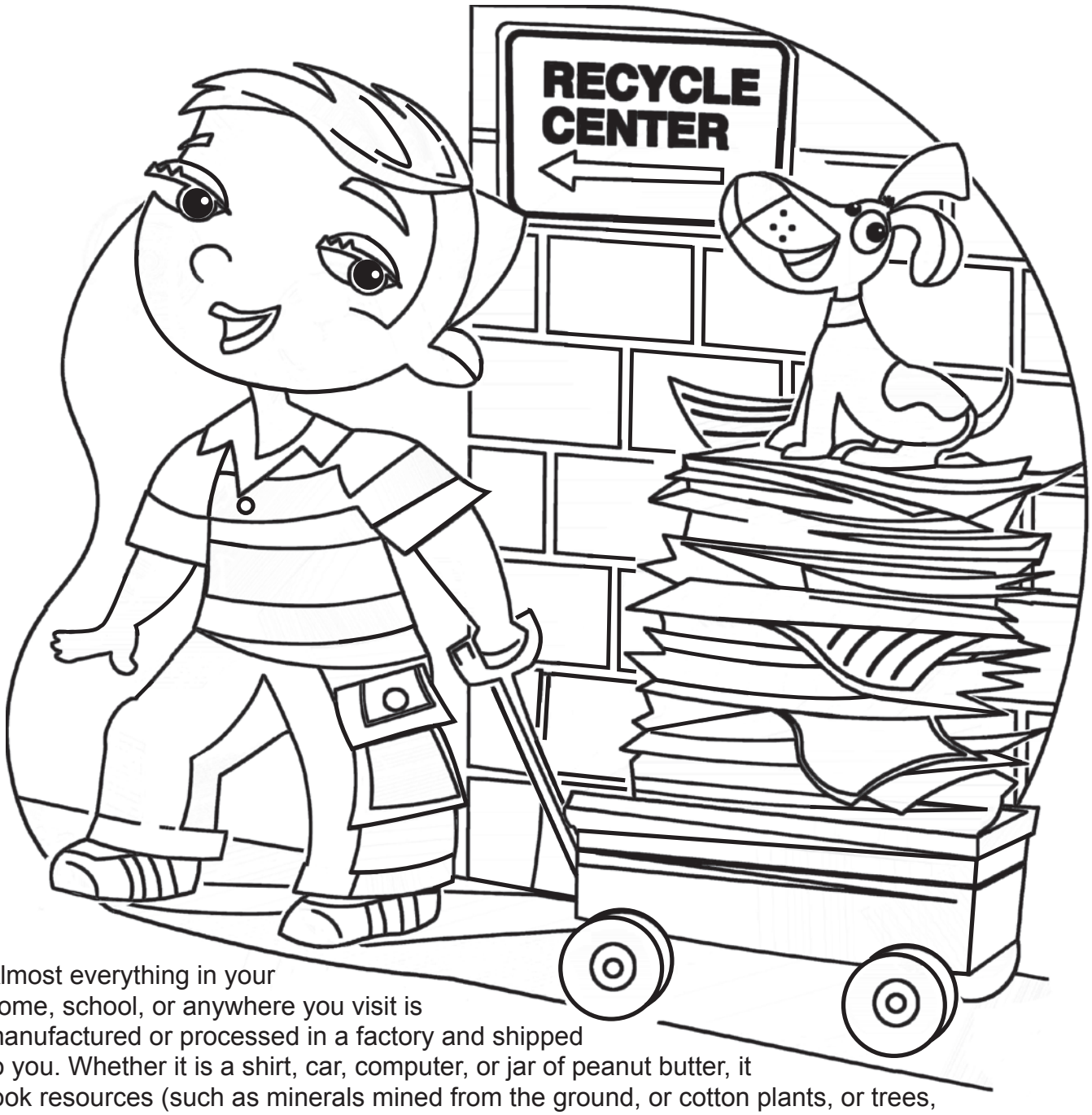
6. Help your mom or dad water the lawn in the early morning to avoid evaporation, and place a layer of mulch around trees and plants to retain water.

7. Stop throwing away so many batteries. The mercury in old batteries can eventually leak out and poison the water it runs into. What can you do? Buy rechargeable alkaline batteries. They can be charged 25 times. That means 25 batteries you don't have to buy and throw away!



Log onto this Web site for more clean water facts and activities. www.epa.gov/safewater/kids/gamesandactivities.html

Recycling



Almost everything in your home, school, or anywhere you visit is manufactured or processed in a factory and shipped to you. Whether it is a shirt, car, computer, or jar of peanut butter, it took resources (such as minerals mined from the ground, or cotton plants, or trees, or petroleum drilled deep in the Earth) to make it.

It also took water and energy to process it. Then someone burned fossil fuels (gasoline or diesel) in a truck to bring it to a store. Everything you own or buy was probably packaged in plastic and packed in a box, which also takes up resources, energy, and water. All of these activities also created garbage along the way, and might have released pollution chemicals into our air, water, and soil.

Manufacturing products have a big impact on the Earth and our environment. This is why the three steps of **"Reduce, Reuse, Recycle"** is important. The "three Rs" are not equal. The first one, **Reduce** is the most important, then **Reuse**, and **Recycle** is the final step.

Reduce, Reuse, and Recycle

Reduce

Try to use fewer resources by

- Walking, riding your bike, or taking the bus to reduce gasoline.
- Not taking something that you know you will not use, such as a handout at a fair.
- Only purchasing items that you need and know you will use.

Can you think of other ways to reduce your use of resources?

Reuse

You can reuse products over and over

- Use a brown paper lunch bag more than once or carry a lunch box to school.
- Create and use notepads from once-used paper.
- Leave messages for family members on a reusable message board.
- Make your own cards and letters from once-used products or handmade paper.
- Try to use rewashable plates instead of paper plates.
- Don't throw away your old clothes, computers, or cell phones. Donate them to organizations that give them to people who might be able to use.
- Shop at and hold garage sales—this is a great way to reuse products.

Recycle

Once you can't use an item anymore and no one else can use it either (Think hard!) then it may be garbage. Find a way to keep it out of those landfills that take up a lot of space. Learn about the recycling centers in your area. Check your local phone directory or call your city hall for information about your town's recycling program.

- Create recycling "bins" for each type of recycled product and place in convenient locations in your home or garage.
- Find out where you can recycle newspapers, glass, styrofoam, corrugated paper, and plastic, aluminum, paper, cardboard, tin cans, scrap metal, junk mail, and alkaline batteries.
- Start a composite pile with yard trimmings and food scraps.
- Purchase products that come in recyclable containers, like glass, plastic, and brown paper bags.

Recycled materials can be used to create new products. This means we don't have to pull new materials out of the Earth to make those products!

Log onto this Web site for more ways you can help reduce, reuse, and recycle.

www.kab.org/kids/educators.htm

Recyclable and Reusable

The items below can be recycled or reused. Find the words listed below in the box of jumbled letters. The words can be found horizontally, vertically, diagonally, and some may be backwards.

Recycling and reusing items is good for the environment because it

- Reduces our reliance on landfills and incinerators
- Protects our health and environment by removing harmful substances from the waste stream
- Conserves our natural resources by reducing the need for raw materials

ALUMINUM CAN

BATTERY

CARDBOARD

GLASS

METAL

MOTOR OIL

PAINT

PAPER

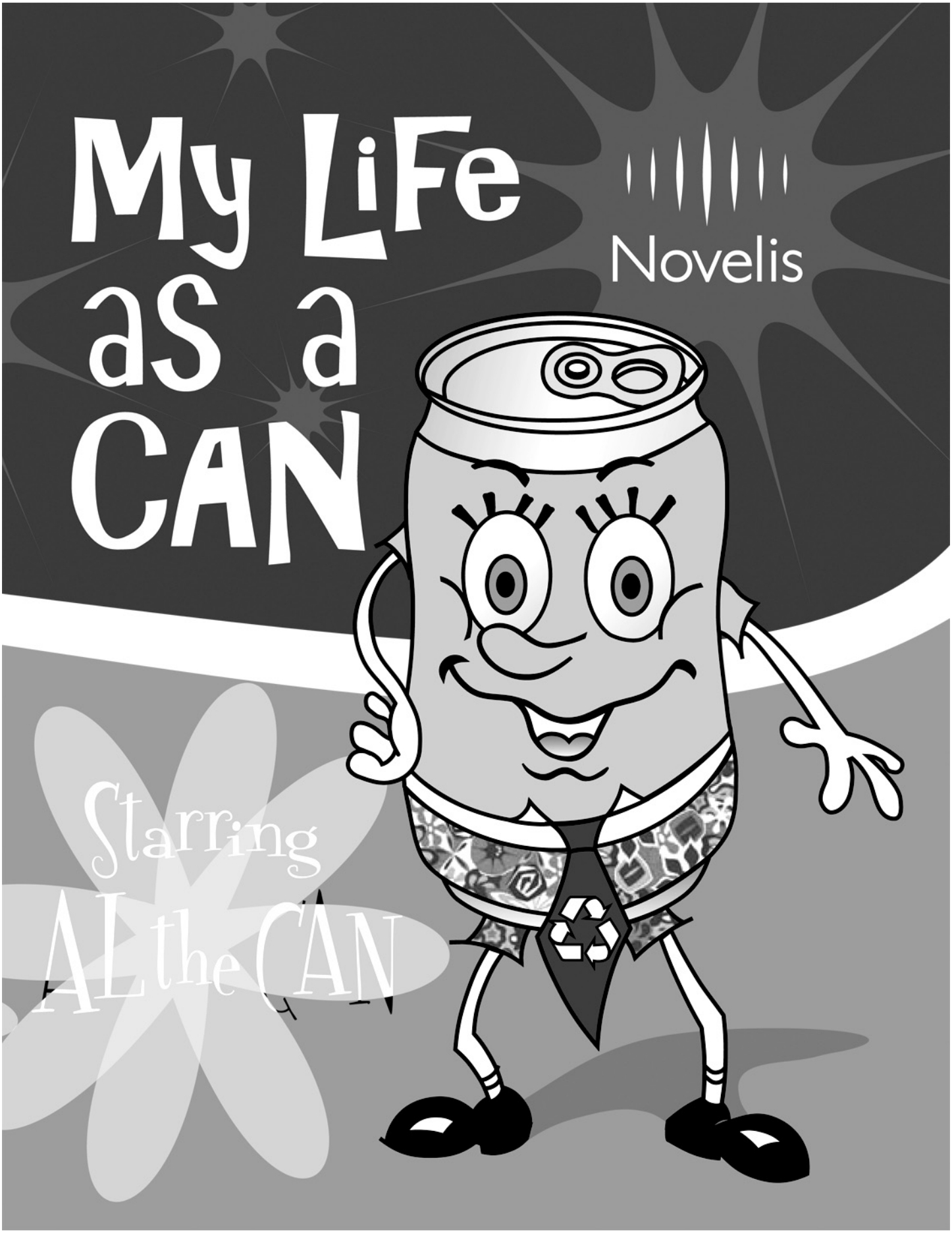
PLASTIC

WOOD

YARD WASTE

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

Answers on page 47



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My Life as a CAN

by

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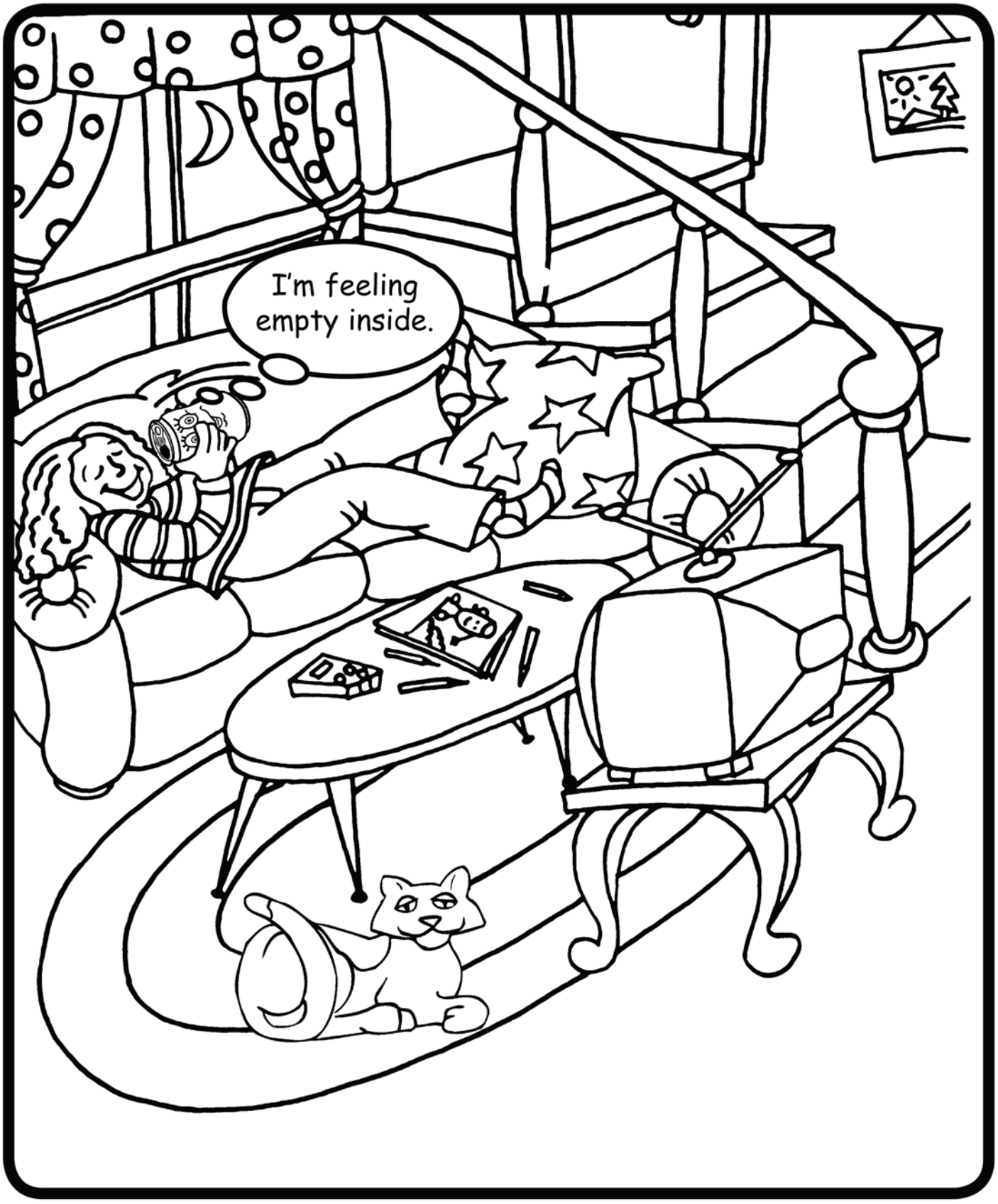
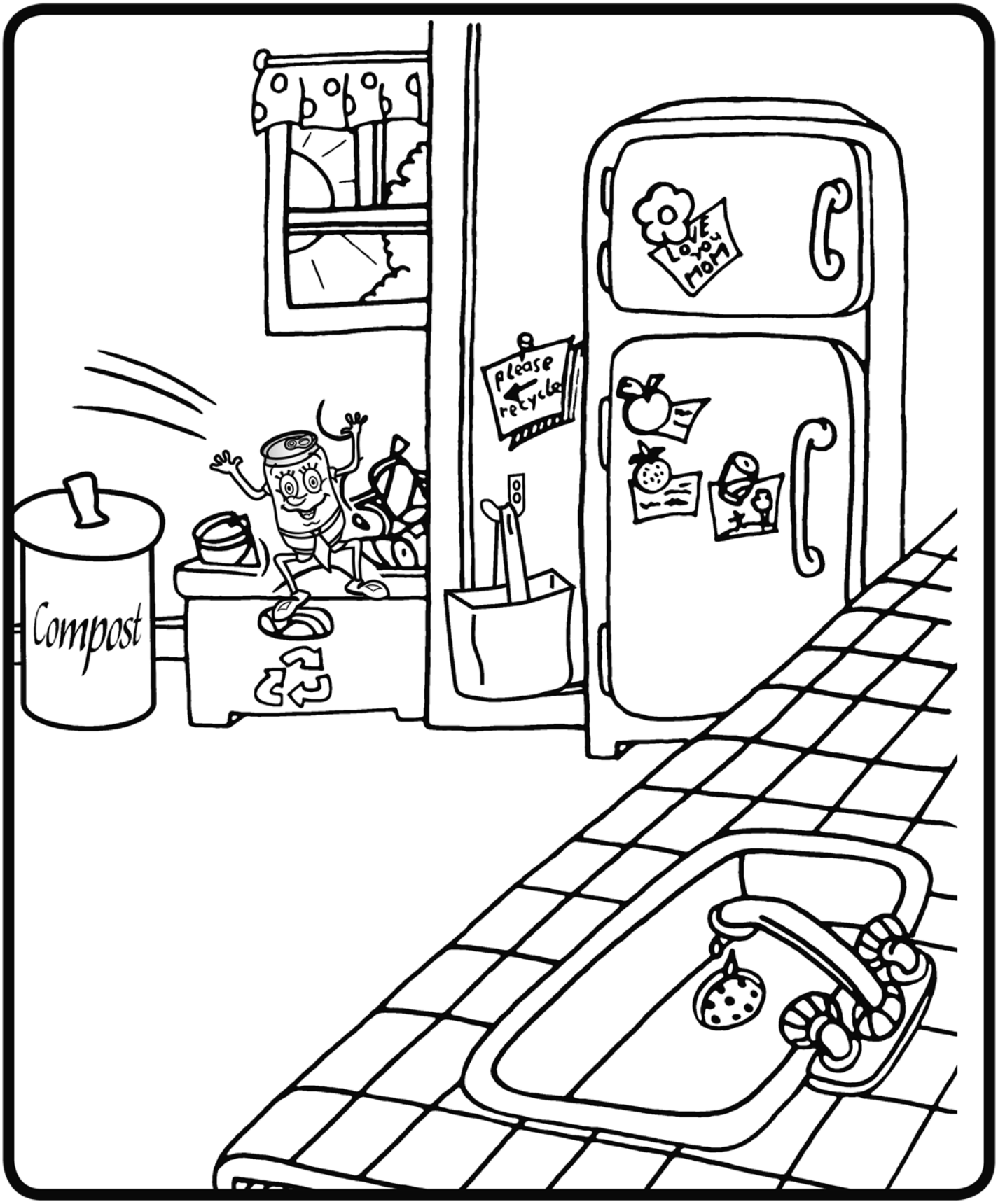
Novelis

Al was a very sad aluminum can. He was sad because he had not been taken home by a family. One day, Susie and her mother were shopping, and Susie noticed Al. Susie begged her mother for Al the can.

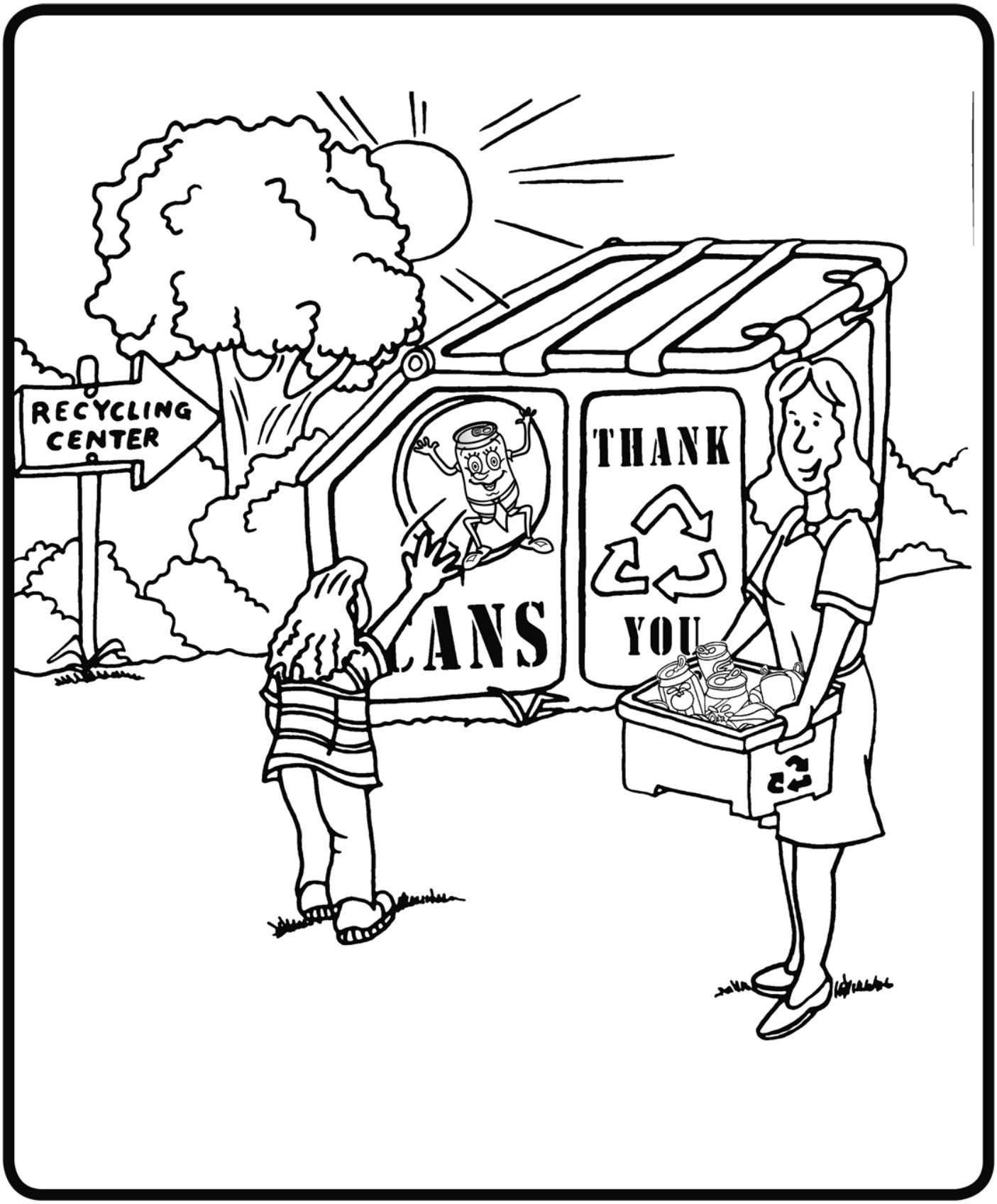
Susie's mother said she could have Al, so in the cart he went. Al was now a happy can.



Al's stay with Susie was short for she loved soda.
She drank the soda inside Al that very night.



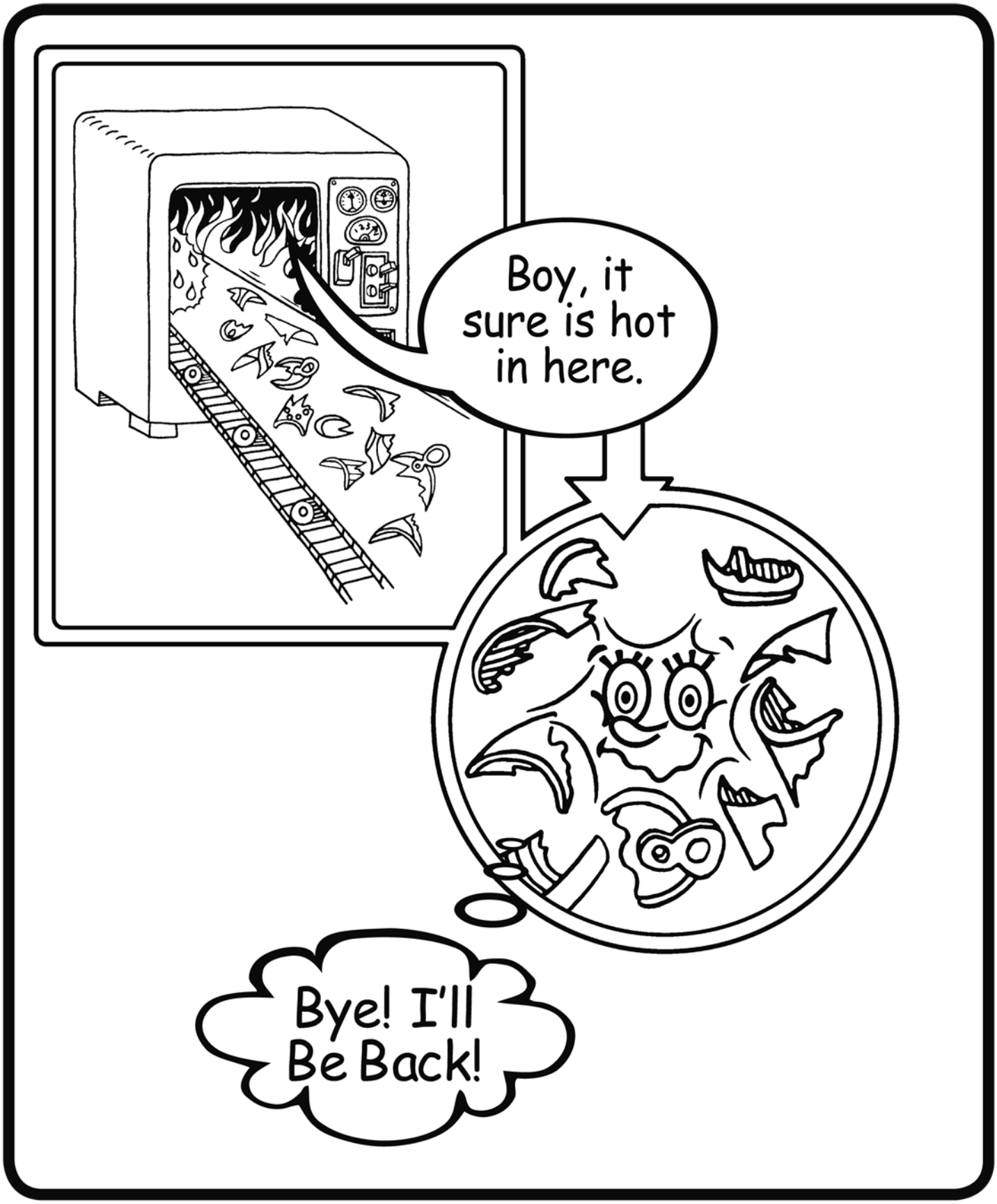
Susie's family recycled everything, so Al went into their recycling bin.



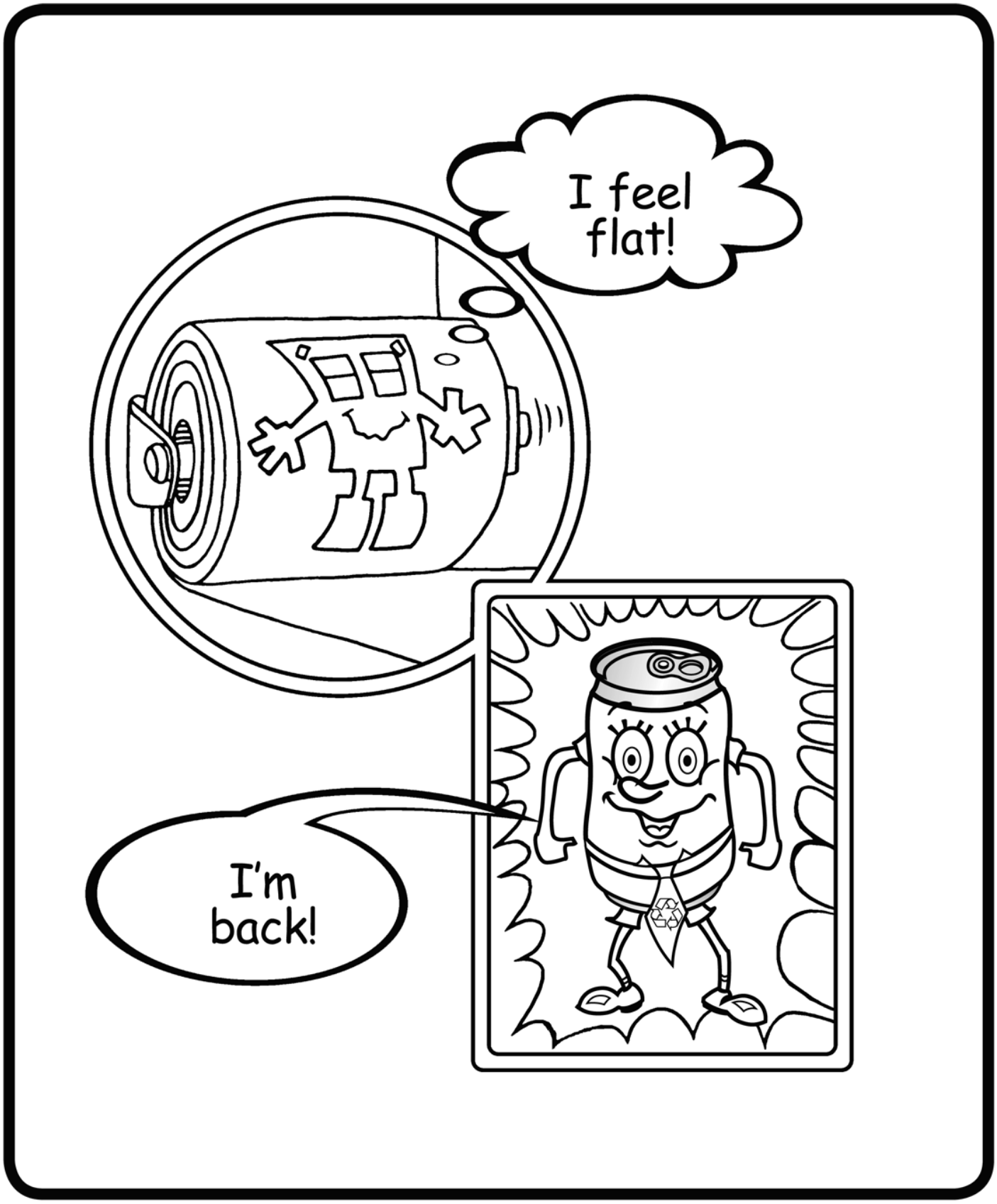
While in the bin, the other cans told Al that he was lucky. Cans that are thrown in the trash are taken to the landfill and never get used again. Al was taken to a recycling center and dropped into a bigger bin.

Suddenly, Al heard a noise. It was a big truck picking up the can bin. Ooooo.....Al went tumbling into the truck.

Al arrived at a recycling plant - a place where cans begin their journey to become new cans.



Al was first shredded into tiny pieces. Then he was heated into molten aluminum along with hundreds of other cans.



At the rolling mill, Al was rolled into sheets and formed into a new can. He was finally a can again. Al realized he completed his recycling journey and was now ready for his trip back to the store shelf.

Al the can was back at the grocery store - waiting for another family to take him home. Al will continue this process for hundreds of years, as long as people like YOU keep recycling.

What is Energy?

Ways you can save energy

In your home, putting insulation in walls and attics can reduce the amount of energy it takes to heat or cool your home. Insulating a home is like putting on a sweater or jacket when we're cold, instead of turning up the heat. The outer layers trap the heat inside, keeping it nice and warm.

To make all of our newspapers, aluminum cans, plastic bottles, and other goods takes lots of energy. Recycling these items by grinding them up and reusing the material again uses less energy than it takes to make them from brand new raw material. So we must all recycle as much as we can.

What is energy?

All around us energy is causing things to happen. Look out a window. If it's daytime, the Sun is giving out light and heat energy. If it's nighttime, street lamps are using electrical energy to make light.

A car drives by your school or house. It is being powered by gasoline, a type of stored energy. Our bodies eat food, which has energy in it. We use that food to play or study.

Energy makes everything happen. Energy can be divided into two different types, depending on whether the energy is moving or stored. Energy that is stored is called potential energy. Energy that is moving is called kinetic energy.

If you have a pencil on your desk, try this example that shows the two different types of energy. Put the pencil at the side of the desk and push it off to the floor. The pencil is moving and is using kinetic energy.

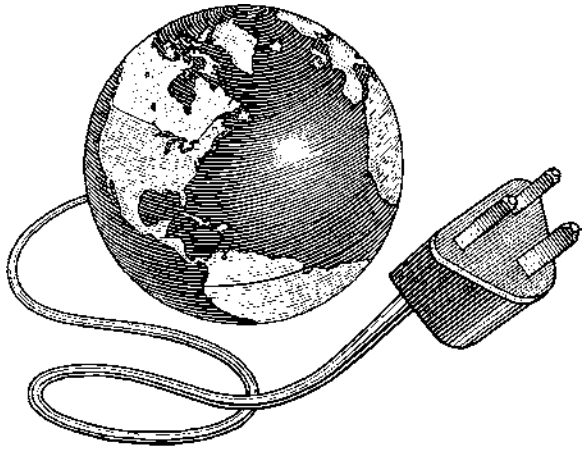
Now, pick the pencil back up and put it back on the desk. You used your own energy to lift and move the pencil. Moving it higher than the floor adds energy to it. As it rests on the desk, it has potential energy. The higher it is, the further it could fall, so the pencil has more potential energy the higher you raise it.

If you have a rubber band, stretch it out. The stretched rubber band has potential energy. If you let it go, it moves and has kinetic energy. Just don't shoot anyone with the rubber band!

Energy is measured in a couple of different ways. One of the basic measuring blocks is called a Btu, which stands for British thermal unit. Btu is defined as the amount of heat energy it takes to raise the temperature of 1 pound of water by 1 °F at sea level.

One Btu equals about one blue-tip kitchen match. One-thousand Btu roughly equals one average candy bar or 4/5 of a peanut butter and jelly sandwich. It takes, for example, about 2000 Btu to make a pot of coffee.

Energy can also be measured in joules. Joules is pronounced the same way as the word jewels, like diamonds and emeralds. It takes 1000 joules to equal 1 Btu. So, it would take 2 million joules to make a pot of coffee.



Joule is named after an English physicist named James Prescott Joule (pictured on the right) who lived from 1818 to 1889. He discovered that heat is a type of energy. One joule is the amount of energy needed to lift 1 pound about 9 inches.

Around the world, scientists measure energy in joules rather than Btu. It's much like people around the world using the metric system—meters and kilograms—instead of the English system of feet and pounds.

Like in the metric system, you can have kilojoules—"kilo" means 1000.

1000 joules = 1 kilojoule = 1 Btu

A piece of buttered toast contains about 315 kilojoules of energy. With that energy you could

- Jog for 6 minutes
- Bicycle for 10 minutes
- Walk briskly for 15 minutes
- Sleep for 1 1/2 hours
- Run a car for 7 seconds at 80 kilometers per hour (about 50 miles per hour)
- Light a 60-watt lightbulb for 1 1/2 hours

Energy can only be changed into another sort of energy. It cannot be created nor can it be destroyed. Here are some changes in energy from one form to another.

- Stored energy in a flashlight's batteries becomes light energy when turned on.
- Food contains energy stored as chemical potential energy. Your body uses the stored energy to do work, kinetic energy.
- If you overeat, the food's energy is stored as potential energy in fat.
- When you talk on the phone, your voice is changed to electrical energy. The phone on the other end changes the electrical energy into sound energy.
- A car uses stored chemical energy in gasoline to move. The engine changes the chemical energy into heat and kinetic energy to power the car.
- A toaster changes electrical energy into heat energy.
- A television changes electrical energy into light and sound energy.

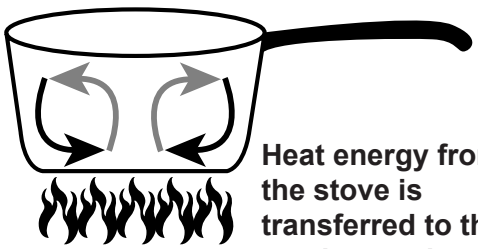
Heat Energy

Heat is a form of energy. We use it for a lot of things like warming our homes and cooking our food. Heat energy moves in three ways:

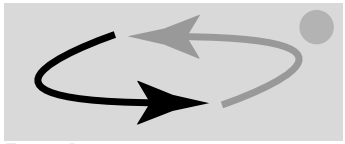
1. Conduction
2. Convection
3. Radiation

Conduction is when energy is passed directly from one item to another. If you stirred a pan of soup on the stove with a metal spoon, the spoon will heat up. The heat is being conducted from the hot area of the soup to the colder area of the spoon.

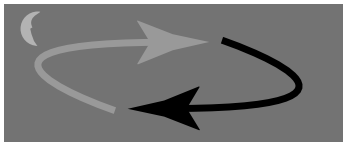
Metals are excellent conductors of heat energy. Other things like wood or plastics are not good conductors of heat energy. These "bad" conductors are called insulators. That's why a pan is usually made of metal and the handle is made of a strong plastic.



Convection is the movement of gases or liquids from a cooler spot to a warmer spot. If the soup pan above was made of glass, we could see the movement of convection currents in the pan. The warmer soup moves up from the heated area at the bottom of the pan to the top where it is cooler. The cooler soup then moves to take the warmer soup's place. The movement is in a circular pattern within the pan (see picture above).



Daytime



Nighttime

Wind is often caused by convection currents. During the daytime, cool air from over water moves to replace the warm air over land that rises. During the nighttime, the directions change and the water is warmer and the land is cooler.

Radiation is the final form of movement of heat energy. The Sun's light and heat cannot reach us by conduction or convention because space is almost completely empty. There is nothing to transfer the energy from the Sun to the Earth. The Sun's rays travel in straight lines called heat rays. When it moves like that, it is called radiation.

When the sunlight hits the Earth, its radiation is absorbed or reflected. Darker surfaces absorb more of the radiation and lighter surfaces reflect the radiation. So, if you wear light or white clothes outside during the summer, you will be cooler.

Here's what we learned

1. Energy is the ability to do work.
2. There are two different types of energy. Kinetic energy is energy in motion. Potential energy is energy that is stored.
3. Energy is measured in units, two of which are Btu (British thermal unit) or joule.
4. Energy cannot be created, nor can it be destroyed. It can only be changed in form.
5. Heat energy comes in three forms: conduction, convection and radiation.

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What is Energy?

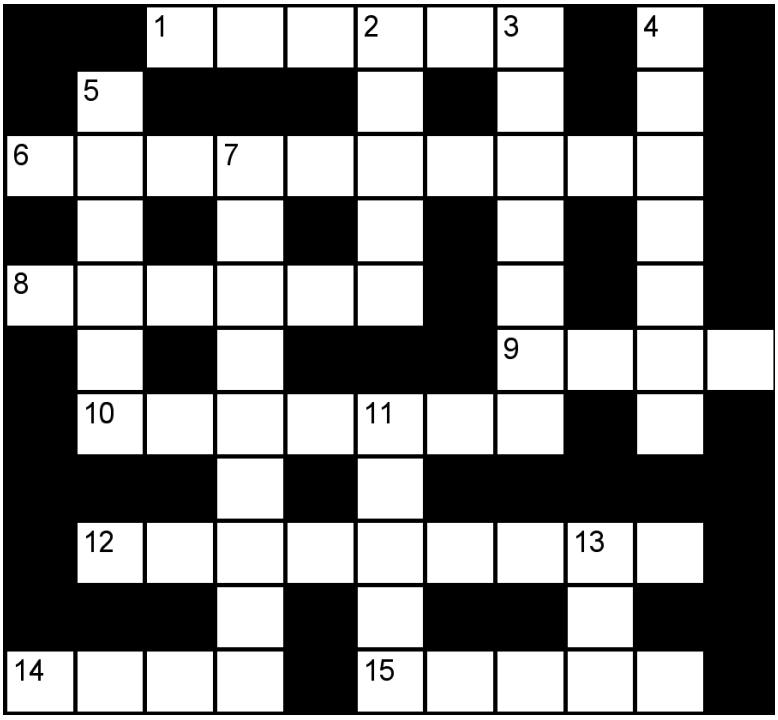
Once you've read the section, "What is Energy?", you should be able to find the energy terms contained in this puzzle.

ACROSS

1. Darker surfaces _____ more of the Sun's radiation.
6. The term for energy passing directly from one item to another.
8. Nearness; as in "the _____ you are to a stove, the warmer it feels."
9. Using a metal spoon to _____ warm soup conducts heat from the liquid.
10. When you do this to a rubber band, it has potential energy.
12. The occupation of James Prescott Joule.
14. What convection currents cause in the atmosphere.
15. Radios turn electrical energy into _____ energy.

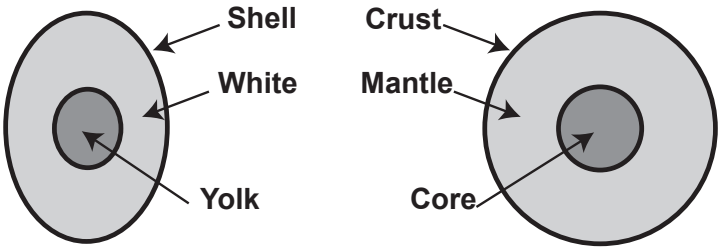
DOWN

2. Another word for "happen," as in conduction causes the transfer of heat to_____ .
3. What the "B" stands for in "Btu."
4. Energy that is moving.
5. Energy can be measured in_____ .
7. According to the rules, energy can neither be created nor_____.
11. Adding these to kites makes them more stable in the wind.
13. Energy radiates to Earth from this.



Answers on page 47

Geothermal Energy



Geothermal Energy has been around for as long as the world has existed. “Geo” means Earth, and “thermal” means heat. So, geothermal means Earth-heat.

Have you ever cut a boiled egg in half without peeling the shell? The egg is what the Earth looks like inside. The yellow yolk of the egg is like the core of the Earth. The white part is the mantle of the Earth. And the thin shell of the egg is like the Earth’s crust.

Below the crust of the Earth, the top layer of the mantle is hot liquid rock called magma. The crust of the earth floats on this liquid magma mantle. When magma breaks through the surface of the Earth in a volcano, it is called lava.

For every 100 meters you go below ground, the temperature of the rock increases about 3 °C. Or for every 328 feet below ground, the temperature increases 5.4 °F.

Deep under the surface, water sometimes makes its way close to the hot rock and turns into hot water or into steam. The hot water can reach temperatures of more than 300 °F or 148 °C. This is hotter than boiling water.

When this hot water comes up through a crack in the Earth, we call it a geyser or hot spring. Sometimes people use the hot water in swimming pools or in health spas. The hot water from below the ground can warm buildings, like a greenhouse, for growing plants.

In some places, like in San Bernardino in Southern California, hot water from below ground is used to heat buildings during the winter. The hot water runs through miles of insulated pipes to dozens of public buildings. City hall, animal shelters, retirement homes, state agencies, a hotel, and a convention center are some of the buildings that are heated this way.

In Iceland, many of the buildings and even swimming pools in the capital of Reykjavik and elsewhere are heated with geothermal hot water. The country has at least 25 active volcanoe, and many hot springs and geysers.

What we learned

1. The inside of the Earth has a core, a hot liquid mantle, and a crust, just like the inside of a hard boiled egg.
2. The upper portion of the mantle is hot liquid rock called magma.
3. In some areas of the Earth, water seeps below ground and is heated by the hot rock.
4. Geothermal means “Earth-heat.”

Energy Seek-a-Word

Find these words hidden across, up and down, and diagonally.

Items you can recycle:
- ALUMINUM
- PLASTIC
- CANS
- WATER
- GLASS
- GRASS
- NEWSPAPERS
- CLIPPINGS

Energy terms:
- CARPOOL
- GASOLINE
- COMPOST
- LIGHTS
- CONSERVE
- RECYCLE
- ENERGY
- ELECTRIC

Types of Energy:
- BIOMASS
- NUCLEAR
- COAL
- OIL
- GEOTHERMAL
- SOLAR
- NATURAL GAS
- WIND

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

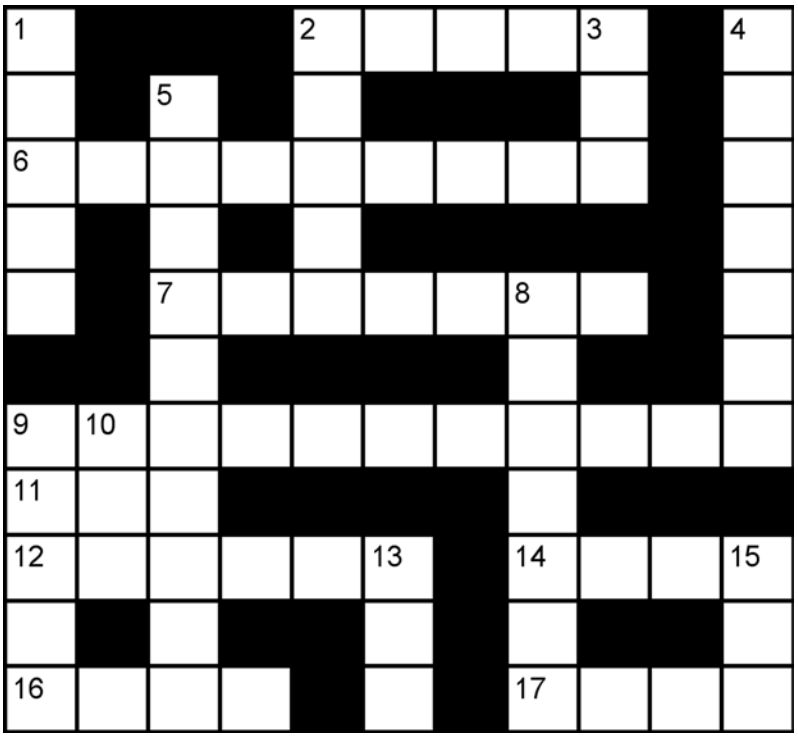
Answers on page 48

What is Renewable Energy?

Renewable energy is solar, wind, geothermal, and water. Energy from the Sun can make electricity which can be stored in a battery. Blowing wind can turn turbines to generate electricity. Falling water, which makes hydroelectric power, can also drive turbines.

Geothermal power relies on heat deep in the Earth to make steam to drive generators. In a similar way, nuclear power uses the heat of tiny atoms to create steam.

Such energy is called renewable because it generates electricity without using up a resource. It doesn't burn fuel like gas or oil. While gas and oil take millions of years to form and will one day be gone, the wind will always blow. The Sun will shine for millions of years and the Earth will continue to be hot deep underground.



ACROSS

2. Windmills turn faster on _____ days.
6. Electricity is described as a flow of _____.
7. Spinning windmill blades turn a _____ to create electricity.
9. Most household appliances are powered by _____.
11. Renewable energy does not pollute the ____ that we breathe.
12. If someone leaves the refrigerator door open, we should _____them to close it.
14. We use these to hear the sound of falling water.
16. A geyser is hot water rushing out of a _____ in the ground.
17. This fills lakes and streams with water.

DOWN

1. Boiling water turns into _____.
2. Hydroelectric power comes from the energy of falling _____.
3. What to say if someone asks if wind energy is renewable.
4. Electrical energy can be stored in a _____.
5. Energy from heat deep in the Earth is called _____.
8. Tiny atomic particles fuel this type of power.
9. Geothermal energy relies on molten rock in the _____.
10. If someone says it is okay to waste energy, it's a _____.
13. A big structure that holds back water.
15. The source of solar power.

Answers on page 47

What is Electricity?

Electricity powers many of the things in our world. Some things like flashlights and GameBoys use electricity that is stored in batteries as chemical energy. Other things use electricity that comes from an electrical plug in a wall socket.

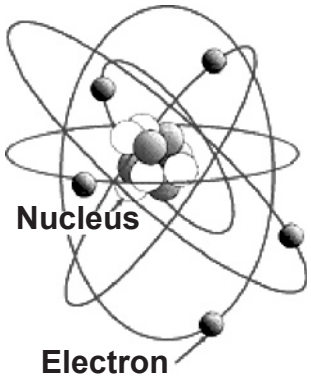
But that energy from the wall socket comes from someplace else. It comes to your house through electrical wires. How does electrical energy come through a solid wire? The wire is not like an empty garden hose that water flows through. How does it get from power plants to your house?

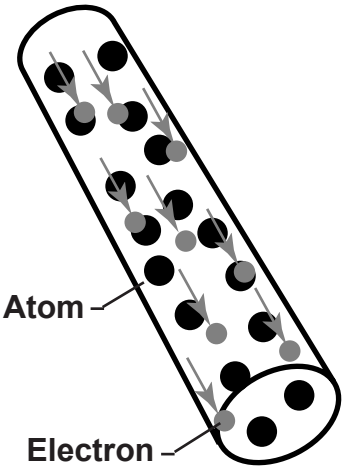
You'll remember in the section "What is Energy?" that energy can be conducted. Heat energy was conducted from the heat through the soup pan to the soup. Electricity is the conduction (or transfer) of energy from one place to another. The electricity is the "flow" of energy.

All matter is made up of atoms, and atoms are made up of smaller particles, one of which is the electron. Electrons spin around the center, or nucleus, of atoms, just like the Moon around the Earth.

The nucleus is made up of neutrons and protons. Electrons have a charge, a negative charge. Protons have a positive charge and neutrons are neutral or have neither a positive nor a negative charge.

Some kinds of atoms have electrons that are loosely attached. They can easily be made to move from one atom to another. When those electrons move among the atoms of matter, a current of electricity is created.





This is what happens in a piece of wire. The electrons are passed from atom to atom, creating an electrical current from one end to the other.

Electricity flows through some things better than others. How well something conducts electricity is measured by its resistance. Resistance in wire depends on how thick it is, how long it is, and what it's made of. The lower the resistance of a wire, the better it conducts electricity.

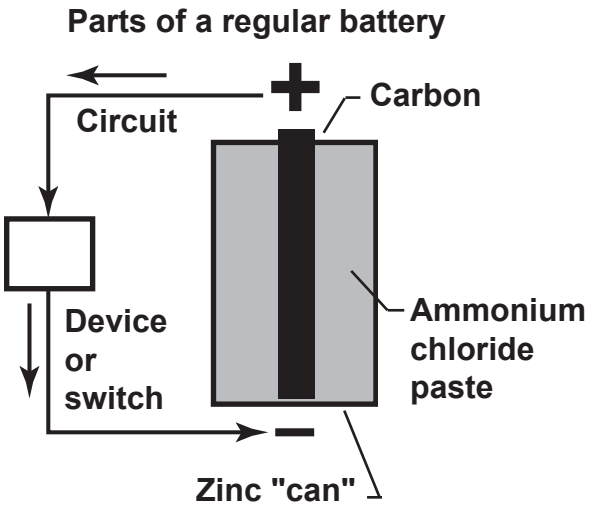
Copper is used in many wires because it has a lower resistance than many other metals. The wires in your walls, inside your lamps, and elsewhere are mostly copper.

The electric force that "pushes" electrons is measured in volts. American homes use 110 volts of electric power for regular appliances. Larger appliances, like a clothes dryer or stove, use 220 volts. Some countries use 220 volts for all of their appliances and electric devices.

Batteries contain stored chemical energy. When the chemicals react with each other, they produce an electrical charge. This charge changes into electrical energy when the battery is connected in a circuit.

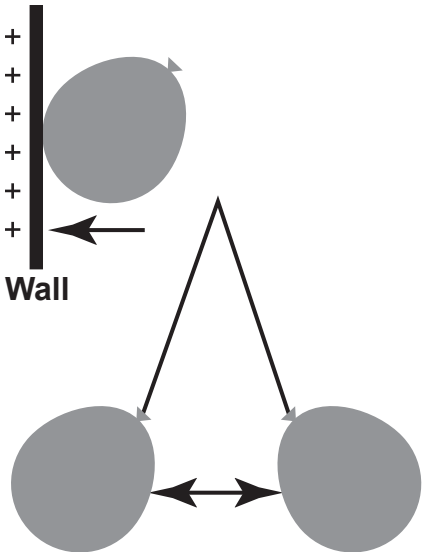
Along the circuit you can have a light bulb and on-off switch. The light bulb changes the electrical energy into light and heat energy.

You can have a heating element. When the electricity flows, the resistance causes friction and the friction causes heat. The higher the resistance, the hotter it can get. So, a coiled wire that is high in resistance, like the wire in a hair dryer, can heat up.



You can also have a motor. A motor works using electromagnetism. It has a coiled up wire that sits between the north and south poles of a magnet. When current flows through the coil, another magnet field is produced. The north pole of the fixed magnet attracts the south pole of the coiled wire. The two north poles push away, or repulse, each other. The motor is set up so that this attraction and repulsion spins the center section with the coiled wire.

One other type of electrical energy is static electricity. Unlike current electricity that moves, static electricity stays in one place.



Try this experiment.

Rub a balloon on a wool sweater or on your hair. Then hold it up to a wall. The balloon will stay there by itself.

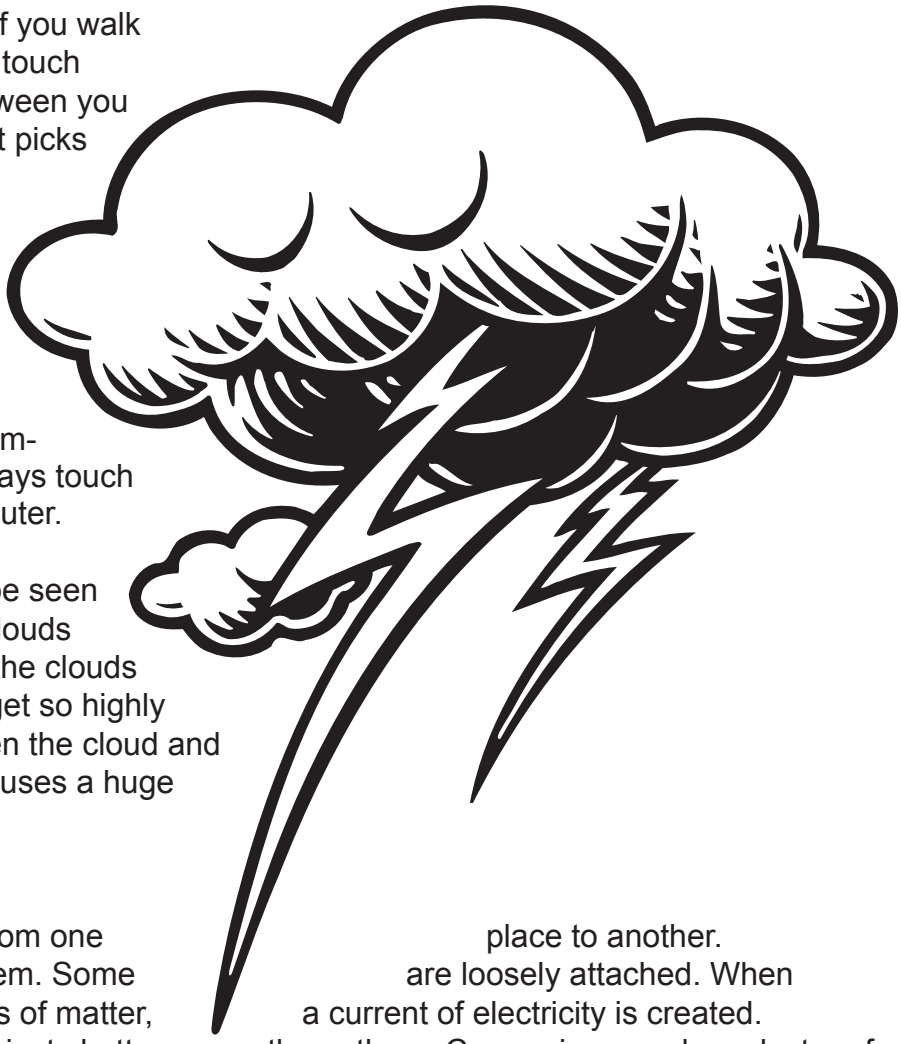
Now rub two balloons, hold them by strings at the end and put them next to each other. They'll move apart.

Rubbing the balloons gives them static electricity. When you rub the balloon it picks up extra electrons from the sweater or your hair and becomes slightly negatively charged.

The negative charges in the single balloon are attracted to the positive charges in the wall.

The two balloons hanging by strings both have negative charges. Negative charges always repel negative charges and positive charges always repel positive charges. So, the two balloons' negative charges "push" each other apart.

Static electricity can give you a shock. If you walk across a carpet, shuffling your feet and touch something metal, a spark can jump between you and the metal object. Shuffling your feet picks up additional electrons that are spread over your body. When you touch a metal door knob or something with a positive charge the electricity jumps across the small gap from your fingers just before you touch the metal knob. If you walk across a carpet and touch a computer's case, you can damage a computer. So if you walk across a room always touch something else before touching a computer.



One other type of static electricity can be seen during a thunder and lightning storm. Clouds become charged as ice crystals inside the clouds rub up against each other. The clouds get so highly charged that the electrons jump between the cloud and the ground, or to another cloud. This causes a huge spark, called lightning.

Here's what we learned

1. Electricity is the flow of energy from one place to another.
2. Atoms have electrons circling them. Some are loosely attached. When electrons move among the atoms of matter, a current of electricity is created.
3. Electricity flows through some objects better than others. Copper is a good conductor of electricity.
4. The electric force that "pushes" electrons is measured in volts.
5. Batteries store chemical energy. An electric circuit connects the positive and negative poles of the battery and allows an electrical current to happen.
6. Static electricity doesn't move. It is the energy that can stick a balloon to a wall if you rub the balloon across a sweater. Lightning is another form of static electricity.

Ways you can save electricity

- In your home, you can save energy by turning off appliances, TVs and radios that are not being used, watched, or listened to.

- You can turn off lights when no one is in the room. You can make "Turn It Off" signs for hanging above light switches to remind yourself.

What is Electricity?

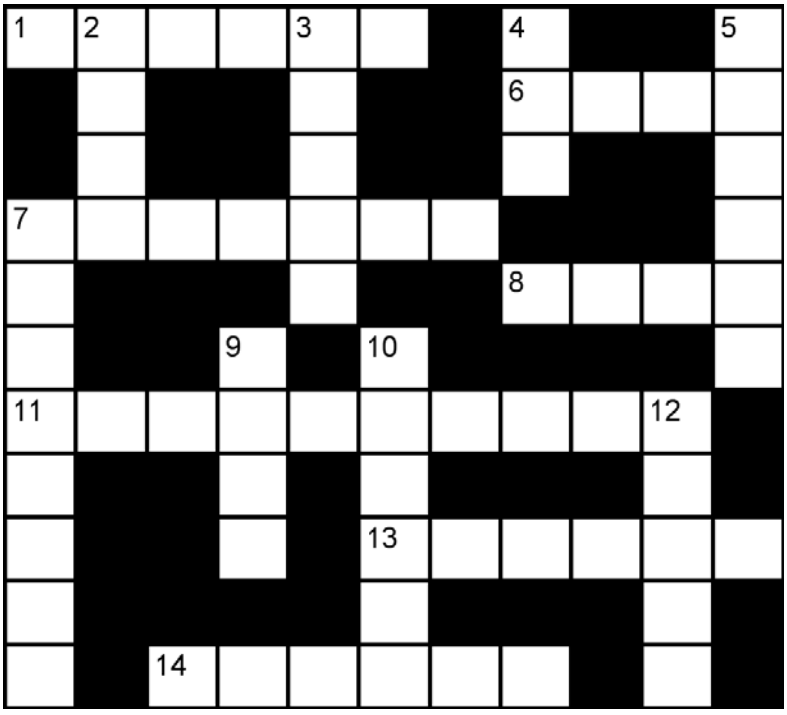
Once you've read the section, "What is Electricity?", you should be able to find the energy terms contained in this puzzle.

ACROSS

1. What turns electricity on and off?
6. All matter is made up of one of these.
7. The part of a nucleus with neither a positive nor a negative charge.
8. A measure of the electric force that "pushes" electrons.
11. Household electric machines, like refrigerators or toasters.
13. Another name for country, as in "We are a _____ of electricity users."
14. The kind of electrical energy that stays in one place.

DOWN

2. A metal "string" that brings electricity to your house.
3. To transport, as in "Transmission lines _____ power from place to place."
4. It is a natural principle, rule, or ____ that says "energy can be neither created nor destroyed."
5. Not rough, as in "the flow of electrons is _____."
7. The charge an electron has spinning around a nucleus.
9. What's on an electrical cord that you can stick in a wall socket?
10. Motors work because electricity in a coil makes one of these.
12. Being careless with electricity can cause this!



Answers on page 47

What is a Climate Change?

To understand what climate change is, we first need to understand two other terms: greenhouse effect and global warming.

Greenhouse effect

The greenhouse effect is the rise in temperature that the Earth experiences because certain gases in the atmosphere (e.g. water vapor, carbon dioxide, nitrous oxide, and methane) trap energy from the Sun. Without these gases, heat would escape back into space and Earth's average temperature would be about 60 °F cooler. Because of how they warm our world, these gases are referred to as greenhouse gases. We need the greenhouse effect in order to survive on Earth.

Global warming

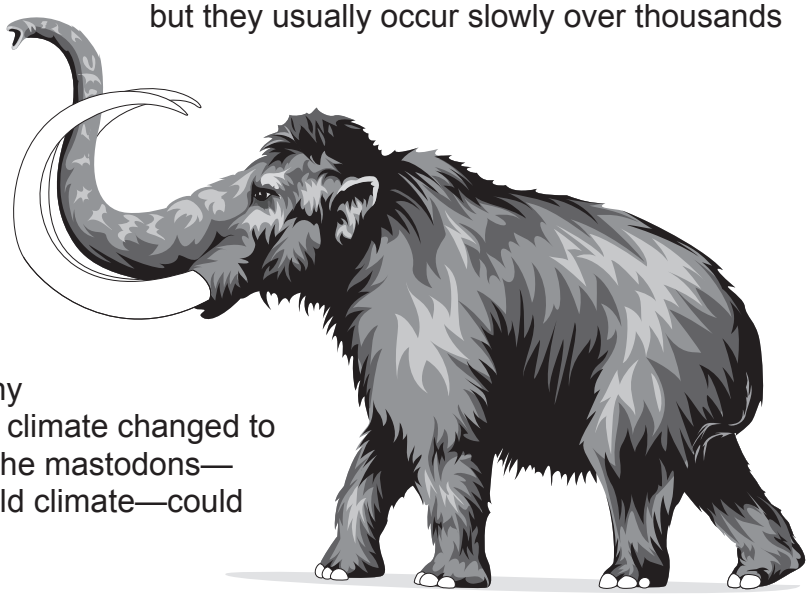
Global warming refers to an average increase in the Earth's temperature, which in turn causes changes in climate. A warmer Earth may lead to changes in rainfall patterns, a rise in sea level, and a wide range of impacts on plants, wildlife, and humans. When scientists talk about the issue of climate change, their concern is about global warming caused by human activities such as burning of fuels like coal or petroleum.

Climate change

A climate is all of the typical weather patterns over a long time in whatever region of the Earth you choose. For example, the typical climate for northern Ohio is usually cold and snowy during the winter months and sunny and warm during the summer months. The average weather period is usually taken over a 30-year time span. Climate is not the same as weather, but is the average pattern of weather for a particular area.

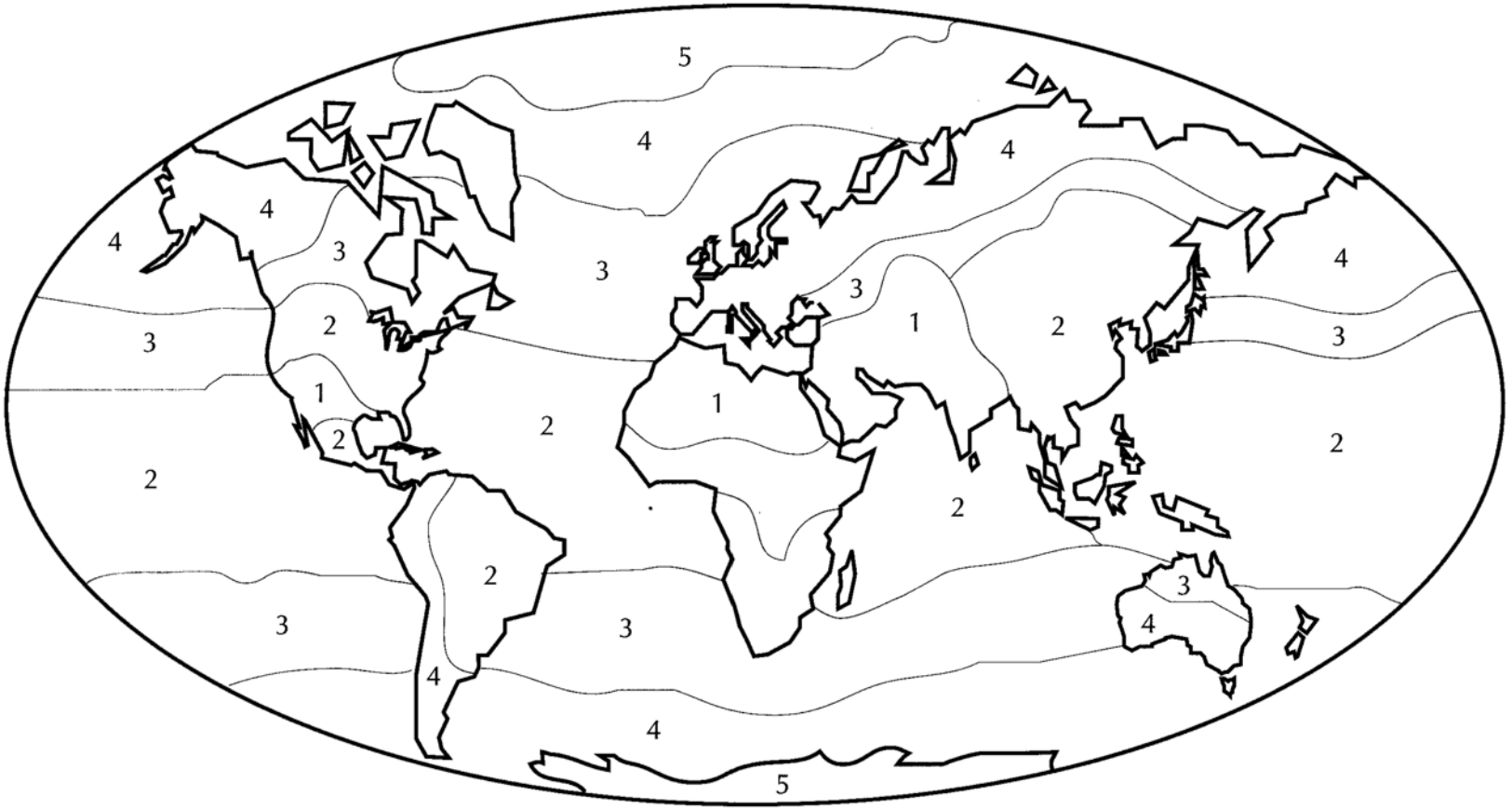
Climate change means a change in these long-term average weather patterns. The changes can be many—warmer or colder temperatures, rain, sunshine, humidity, wind, fog, storms, and others.

Earth's climate has been changing constantly over its 5-billion-year history. Sometimes, the climate has warmed so much that the oceans have risen and covered portions of the Earth. Each of the changes may seem extreme, but they usually occur slowly over thousands of years.



An example of a dramatic climate change is referred to as the ice age. During that time, much of North America was covered by large sheets of ice. Some 14,000 years ago, the ice began to melt very quickly. By 7000 years ago, the ice was gone. This end to the ice age caused big changes on Earth. The changes caused many kinds of plants and animals to die. When the climate changed to warmer, drier conditions, some animals like the mastodons—elephant-like animals who were used to a cold climate—could not survive.

Follow the Color Guide and Color the Surface Temperature of Planet Earth



Cold	Cool	Mild	Warm	Hot
5-dark blue	4-light blue	3-yellow	2-orange	1-red

What Is an Endangered Species?

Wildlife becomes endangered because their habitat has been destroyed. Habitat destruction happens in several ways—pollution (dumping chemicals into an animal's water source), human activity (entering caves while bats are hibernating), and introducing wildlife or plants into an area that does not occur naturally.

Endangered—An endangered species is an animal or plant that is native to a state or the United States but is in danger of becoming extinct in that state or the United States. The danger of extinction may result from one or more causes such as habitat loss, pollution, predation disease, or competition from other species. An animal may be endangered in Ohio but thrive in other states.

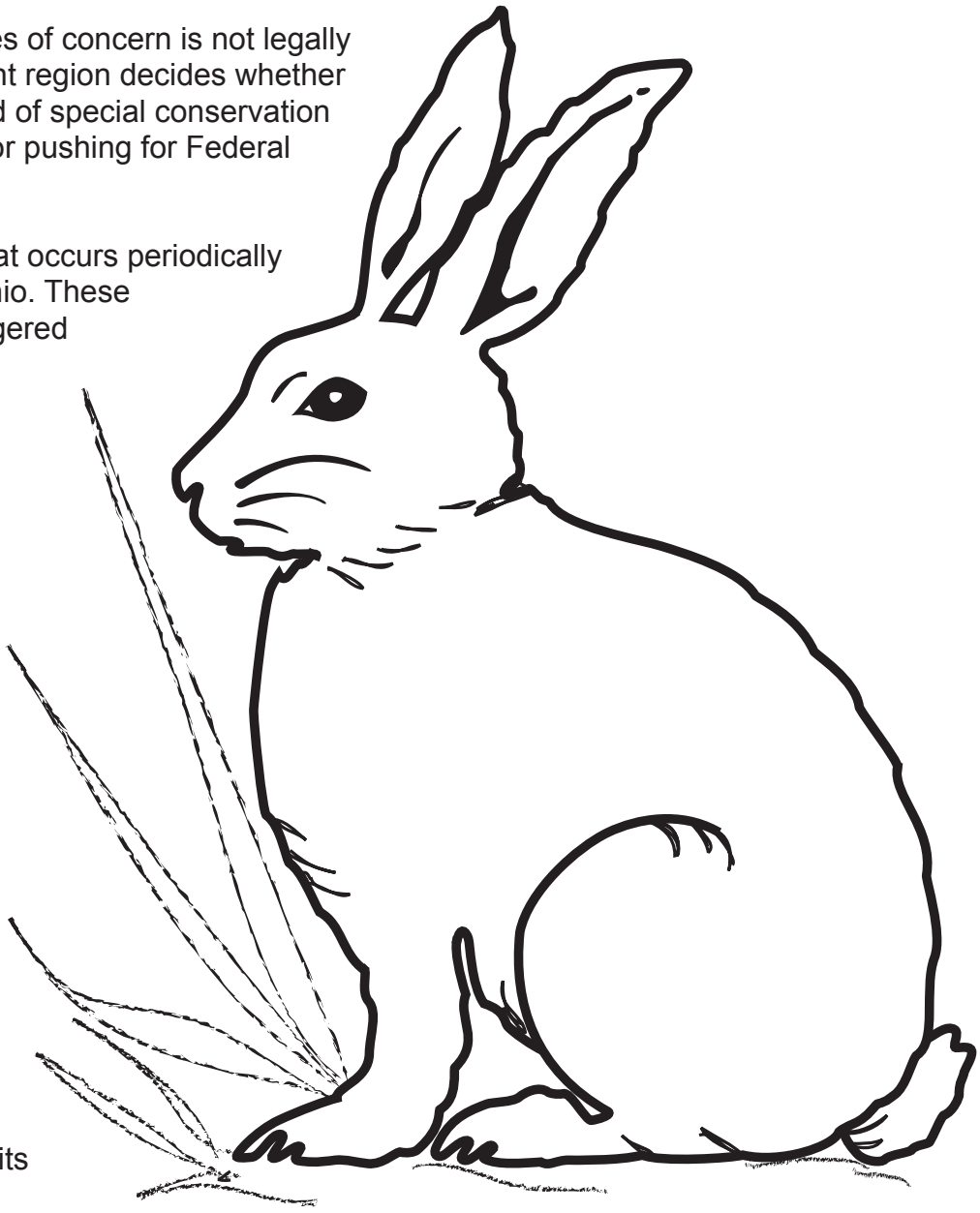
Threatened—A threatened species is an animal whose survival is not in immediate jeopardy, but to which a threat exists. Continued or increased stress will result in the animal becoming endangered.

Species of Concern—A species of concern is not legally protected. The local Government region decides whether a plant or animal may be in need of special conservation actions, like simple monitoring, or pushing for Federal endangered species protection.

Special Interest—A species that occurs periodically and is capable of breeding in Ohio. These species have no Federal endangered or threatened status, are at low breeding rates in the state, and have not been recently released to enhance Ohio's wildlife.

Extirpated—A an extirpated species is an animal that existed in a state at the time of European settlement but has since disappeared, mainly due to human impact. An extirpated animal may be extinct in Ohio but exists elsewhere in the United States. The snowshoe hare is an example of an extirpated species in Ohio.

Extinct—An extinct species is an animal that existed in a state or the United States at the time of European settlement but has since disappeared from its entire range.



Ohio's Endangered Wildlife

Find several of Ohio's endangered species in the word search below. The words can be found horizontally, vertically, diagonally, and some may be backwards.

ALLEGHENY WOODRAT
AMERICAN BURYING BEETLE
BALD EAGLE
COPPERBELLY WATER SNAKE
LARK SPARROW
INDIANA BAT
LAKESIDE DAISY
SCIOTO MADTOM
LAKE ERIE WATER SNAKE
PIRATE PERCH
BLACK BEAR
SNOWSHOE HARE
BOBCAT
OHIO LAMPREY
SNOWY EGRET
KING RAIL

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

Log onto this Web site for information on endangered animals and plants.

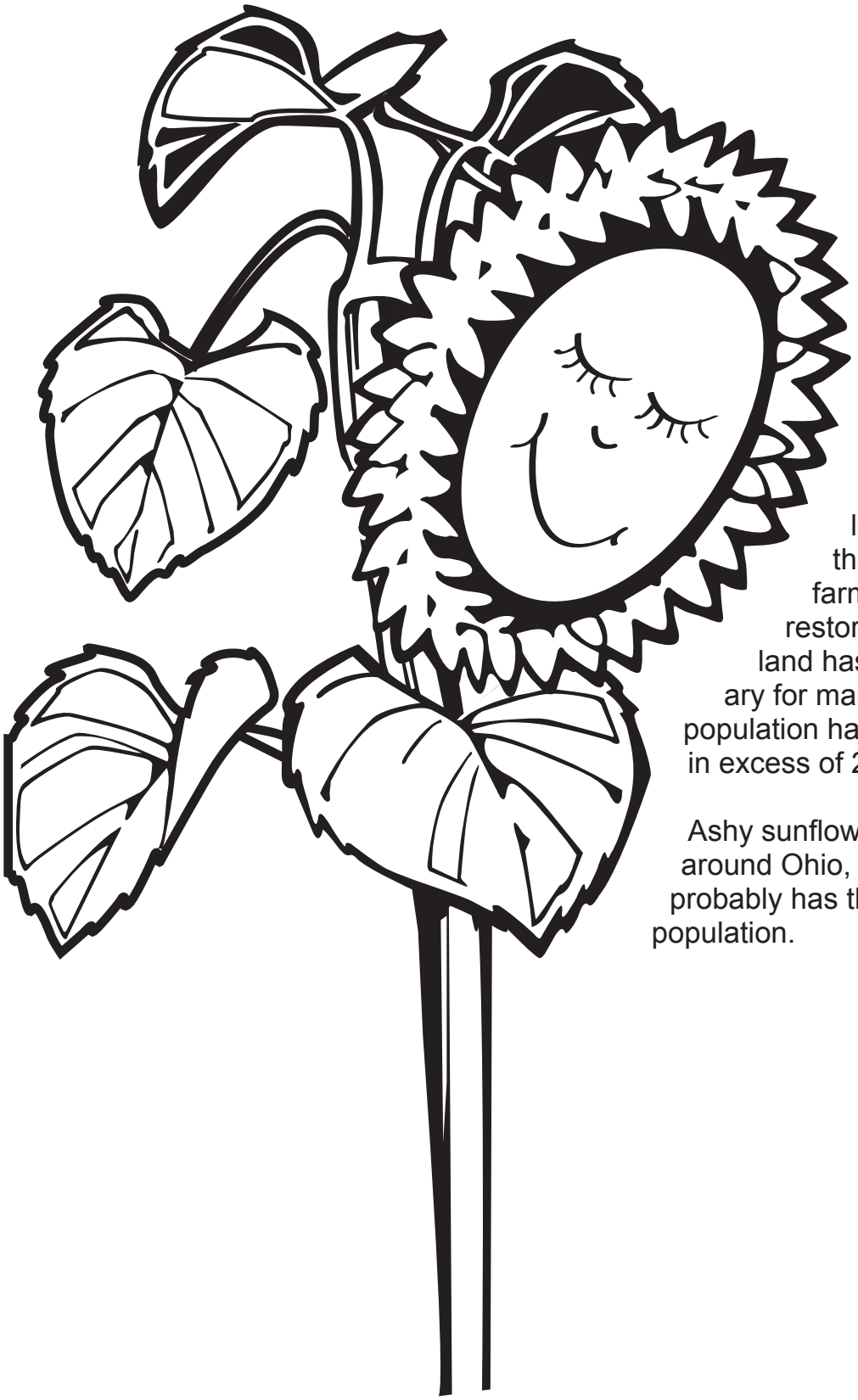
www.kidsplanet.org/factsheets/map.html

Answers on page 48

NASA Plum Brook Station

The land surrounding and including NASA's Plum Brook Station in Sandusky, Ohio is a protected and unique natural preserve. The Plum Brook acreage demonstrates an incredible ecological variety of plant and animal life, including 521 plant, 12 breeding bird, 21 amphibian and reptile, 16 fish, 53 butterfly, 450 moth, and 8 bat species.

Several of these are protected by the Endangered Species Act, which maintains that federal agencies can not jeopardize the existence of any threatened species. The Sedge Wren uses the area as one of the most important breeding grounds for its species. In recent years a Bald Eagle pair built a nest at the station and onlookers were treated to the rare sight of baby eagles.



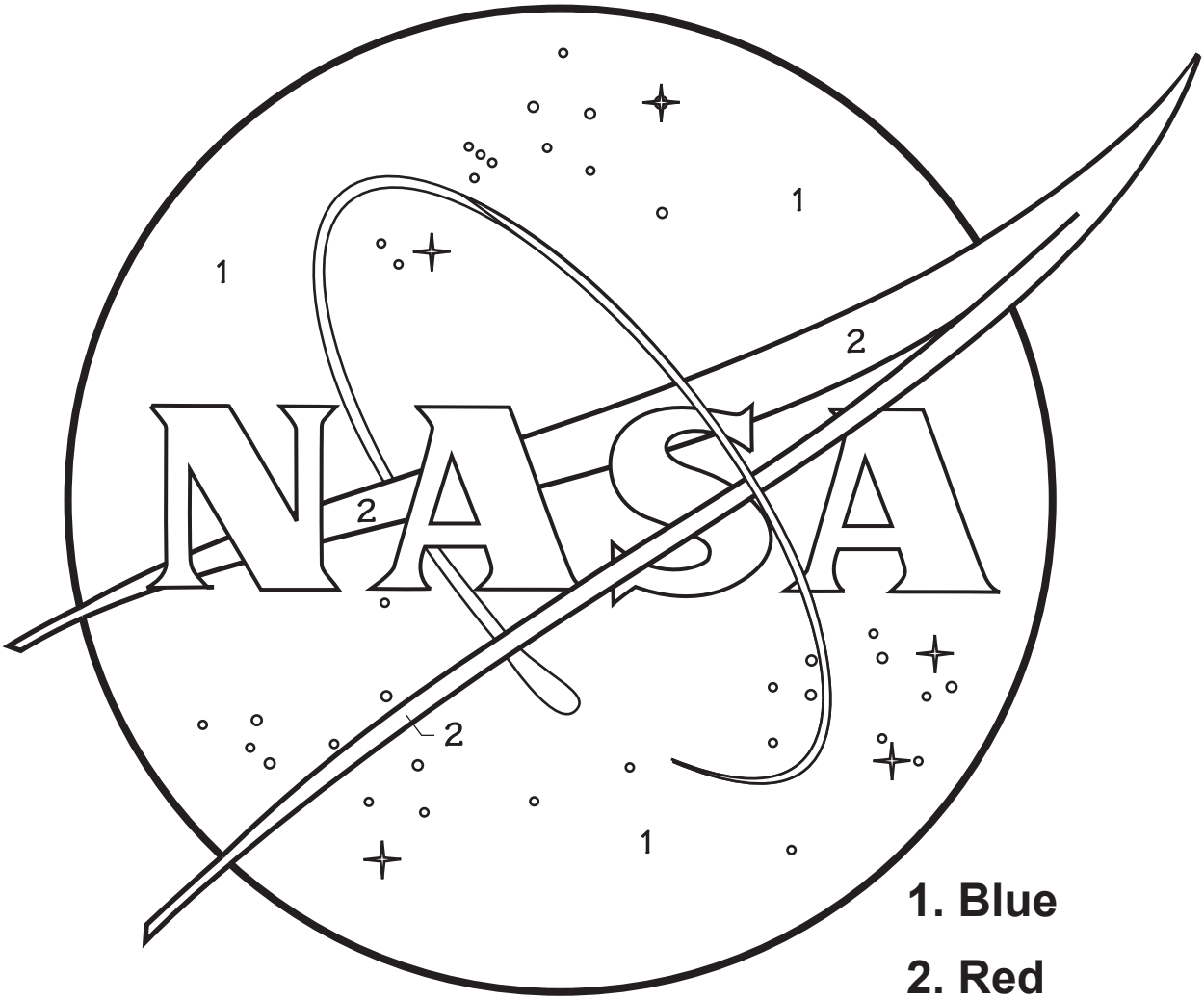
The Plum Brook forests and plains are also unique. The central meadows area is significant because Ohio has no other native prairie locations like it. The forests that were once cleared for farmlands are now being restored. Plum Brook's protected land has created a wildlife sanctuary for many wildlife species. The deer population has grown over the years, often in excess of 2000.

Ashy sunflower plants are scattered around Ohio, but the Plum Brook Station probably has the state's largest natural population.

This is your planet . . . your home!
Learn to take care of it . . . it's your future!

Respect the Earth
Every Day • Everybody

Color the National Aeronautics and Space Administration Logo



This book is dedicated to the men and women who work for the NASA Glenn Research Center.

The activity book was created by the NASA Glenn Earth Day Committee, and was sponsored by the NASA Glenn Recycling Program, Michelle Kenzig, NASA Recycling Coordinator, 21000 Brookpark Rd., Cleveland, Ohio, 44135, 216–433–3103.

For more information, check out our Web site at http://earthday.grc.nasa.gov/

NASA Glenn Visitor Center

The NASA Glenn Visitor Center is a place where you can expand your horizons of knowledge about travel through air and space to gain a new perspective on the universe in which we live. Exhibits range from a real Moon rock to a flight simulator. You will learn about a broad spectrum of NASA's aerospace program and their benefits to humanity. The NASA Glenn Visitor Center is located onsite, easily accessible from Cleveland's major highways.

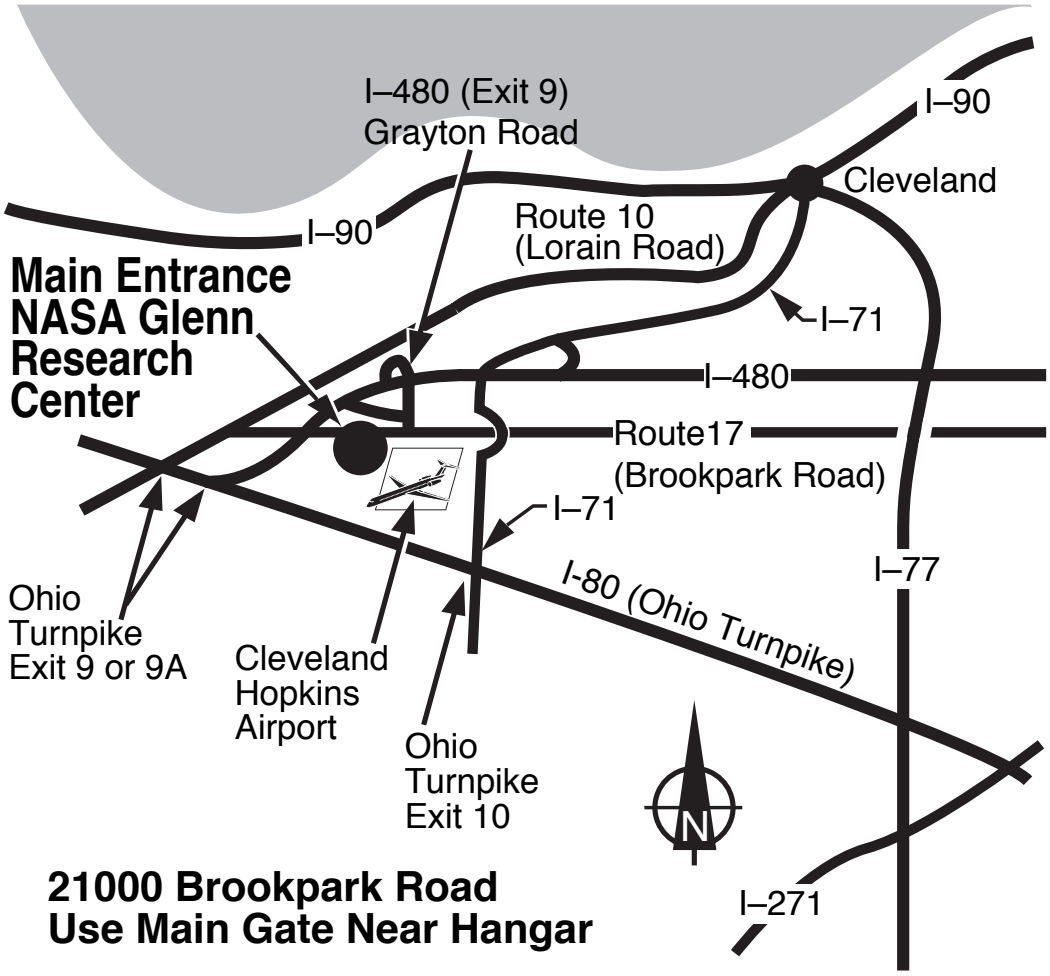
Visitor Center Hours:

Weekdays	9 a.m. to 4 p.m.
Saturdays	10 a.m. to 3 p.m.
Sundays	1 p.m. to 5 p.m.
Holidays*	10 a.m. to 3 p.m.

*Open every day except New Year's Eve, New Year's Day, Easter, Thanksgiving, Christmas Eve, and Christmas Day.

FREE ADMISSION

Directions to the NASA Glenn Research Visitor Center



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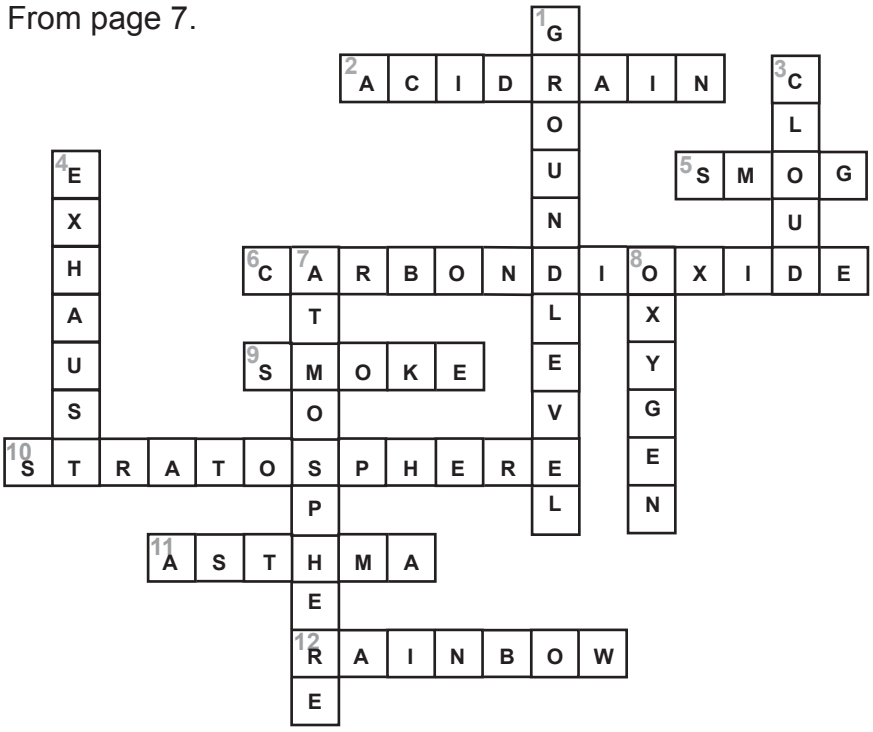

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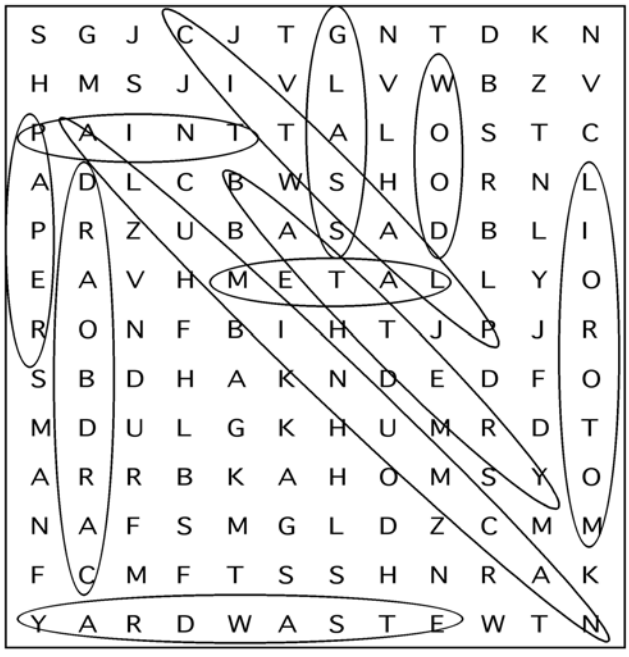

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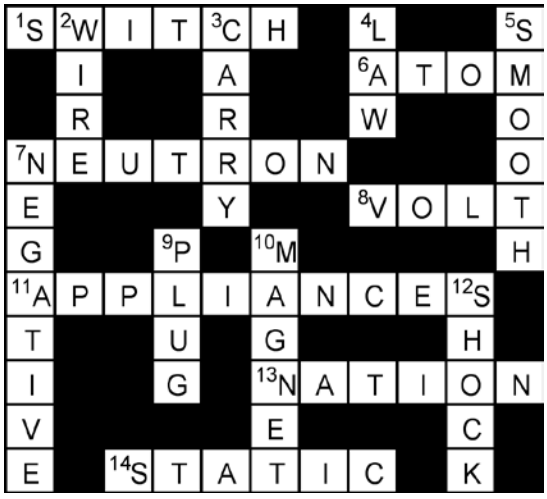

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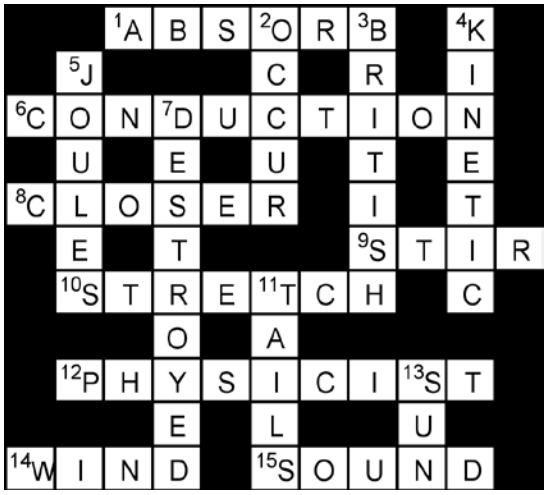

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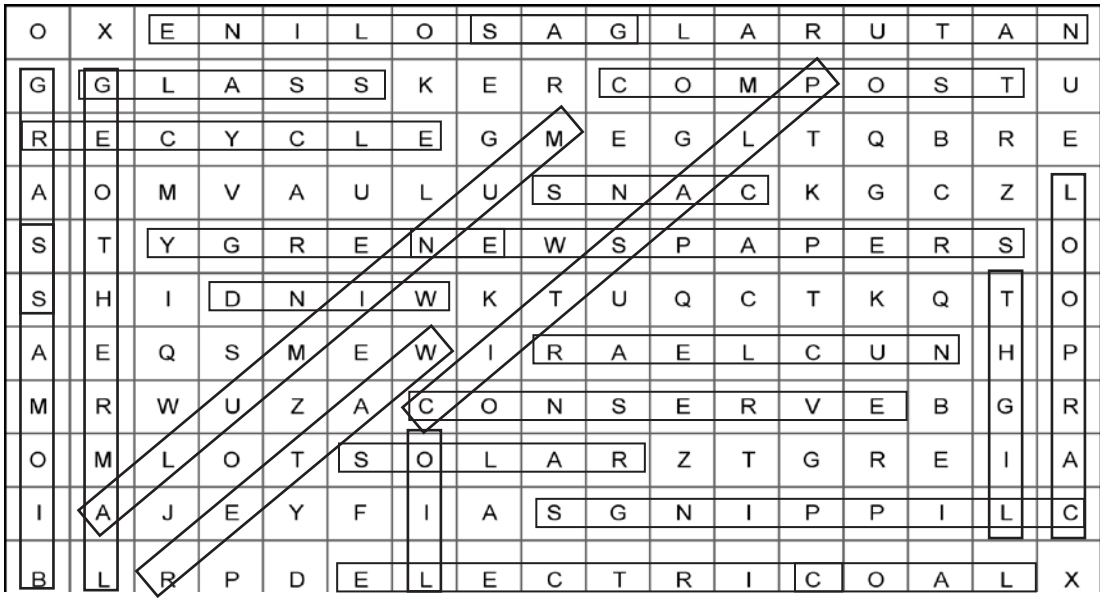

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Environmental Policy

NASA Glenn Research Center operates in a manner that preserves and protects the environment through pollution prevention, the continual improvement of our operations, and complying with regulations.

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