Earth Day 2003

National Aeronautics and
Space Administration

John H. Glenn Research Center at Lewis Field
21000 Brookpark Rd.
Cleveland, Ohio 44135

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."

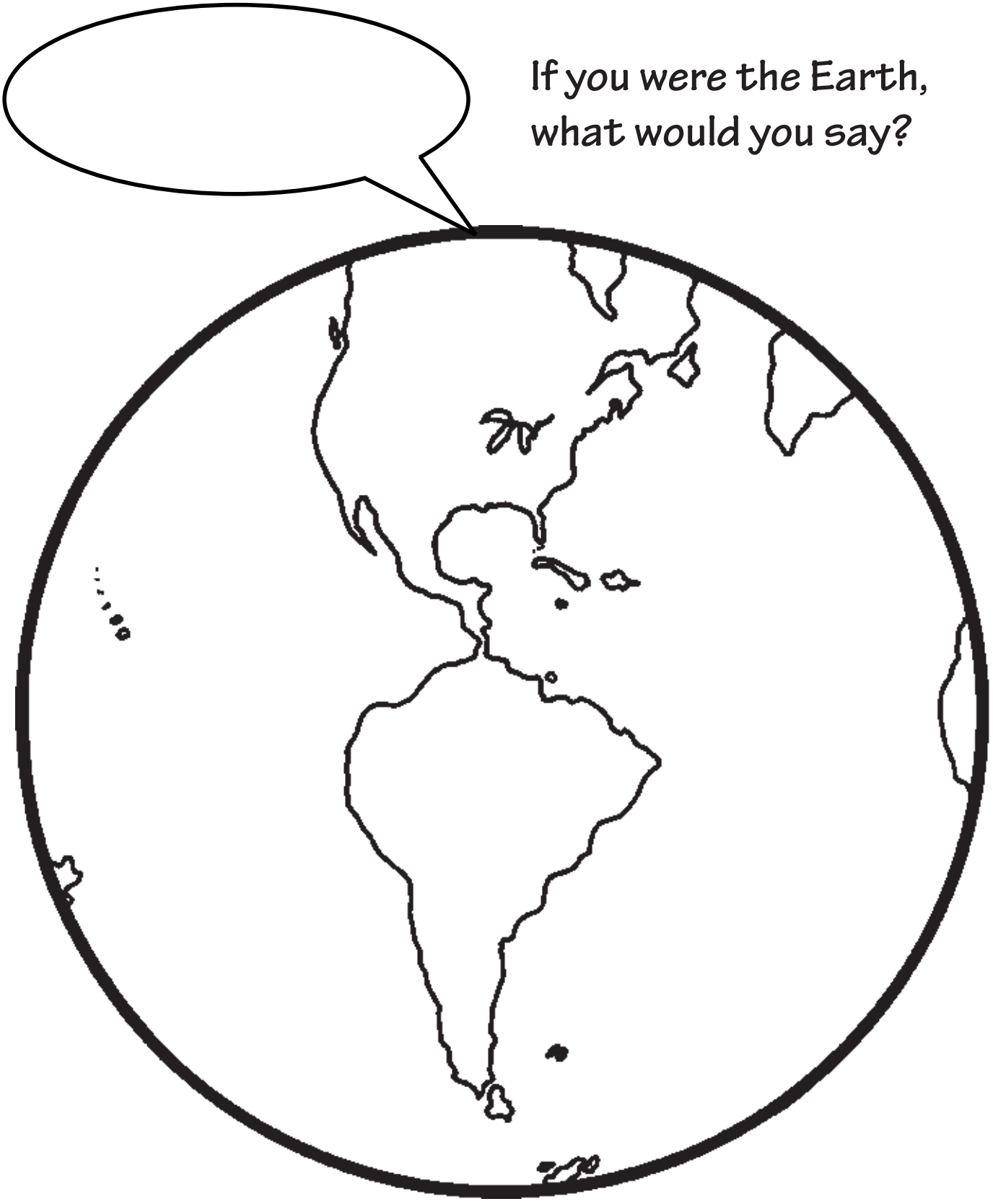
Earth Day celebrations offer an important point of entry to address worldwide environmental concerns as well as the opportunity for communities to focus on their unique environmental problems.

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

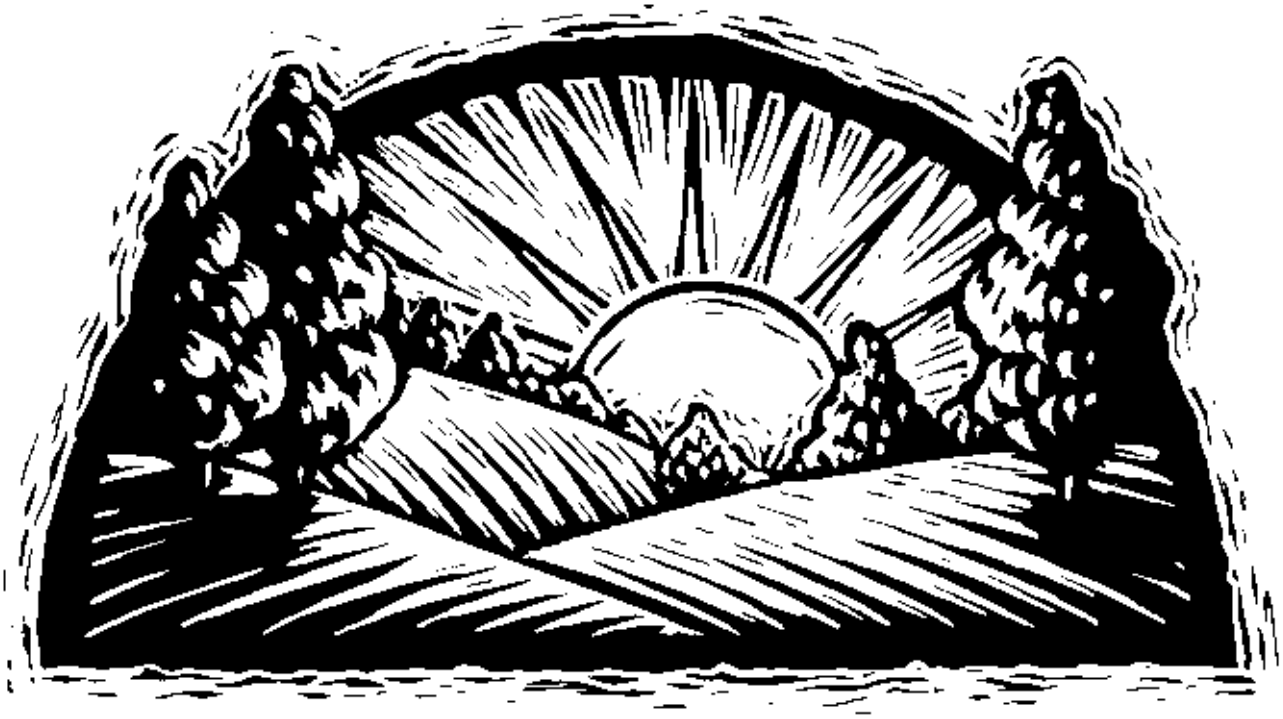
This is your planet...Your home!
Learn to take care of it...It's your future!

If you were the Earth,
what would you say?



Tackle-a-Term: ***Greenhouse effect.*** A process whereby heat is trapped at the surface of the Earth by the atmosphere. Heat is prevented from leaving the Earth by atmospheric gases (which act like the glass in a greenhouse), and much of it goes back into the ground. An increase in atmospheric carbon dioxide of 10% over the past century has led some authorities to predict a long-term warming of the Earth's climate.

Animals Disappearing From Your Own Back Yard



What Is an Endangered Species ?

Endangered – an endangered species is an animal that is native to Ohio but is in danger from becoming extinct in this state. The danger of extinction may result from one or more causes such as habitat loss, pollution, predation, interspecific competition or disease. 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.

Special Interest – a special interest species is an animal which might become threatened in Ohio under continued or increased stress. It is also an animal for which there is some concern but there is too little information to determine an adequate status evaluation.

Extirpated – an extirpated species is an animal that existed in Ohio at the time of European settlement but has since disappeared. An extirpated animal is extinct in Ohio but exists elsewhere in the United States.

Extinct – an extinct species is an animal that existed in Ohio at the time of European settlement but has since disappeared from its entire range.

The snowshoe hare is an example of an **extirpated** species in Ohio.

Did You Know?

Caterpillars turn into butterflies when they grow up. There are currently 12 kinds of butterflies in danger of extinction in Ohio.

The short-eared owl is an example of a **special interest** species in Ohio.

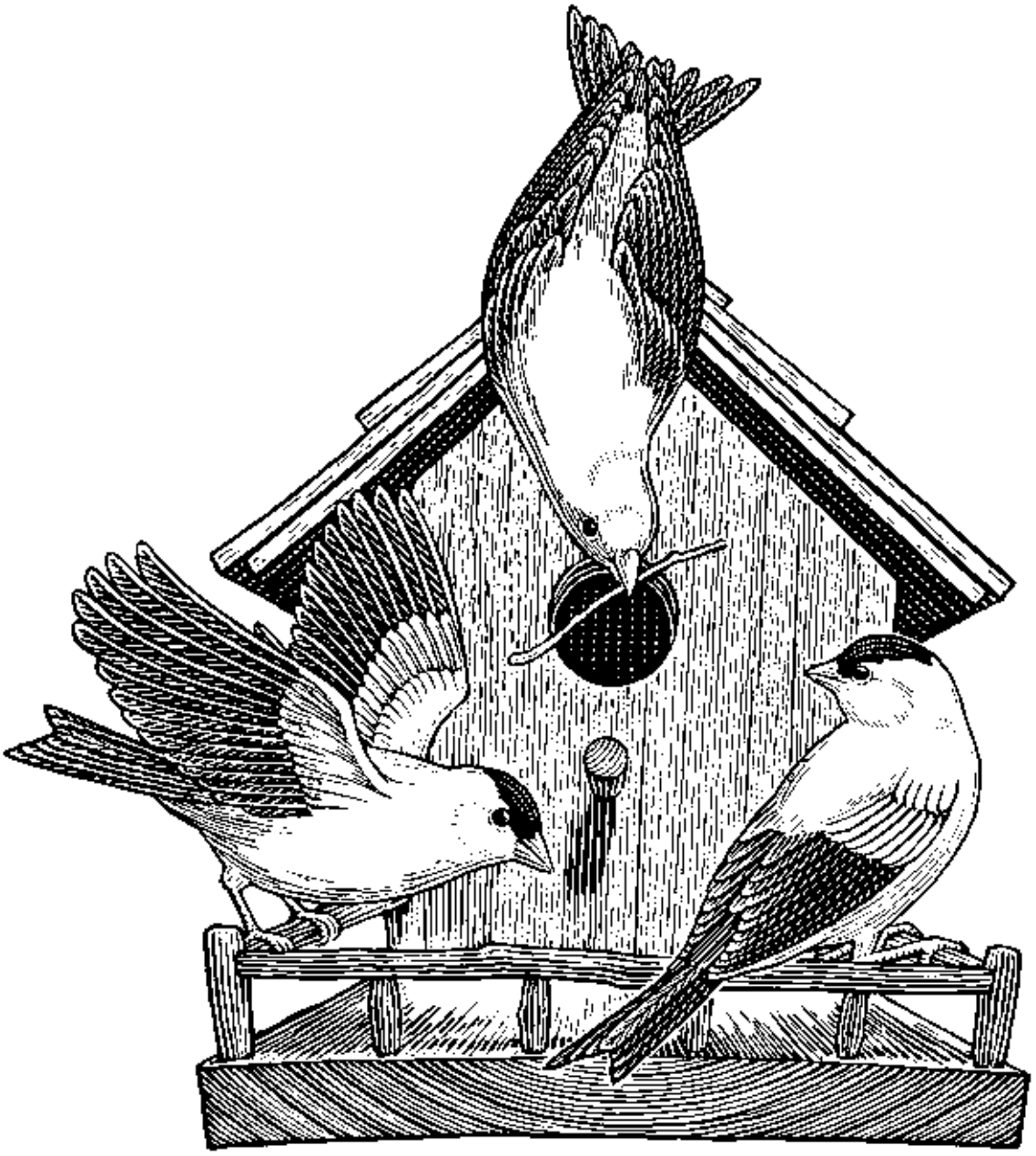
Did you know?

An owl can eat 1.5 times their weight in food, mostly mice, each day. That's like a 100-pound person eating 150 pounds of food every day!

The winter wren is an example of an **endangered species** in Ohio.

Did you know?

In the summer, the winter wren softly sings beautiful melodies but in the winter, it will only give loud chirps.



The brook trout is an example of a **threatened** species in Ohio.

Did you know?

Brook trout actually like to swim in cold water. They can be found in many of Northeast Ohio's rivers and streams.

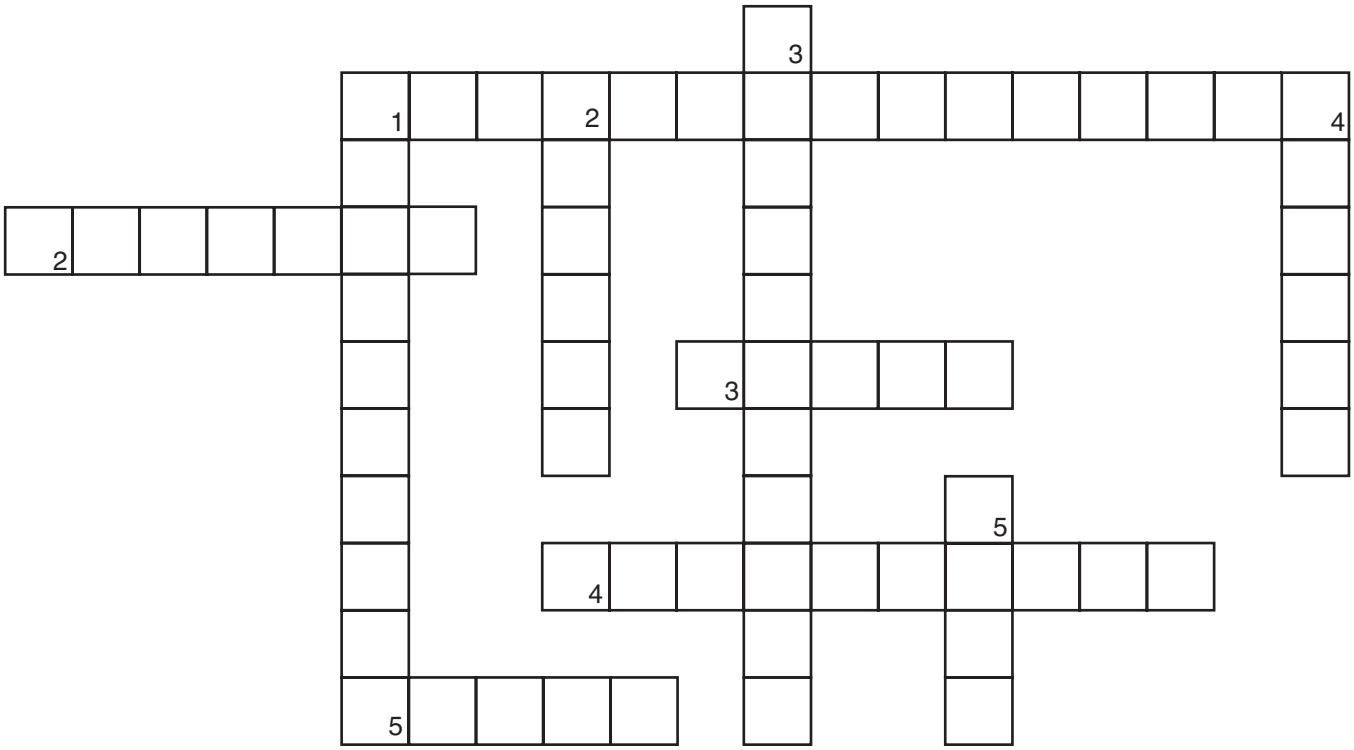
Native Ohio Species Found at NASA Glenn Research Center

Across

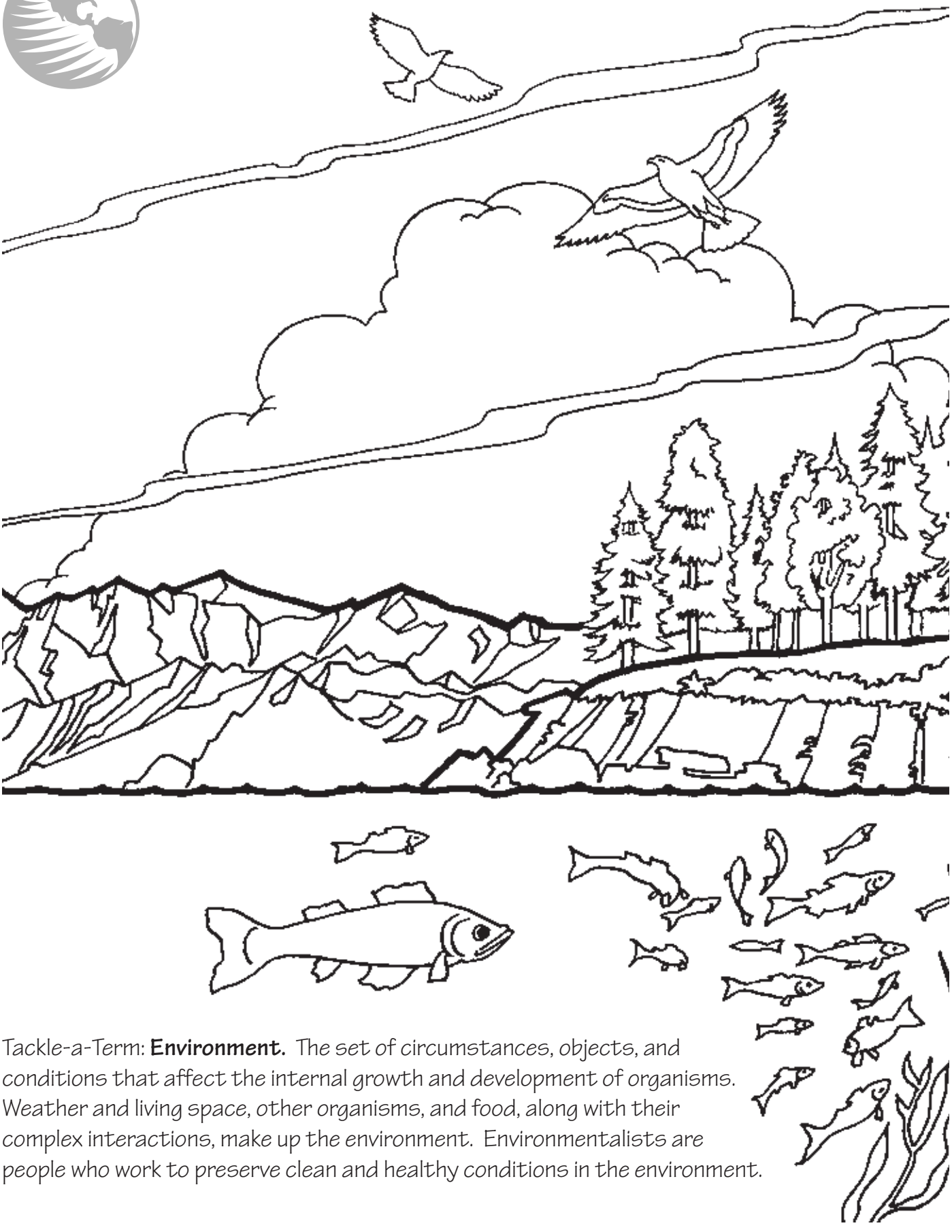
1. This hoofed mammal flashes its white tail to alert others of danger
2. Often considered a masked bandit
3. Hunters from the sky
4. This fish likes to swim in cold water
5. This bird is considered the first sign of spring

Down

1. This bird drills trees for food
2. This reptile takes its home wherever it goes
3. Once endangered, this waterfowl has made a dramatic comeback thanks to conservation efforts
4. Related to our pet dogs
5. This amphibian starts out life looking like a fish but ends up as a prince



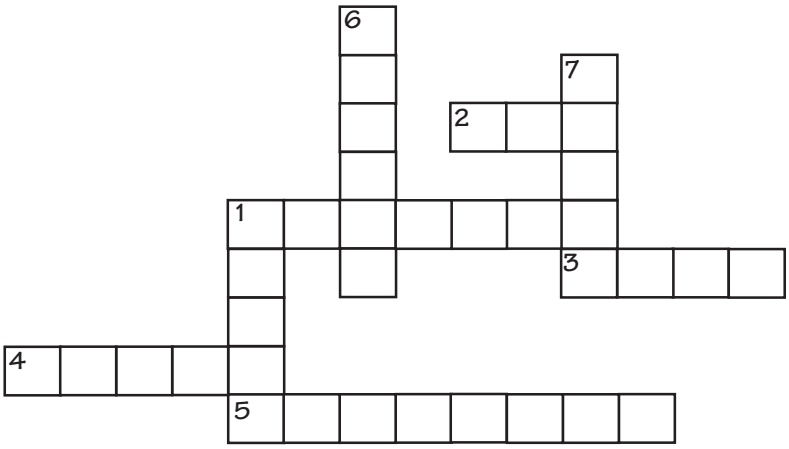
Answers on page 49



Tackle-a-Term: **Environment.** The set of circumstances, objects, and conditions that affect the internal growth and development of organisms. Weather and living space, other organisms, and food, along with their complex interactions, make up the environment. Environmentalists are people who work to preserve clean and healthy conditions in the environment.

Ways to Protect Our Environment

- **Recycle** means to make something new out of something old.
- **Reuse** means to use containers that can be used over and over again.
- **Reduce** means to use less. An example might be to walk to the corner store instead of driving a car. This would reduce the amount of fuel used and pollution into the air. Can you find the solutions to our environment puzzle?



Across

1. We can _____metals, wood, glass, etc., and help to save our natural resources.
2. _____ pollution is caused by burning coal, oil, and many waste materials.
3. _____ is another word for dirt. When trees are not replaced, much of the answer is eroded away by the rain and wind.
4. A product made from sand and can be made into containers to hold liquids such as water or milk is called _____. It can be recycled or reused.
5. Make every day _____.

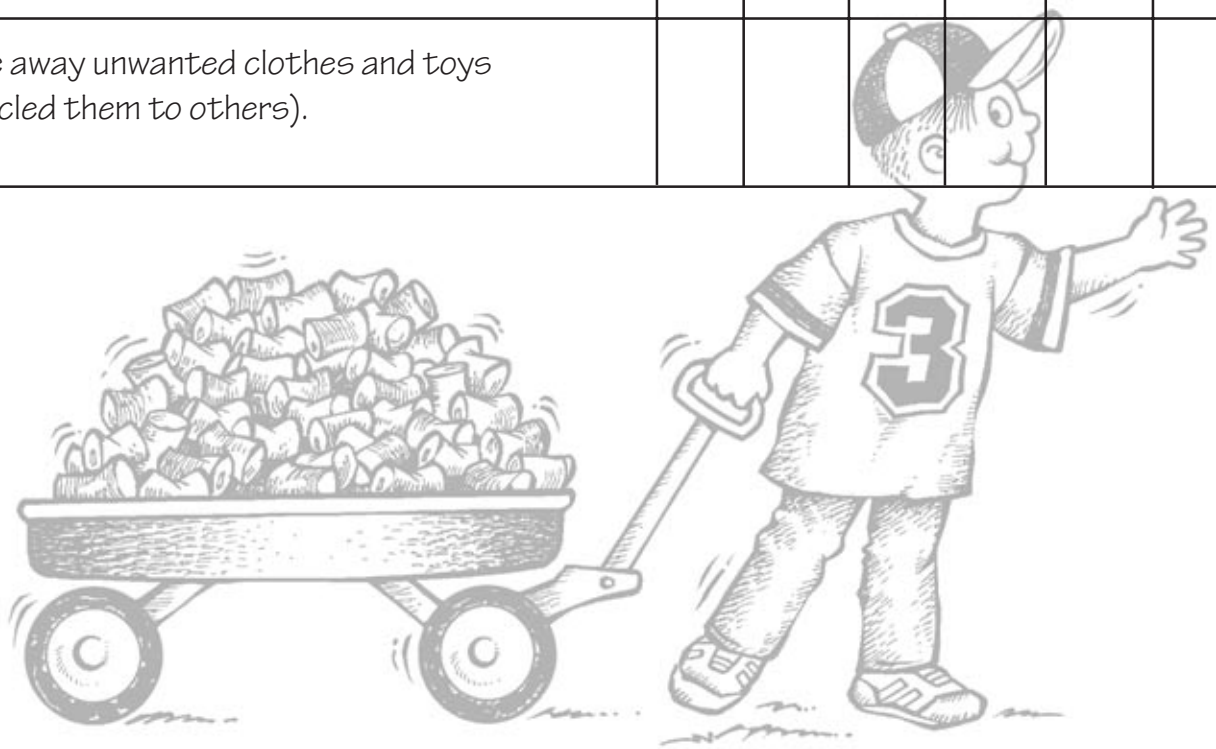
Down

1. To _____ a milk carton means to use it over again.
6. There are many ways to _____ waste in our daily lives.
7. _____ around the world are being destroyed and not being replaced and are a resource for furniture and paper products.

Answers on page 49

What Can You Do at Home to Help the Earth?

	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
I turned off the lights when I left the room.							
I didn't leave water running (for example, turn off water while brushing your teeth).							
I helped my parents recycle our glass, cans, aluminum pop cans, soda bottles, and newspapers.							
I used a lunch box instead of brown bag for my lunch or I used my bag for several days.							
I looked for creative ways to use unwanted items (for example, use yogurt and margarine containers to grow small plants or store leftovers).							
I gave away unwanted clothes and toys (recycled them to others).							



Recycling FAQ's

Q. How many pounds of paper do you have to recycle to save a tree?
A. It takes about 120 pounds of paper to save a tree. The NASA Glenn Research Center recycles about 2 tons of paper a year. That's 34 trees being saved!

Reality check.

Americans throw away enough writing and office paper annually to build a wall 12 feet high stretching from New York City to Los Angeles.

One ton of recycled paper saves 17 trees and uses 64% less energy, 50% less water, 74% less air pollution than one ton of paper products from virgin wood pulp.

Q. How much energy does it require to make a pop can from recycled aluminum versus making a pop can from virgin ore?
A. It takes 95% less energy to produce a can from recycled aluminum than virgin ore!

Reality check.

Every 3 months, Americans throw away enough aluminum to rebuild the entire U.S. commercial air fleet!

Q. How large of an oil spill does it take to impact the environment?
A. It only takes 1 gallon of oil (about the amount used in automobiles) to ruin a year's supply of water for 50 people!

Reality check.

The world's largest oil recycling facility is in Indiana and recycles about 95 million gallons of oil a year!

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 even 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 50

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

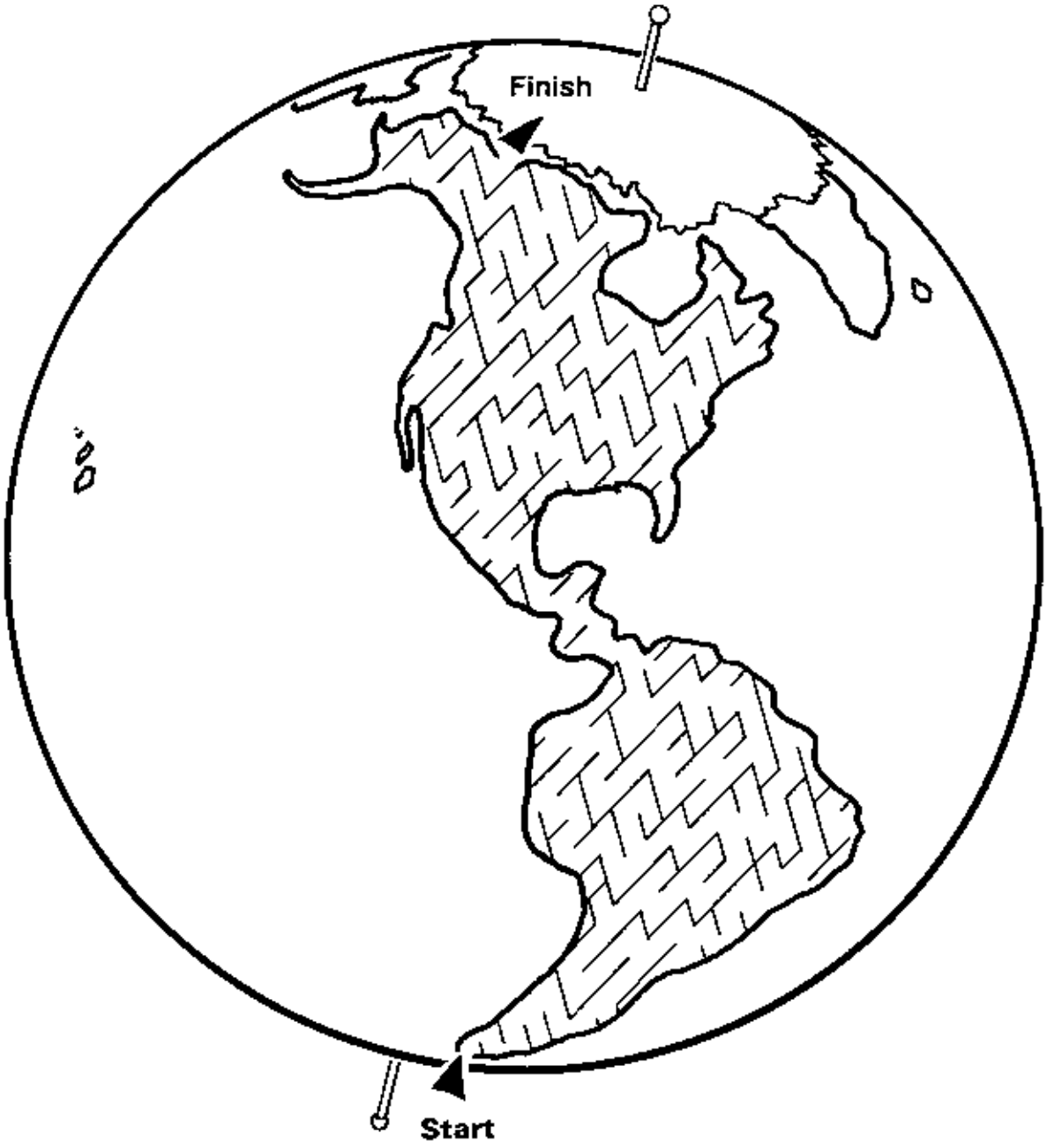
REALITY
RECYCLE
RECYCLING
REDUCE
REGULATIONS
REPLACE
RESEARCH
RESOURCE
REUSE

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

EARTH
EARTHDAY
ECOLOGIST
ELECTRICITY
ENDANGERED
ENERGY
ENVIRONMENT (3 TIMES)
EVERYDAY

Answers on page 49

Find your way to the Arctic



Fascinating Fact: The atmosphere of the Earth is made up of about 80% nitrogen and 20% oxygen.

LITTLE WORLDS

Our planet Earth is really very small when compared to the rest of the universe. It's our home, and we need to be as careful with it as we can. We're all living in one community, and how each one of us lives affects all of the other living things. The amount of fresh water and the number of growing trees are really very small when compared to living things depending on these resources. We need to use what we have left wisely.

One way to do this is to look at objects around your house with imagination and a creative eye. Boxes, tubes, cans, containers can all be used to make something out of nothing. All it takes is the simple step of looking at a common object and asking yourself, "How many different ways can I use this?"

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PEBBLE JEWELRY

MATERIALS

- Small pebbles or pretty rocks
- Tacky glue
- Jewelry backings from some old jewelry or craft store

Search around your house for some inexpensive pin backs, earring backs, barrettes, and hair combs. Ask if you can use them first! If not, you can buy backings at craft shops. Button backs from fabric-covered button kits (at the fabric store) can be used to make pebble buttons.

Collect some pretty, small pebbles. Wash them and let dry. Select interesting pebble combinations and glue them to the jewelry backs.

When the glue dries, you can decorate the pebbles with fine-tip marking pens, making designs or faces, or leave them their natural colors.

Brush on a coat of clear nail polish to give the pebbles a shine, as if they just came from the stream bed. What other things can you make by gluing carefully selected pebbles or shells onto backings made from yogurt containers or tissue rolls? What about napkin rings, bracelets, vases for violets, ...

INSPIRATION BOX

Materials

Assorted boxes including 2 large ones

Paints and permanent markers

Make a box just for those unusual things you find now and then that might be useful in art and craft projects. Find a sturdy carton and decorate it to suit your personality: perhaps graffiti with markers, or a collage cut from magazines. Add a few smaller boxes to keep tiny findings inside — like small shells you have gathered, unusual pebbles, or buttons you've collected. Ask your family to help you watch for useful items. A broken necklace, pretty stamps or stickers from the mail, corks, magnets, fake flowers, fabric remnants, yarn, gift wrap, and ribbons — whatever you come across that might be useful some day — can be saved until you are ready for it.

You'll also want to keep a separate, larger box to store clean jars, margarine tubs, and yogurt containers, tissue rolls, egg cartons, styrofoam meat trays (rinse in hot water first), and pieces of foil you have sponged off and folded flat. Paint or decorate it and write "Crafts" on it.

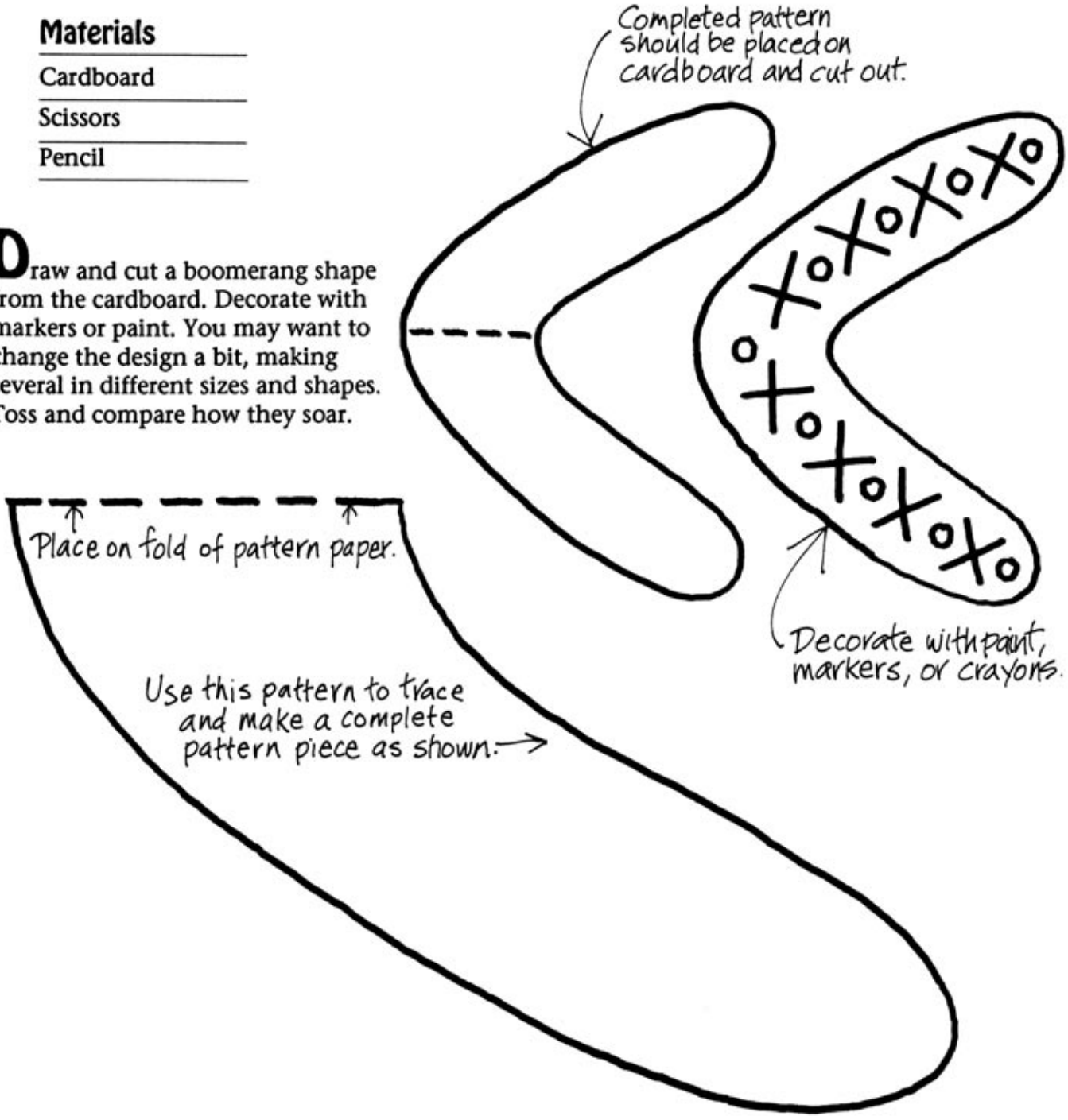
BOOMERANG

Australians invented the boomerang, which is a flat, curved shape that can be thrown so that it returns to the thrower.

Materials

- Cardboard
- Scissors
- Pencil

Draw and cut a boomerang shape from the cardboard. Decorate with markers or paint. You may want to change the design a bit, making several in different sizes and shapes. Toss and compare how they soar.



QUILL PEN

MATERIALS

Feather

Ink or tempera paint

Scissors or knife

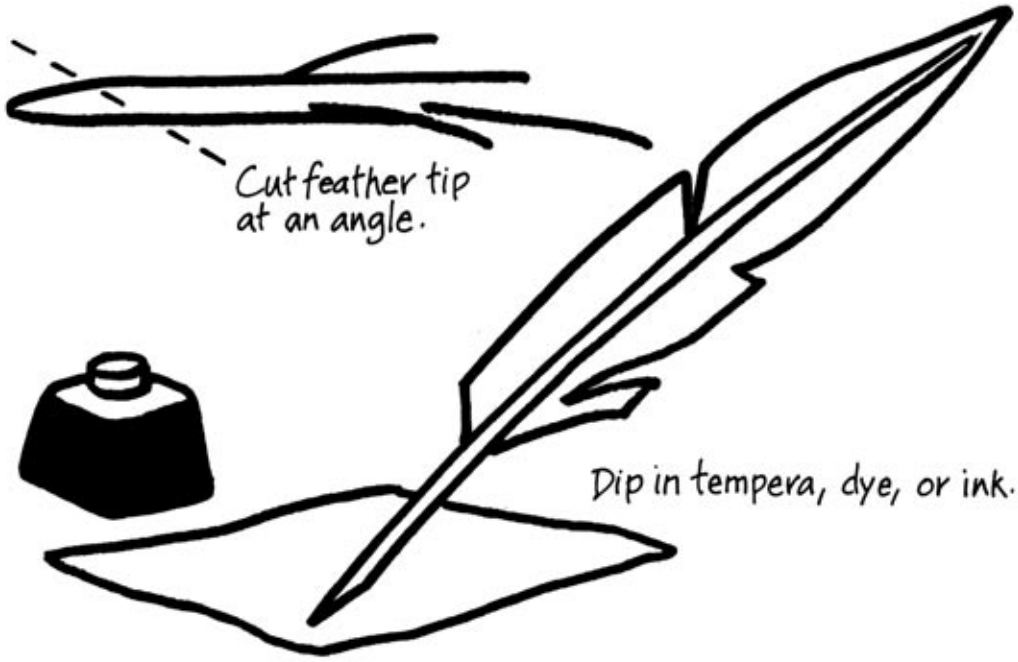
You can make a pen like those used by writers from the sixth century until the mid-nineteenth century, when the steel pen point was invented.

Feathers from geese were most commonly used. Swan feathers were more expensive. Crow's feathers were best for creating fine lines.

In order to make your own quill pen, you need to find or purchase a feather. Look outside and see if you can find any feathers in your yard or along the beach. (Wash your hands after handling.) Chicken or turkey feathers are sold in most craft supply shops, if you can't find any.

With scissors or a sharp knife, snip off the end at a slant. Dip the cut end into ink or paint and write just like your ancestors might have!

When the tip wears down, snip it off a bit more, to create a fresh sharp tip. Now that is really recycling!

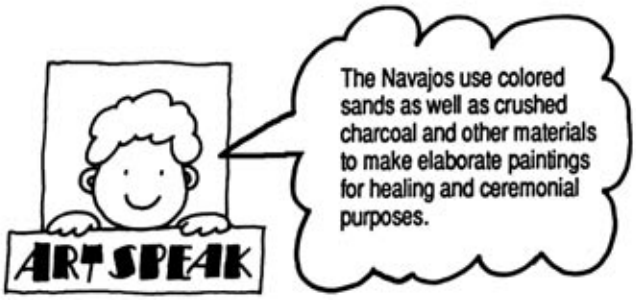


NATURE NOTE

STONE CRITTERS

MATERIALS

- Rounded stones in assorted shapes and sizes
- Acrylic paints or permanent marker pens
- Adhesive: Tacky-type glue, silicone sealer (sold in tubes in hardware stores).



Rinse the stones and let dry. Then lay them out, looking at their shapes and colors to get ideas. You can use them to create paperweights, doorstops, garden sculpture, refrigerator magnets, or interesting designs.

Tiny decorated pebbles can be glued to magnets, pin backs, or barrettes.

To fasten stones together to create animal ears, arms, or legs, dab silicone sealer or tacky-type glue on the stone. Hold stones in place until the glue sets.

Use paints or permanent markers to decorate or draw on eyes and mouth. Glue broom straws, dry grass, or toothpicks on for whiskers. Old leather scraps make good ears or tongues.

Large rocks can be painted like ladybugs or turtles and placed in your garden.

Use white stones. Make black spots with paint or marker or glue on tiny, dark pebbles. Glue on yarn tail.

Paint circles and triangles for eyes and nose. Use marking pen to draw feathers or find feathers and glue on.

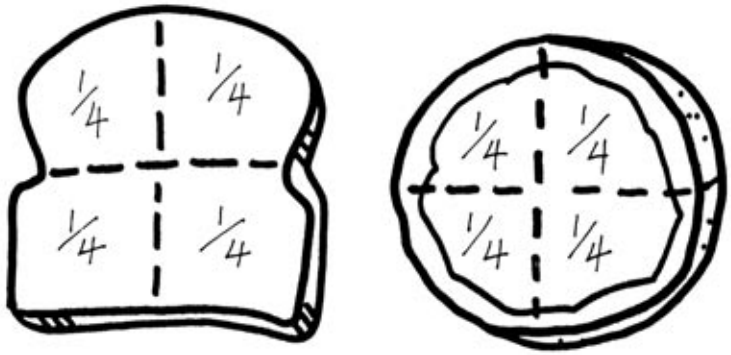
LADYBUG

Paint large rocks in bright colors. Position them around your yard or garden.

Winter Treat Garlands

Materials

- Oranges
- Bread: day-old is best
- Heavy-duty thread and yarn needle
- Knife

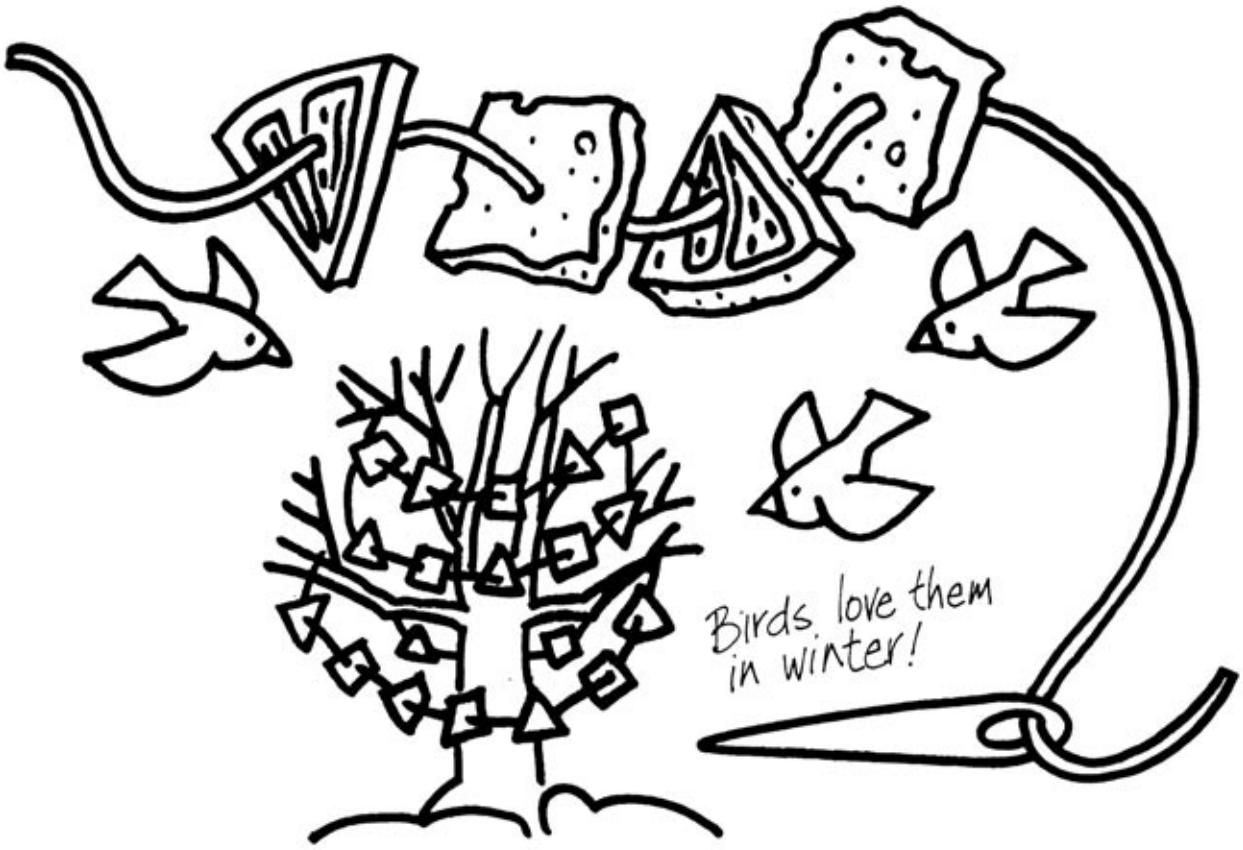


Tear the bread into fourths. Ask a grown-up to help you slice the oranges in rounds and then cut each round in fourths.

Thread the needle with about a yard of thread and string the food in a pattern, leaving a few inches between foods.

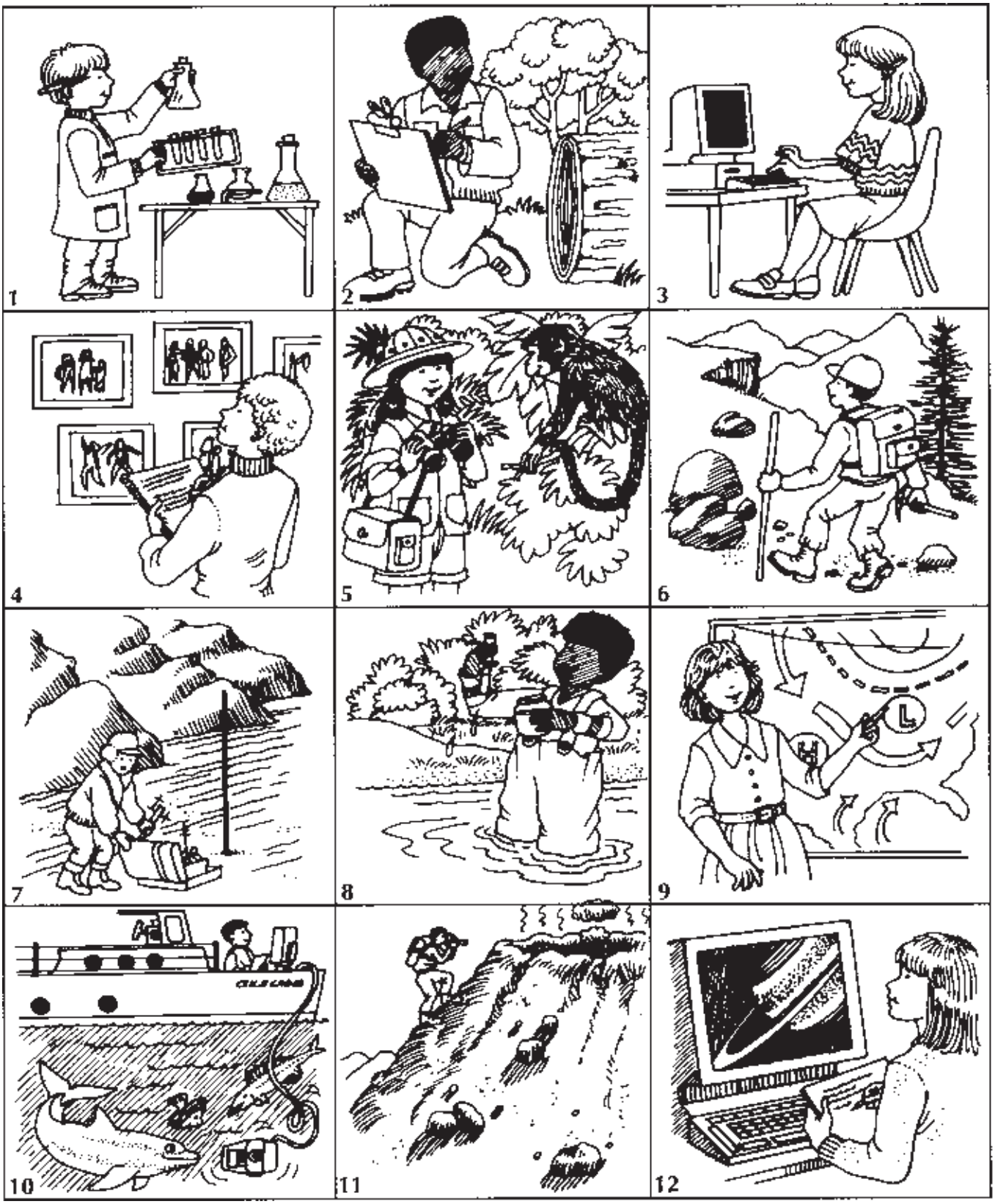
When you have several lengths strung, put on warm clothes and head outside to decorate a tree or bush with natural goodies for the winter birds.

This can be a fun holiday alternative to plastic and electric holiday decorations outdoors, plus the birds will love this treat.



Mission to Planet Earth Careers

1. **Atmospheric Chemist:** I study the atmosphere 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 shoe 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 data 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 decisionmakers make policies that help prevent damages to the environment.
5. **Ecologist:** I study various forms of life on Earth and how they interact. I go out in ships or use aircraft and satellites to measure where and how healthy the plants and animals are in their habitats. 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 then, 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. **Glaciologist:** I study glaciers in the Arctic and Antarctic as well as those formed in the tallest mountains. I study temperatures, snow accumulation, and deep ice cores to understand what is happening to the glaciers. I also use satellites and aircraft to get the data.
8. **Hydrologist:** I study the water cycle. I study where the water goes, what elements it contains, and whether its chemistry has changed. My research often is used to determine where droughts occur and why fish populations decline.
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 work on ships or in aircraft and get data from floats and satellites.
11. **Volcanologist:** Using ground instruments, I study volcanoes and how they influence the climate. I use satellite and robots to gather data when the volcanoes are active and become too dangerous to go near.
12. **Planetologist:** I study planets other than Earth. When I compare planets like Mars, which has very little water compared to Earth, I can learn more about what could happen to our planet. The only way I can study Mars is by observing the planet with large telescopes or using data collected by satellites, such as obtained by Voyager.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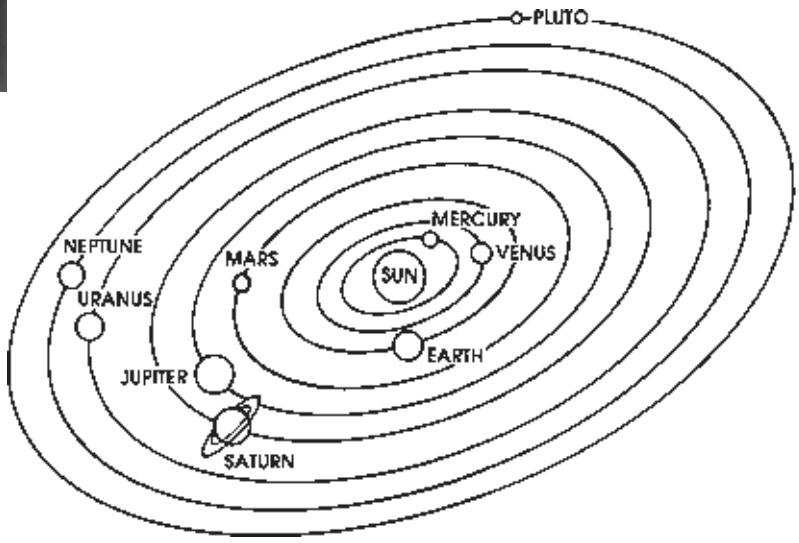
Our Universe

Where Is Home?

Our Galaxy

What's the name of our galaxy?
(A) M21 (B) M32 (C) G1 (D) MILKY WAY

Our Solar System



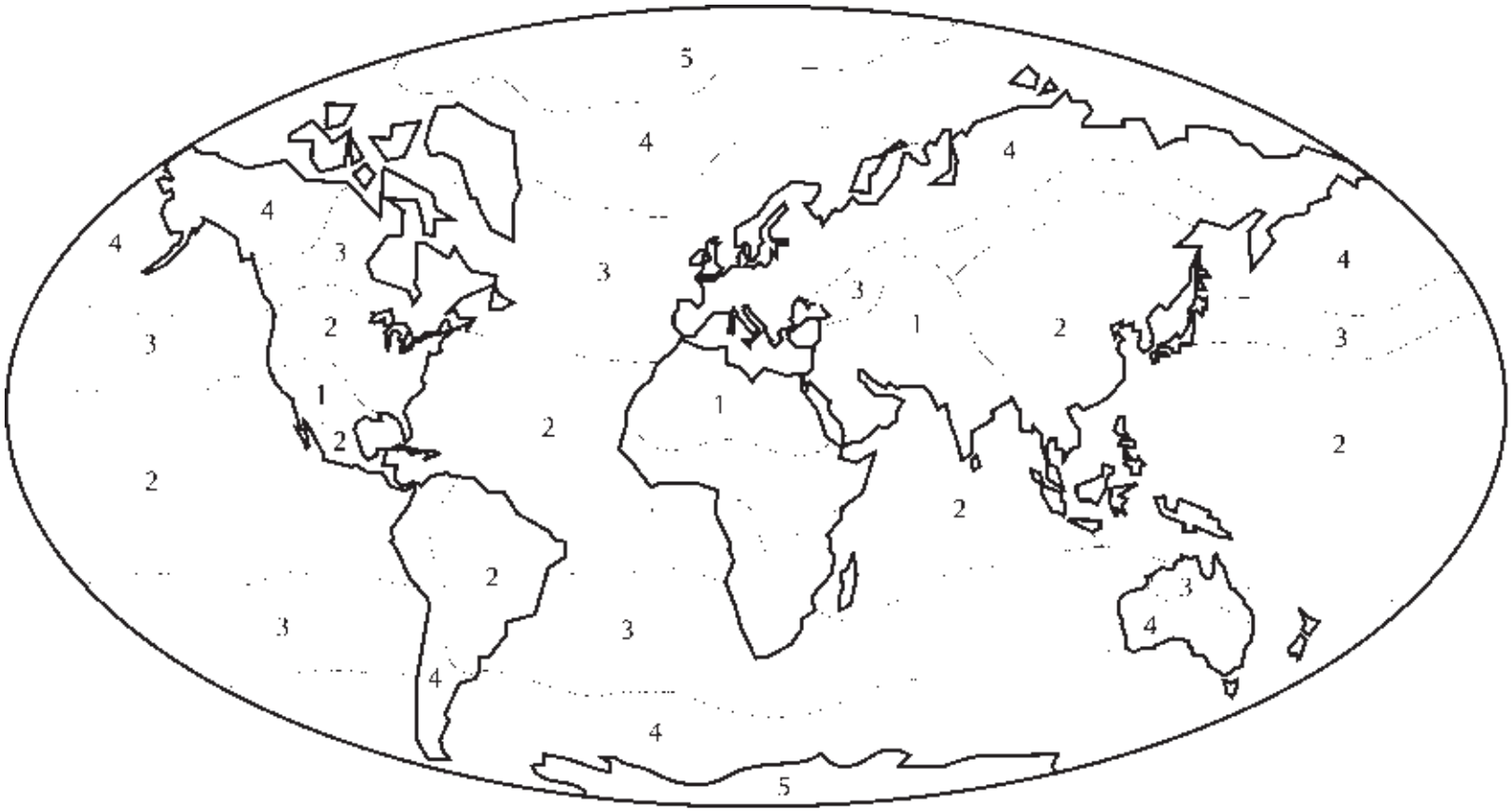
Our Planet

Earth

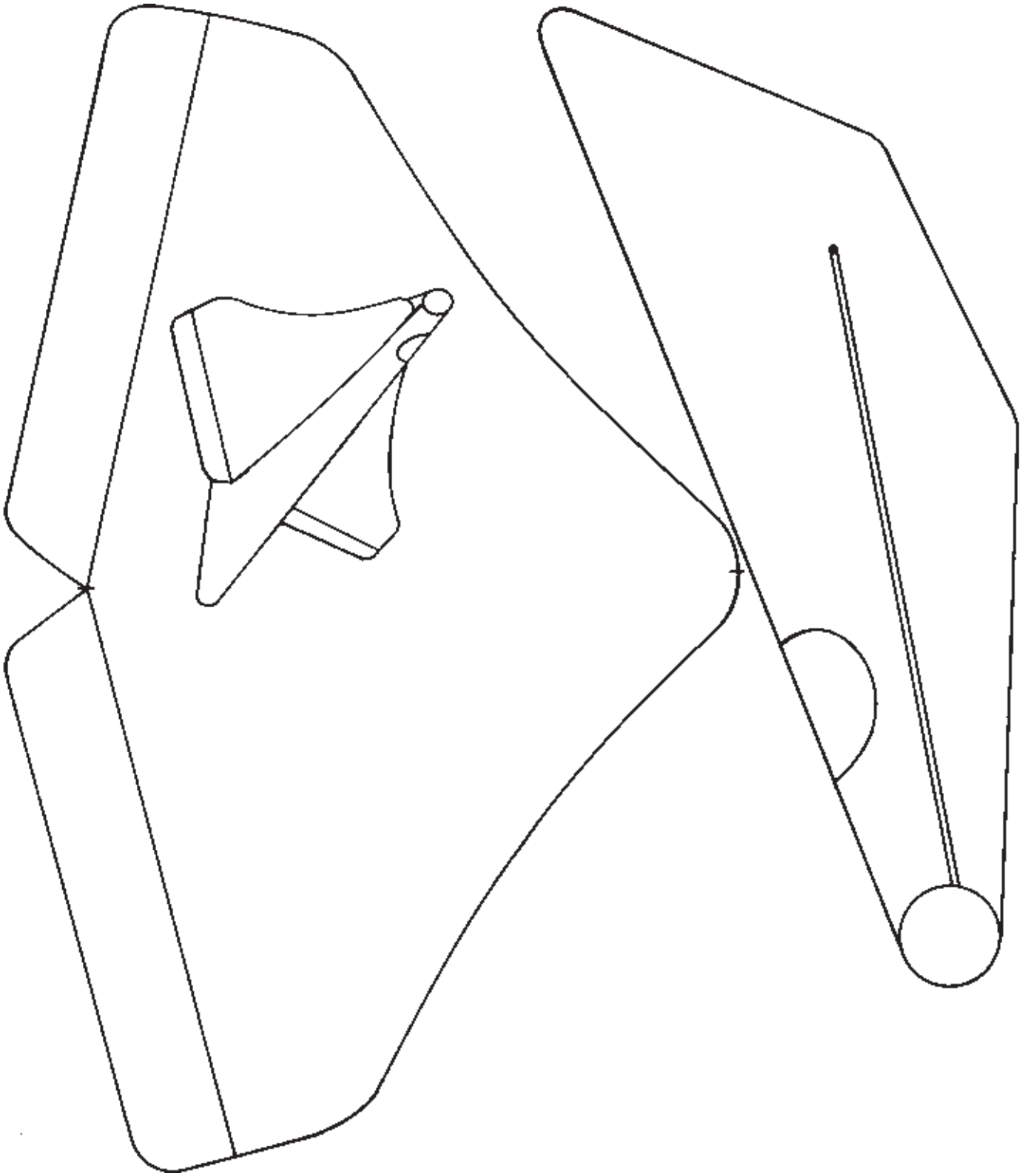
Our Country

USA

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



Star Glider Pattern

Star glider pattern (on previous page)
1. Cut wing and fuselage from foam deli tray.
2. Mark elevon hinge with roller ball pen using moderate pressure.
3. Cut slot in fuselage so wing fits snugly.
4. Slide wing in slot.
5. Tape penny on nose to balance.
6. Bend elevons upwards as needed.
7. Fly.

Elevon
Has dual function of aileron and elevator.

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. This stands for British thermal unit. Btu is defined as the amount of heat energy it takes to raise the temperature of one pound of water by one degree Fahrenheit, at sea level.

One Btu equals about:

- One blue-tip kitchen match

One-thousand (1,000) Btu roughly equals:

- One average candy bar
- 4/5 of a peanut butter and jelly sandwich

It takes, for example, about 2,000 Btus to make a pot of coffee.

Energy can also be measured in **joules**. Joules sounds the same way as the word jewels, like diamonds and emeralds. It takes 1,000 joules to equal a British thermal unit. So:

1,000 joules = 1 Btu
So, it would take 2 million joules to make a pot of coffee.

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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 one pound about nine inches.

Around the world, scientists measure energy in joules rather than Btus. 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 1,000.

1,000 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 light bulb 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.

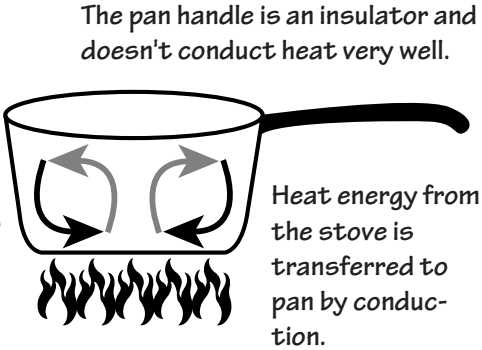
Heat Energy

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:

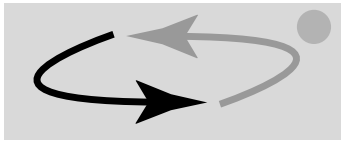
1. Conduction
2. Convection
3. Radiation

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 spoon.

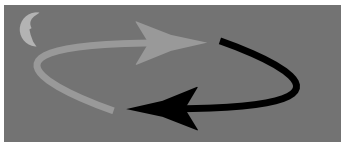
Metals are excellent conductors of heat energy. Other things like wood or plastics are not good conductors of heat energy. These "bad" conductors are called insulators. That's why a pan is usually made of metal and the handle is made of a strong plastic.



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).



Day time



Night time

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 changes 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 sun light 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 would be cooler.

Here's what we learned

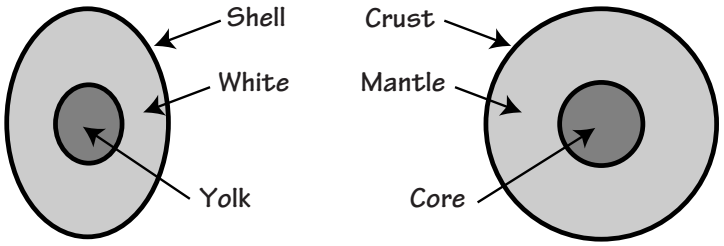
1. Energy is the ability to do work.
2. There are two different types of energy. Kinetic energy is energy in motion. Potential energy is energy that is stored.
3. Energy is measured in units, two of which are Btu (British thermal unit) or joule.
4. Energy cannot be created, nor can it be destroyed. It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

Ways you can help save energy

In your home, putting insulation in walls and attics, we can reduce the amount of energy it takes to heat or cool our homes. 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, 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.

Geothermal Energy



Geothermal Energy has been around for as long as the world 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 degrees Celsius. Or for every 328 feet below ground, the temperature increases 5.4 degrees Fahrenheit.

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 degrees Fahrenheit or 148 degrees Celsius. 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 green house, 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. The City Hall, animal shelters, retirement homes, state agencies, a hotel and convention center are some of the buildings which 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 volcanoes, 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".

What is Energy?

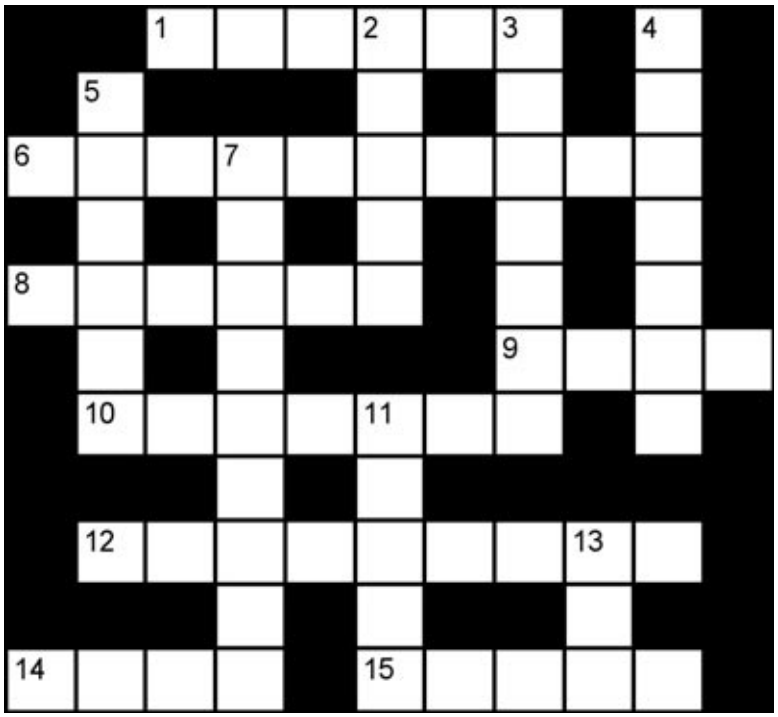
Once you've read the story, "What is Energy?", you should be able to find the energy terms contained in this puzzle.

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. A measurement of energy — much less than a Btu.
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 49

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 49

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 hydro-electric 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.

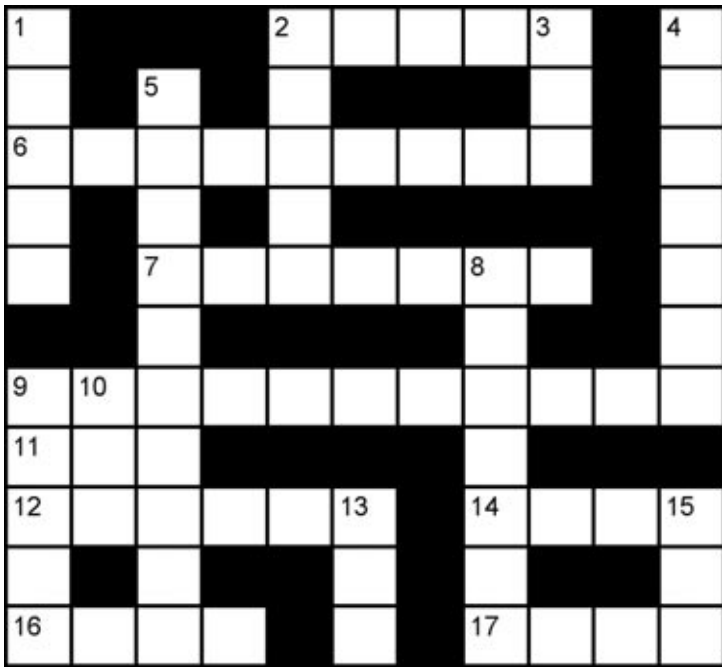
Can you find the renewable energy terms in this puzzle?

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 breath.
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 49

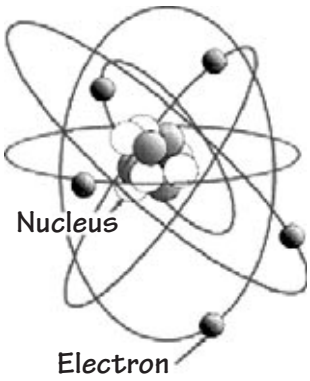
What is Electricity?

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?

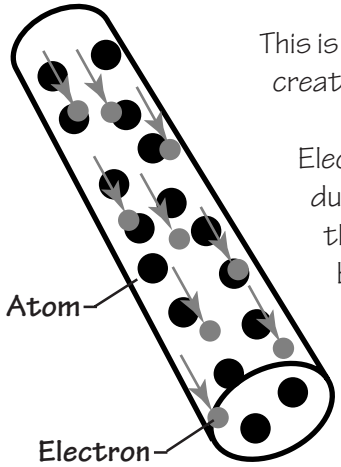
You'll remember in "What is Energy" that energy can be conducted. Heat energy was conducted from the heat through the soup pan to the soup. Electricity is the conduction (or transfer) of energy from one place to another. The electricity is the "flow" of energy.

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.

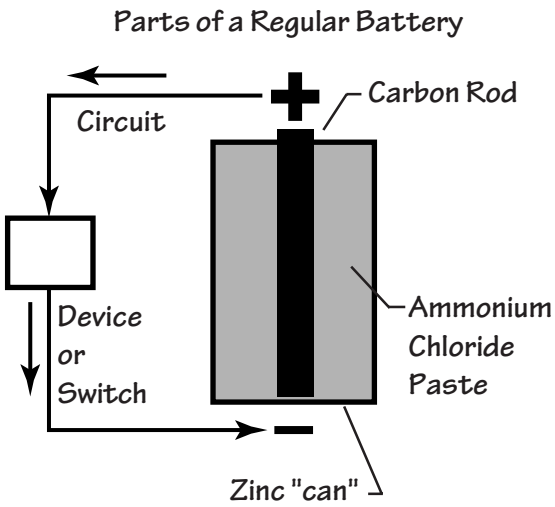


This is what happens in a piece of wire. The electrons are passed from atom to atom, creating an electrical current from one end to the other.

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.



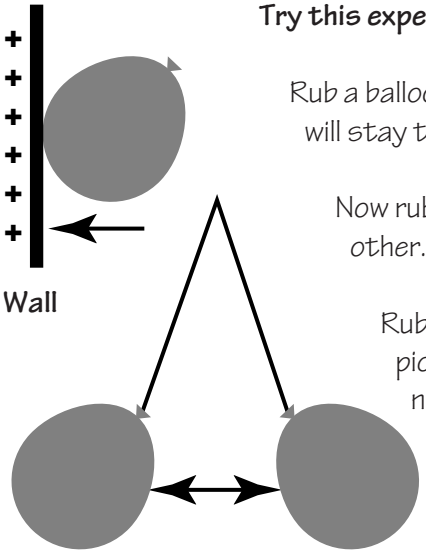
Batteries contain stored chemical energy. When the chemicals react with each other, they produce an electrical charge. This charge changes into electrical energy when the battery is connected in a circuit.

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 always repels positive charges. So, the two balloons' negative charges "push" each other apart.

Static electricity can also 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?

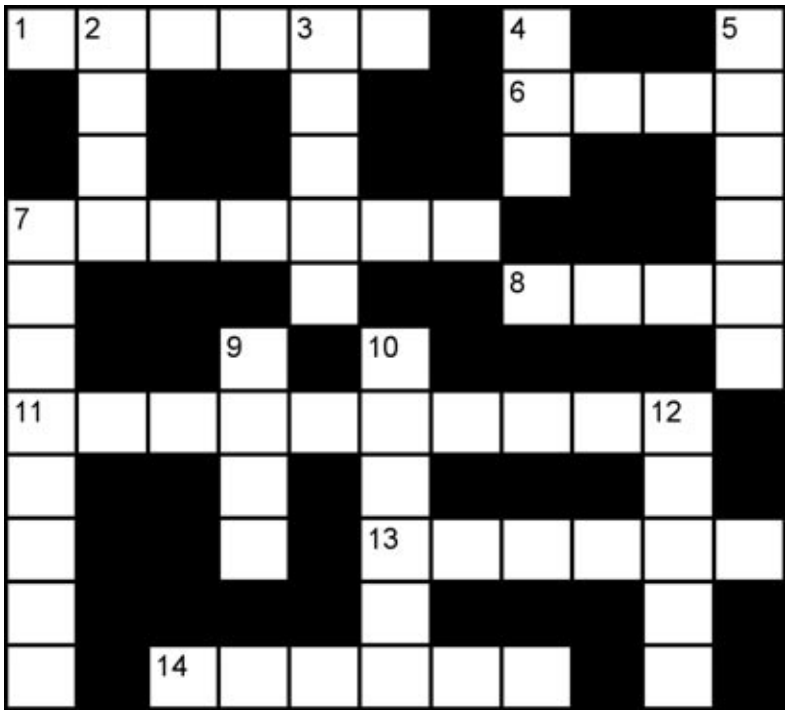
Once you've read the story, "What is Electricity?", you should be able to find the energy terms contained in this puzzle.

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 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.

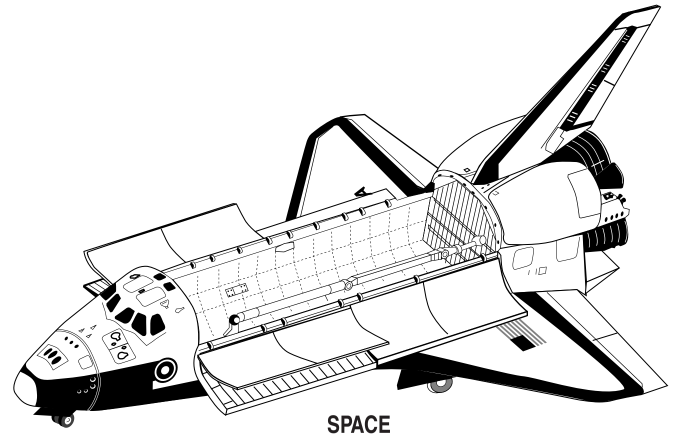
DOWN

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 neither be created or 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!



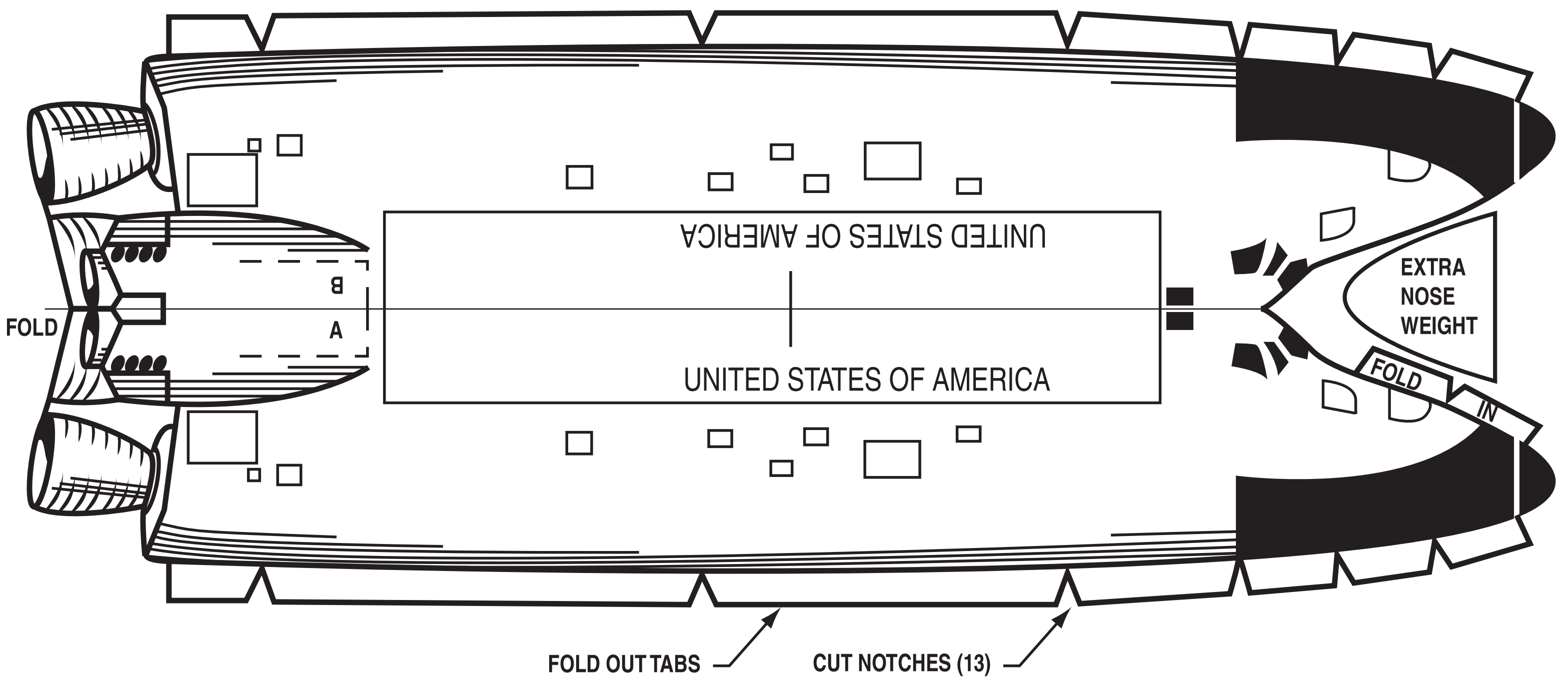
Answers on page 48

U.S. Space Shuttle Glider Kit

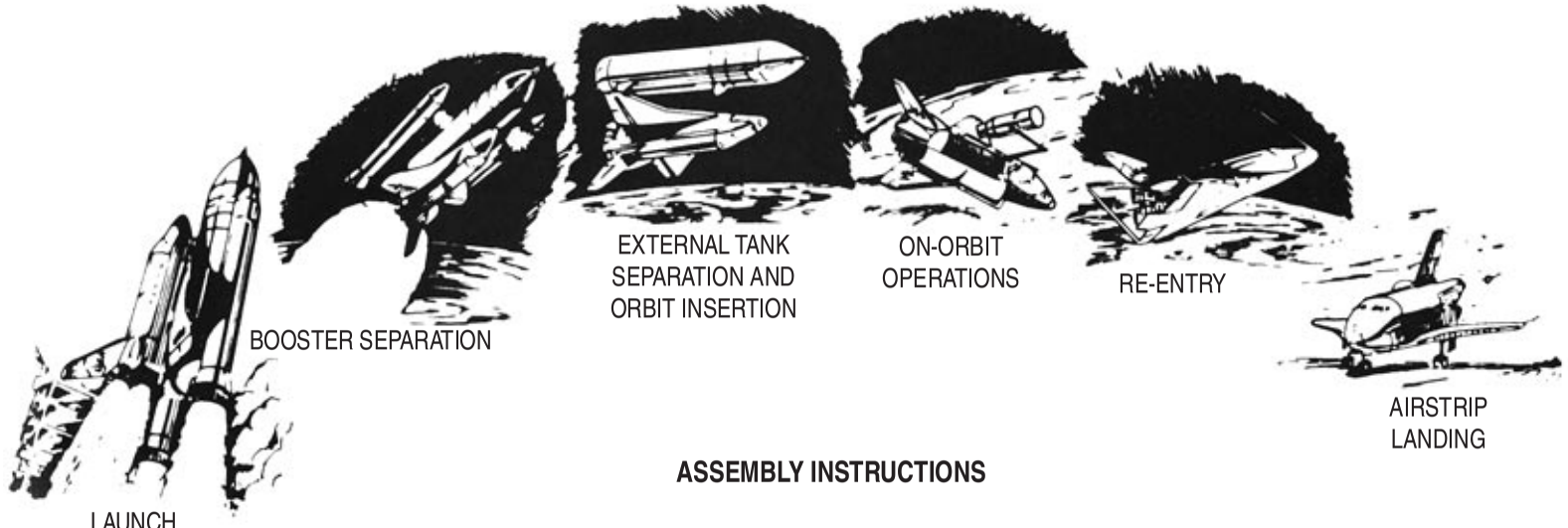


Your Space Shuttle glider is a 1:200-scale model of the U.S. Space Shuttle orbiter. The airplane-like orbiter functions as a space station that can remain in Earth orbit for up to 30 days at a time. It normally carries about seven people; three of these may be astronaut-pilots, the others may be specialists in some area of science or technology. From the Space Shuttle orbiter, the crew is able to conduct many of the space missions that until now have been executed from Earth; they are able to launch satellites (weather, communications, navigation, Earth Resources), scientific spacecraft to explore and study our solar system, and military spacecraft. In addition, the crew is able to retrieve and repair satellites and conduct onboard experiments. At the end of each mission, the 120-ft. orbiter is piloted back to Earth and lands like an airplane on an airstrip. It is then refurbished and in 2 weeks is ready for another mission. In this manner, each orbiter is expected to be used at least 100 times.

The orbiter and its engines are just part of the Space Shuttle system. The other parts are the solid rocket boosters (SRB's) used for launch and the external tank that contains liquid propellant for the engines. All of these parts are reusable except the tank, which is jettisoned just before the Shuttle orbiter achieves Earth orbit. This ability to reuse costly equipment as well as the ability to conduct missions from Earth orbit substantially decreases the cost of space operations. Just as during our Earthbound years we relied on trucks, trains, and airlines to provide transportation, we now rely on the Space Shuttle to provide transportation to and from space.

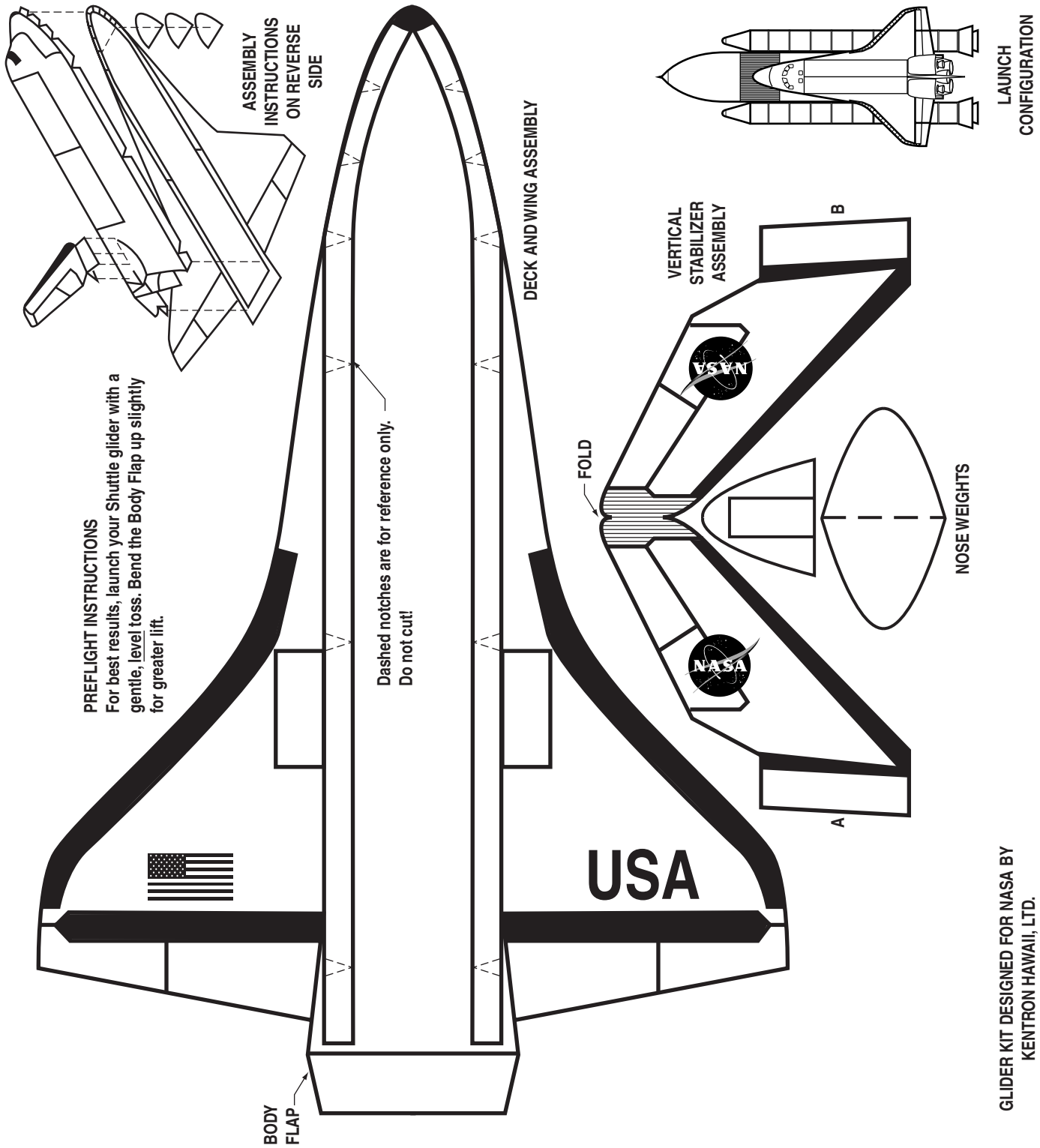


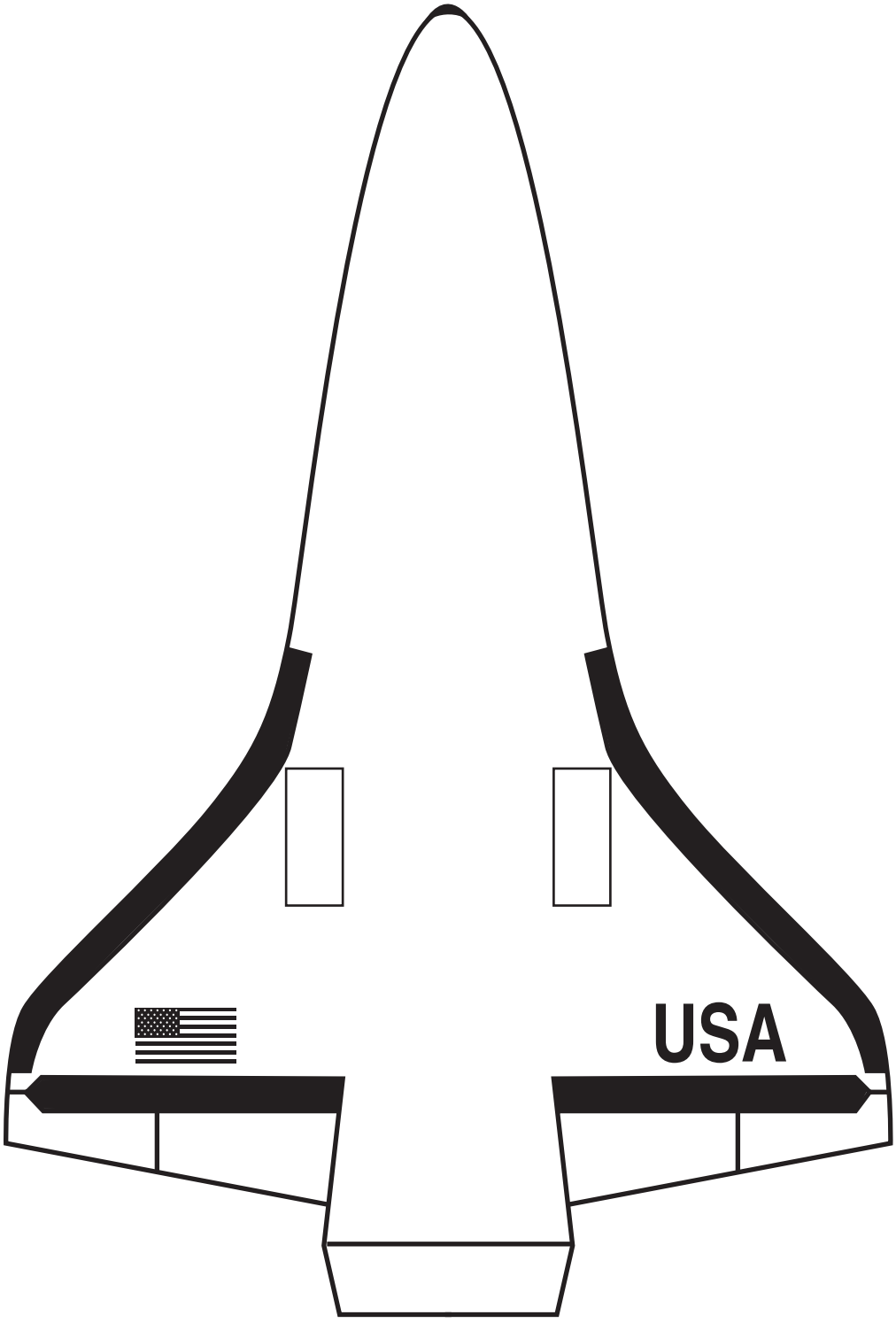
Shuttle assembly instructions on the following page.



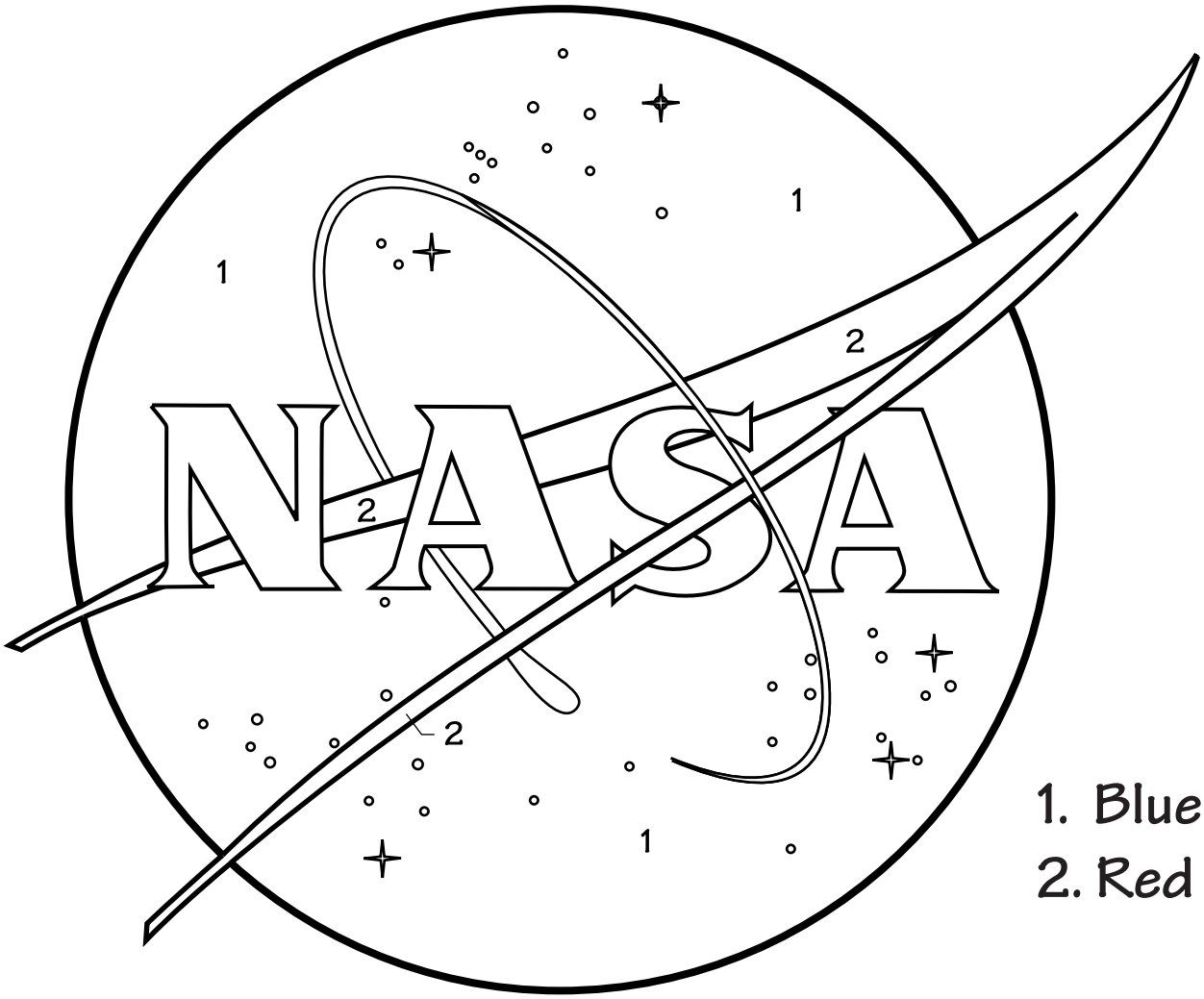
ASSEMBLY INSTRUCTIONS

Read carefully before assembly: 1. Cut out all parts using scissors. 2. Cut out V-shaped notches on Fuselage to create tabs along outside edge. Fold tabs out. 3. Glue or tape three Nose Weights to underside of nose of your glider. Use the fourth weight provided if needed for extra weight trim after assembly. 4. Fold Fuselage along middle line. 5. Starting at the nose, glue or tape fuselage to Deck and Wing Assembly. Match tabs on Fuselage exactly to those printed on Deck and Wing Assembly. 6. To close the nose, glue or tape the two halves together using tabs provided. 7. Fold Vertical Stabilizer Assembly. Fold out tabs A and B. Except for tabs A and B, glue or tape Vertical Stabilizer Assembly to make one solid piece. 8. Attach Vertical Stabilizer to Fuselage, matching tab A with point A and tab B with point B. 9. Read PREFLIGHT Instructions.


ASSEMBLY INSTRUCTIONS ON REVERSE SIDE
PREFLIGHT INSTRUCTIONS
For best results, launch your Shuttle glider with a gentle, level toss. Bend the Body Flap up slightly for greater lift.
Dashed notches are for reference only. Do not cut!
DECK AND WING ASSEMBLY
BODY FLAP
USA
FOLD
VERTICAL STABILIZER ASSEMBLY
B
A
NOSE WEIGHTS
LAUNCH CONFIGURATION
GLIDER KIT DESIGNED FOR NASA BY
KENTRON HAWAII, LTD.
ARTIST: ROLAND O. POWELL


USA

Color the National Aeronautics and Space Administration Logo



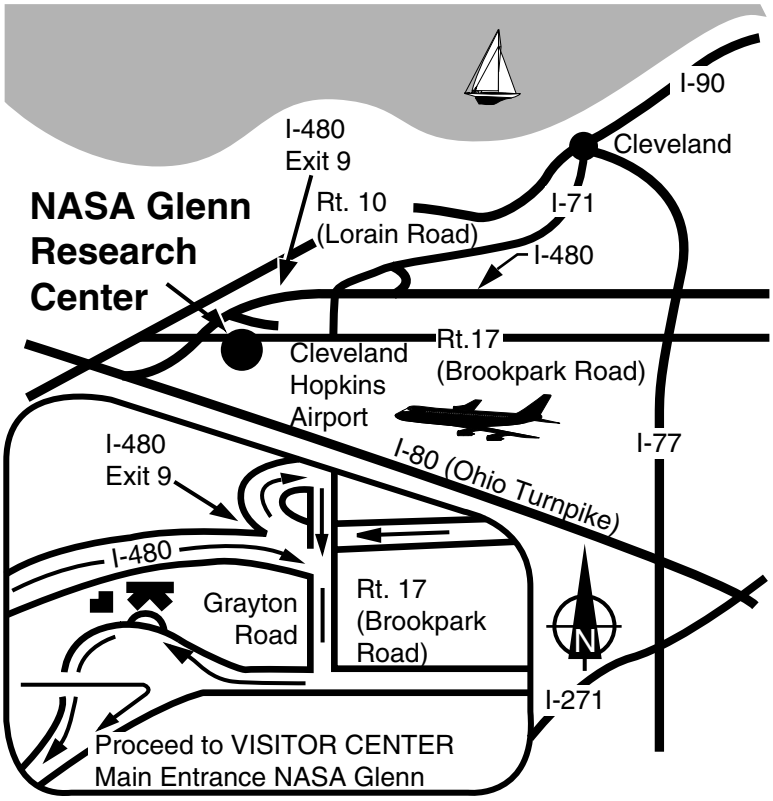
1. Blue
2. Red

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

The activity book was created by Dan White, Team lead, 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://osat-ext.grc.nasa.gov/emo/.

Directions to the NASA Glenn Research Visitor Center



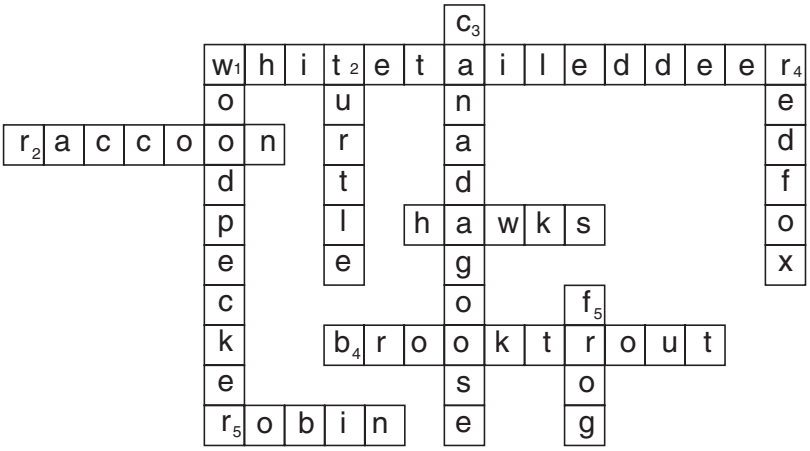
FREE ADMISSION

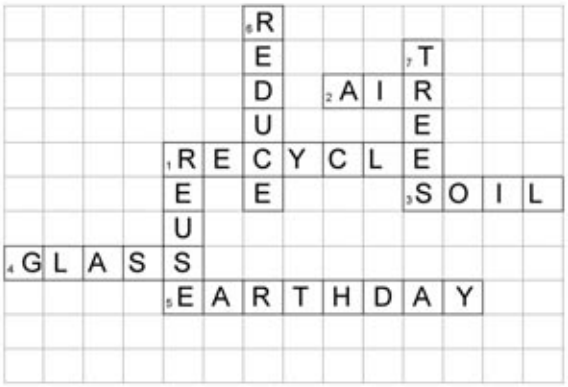
Visitor Center Hours:

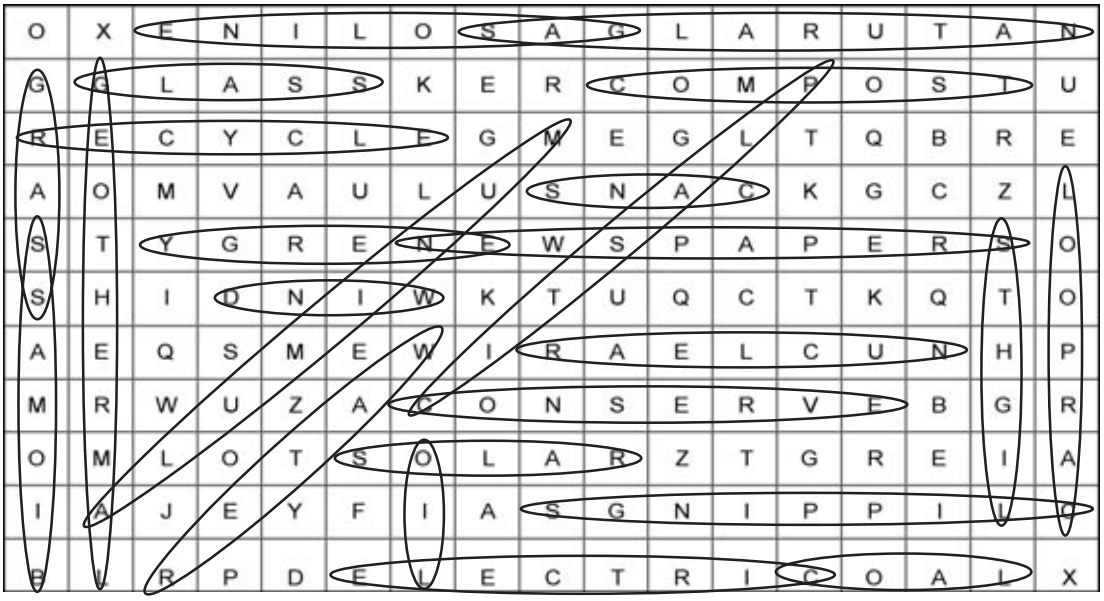
Weekdays	**9:00 a.m. - 4:00 p.m.**
Saturdays	**10:00 a.m. - 3:00 p.m.**
Sundays	**1:00 p.m. - 5:00 p.m.**
Holidays*	**10:00 a.m. - 3:00 p.m.**

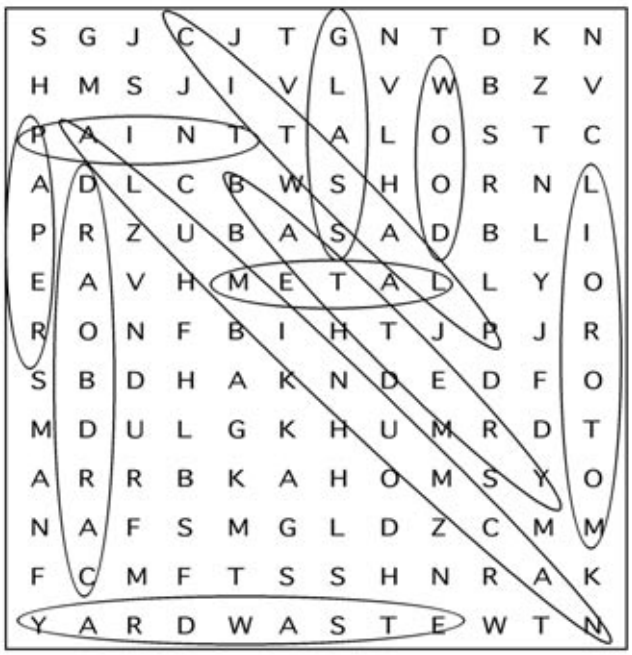
*The Visitor Center is closed on the following major holidays: New Year's Eve, New Year's Day, Easter, Thanksgiving, Christmas Eve, and Christmas Day.

Answers to Puzzles









E	G	O	I	S	U	E	R	O	S	E	B	T	X	E	R
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H	N	D	E	N	G	E	R	G	E	E	A	B	F	H	D	E

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.

Committee Members

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Linda Cognata
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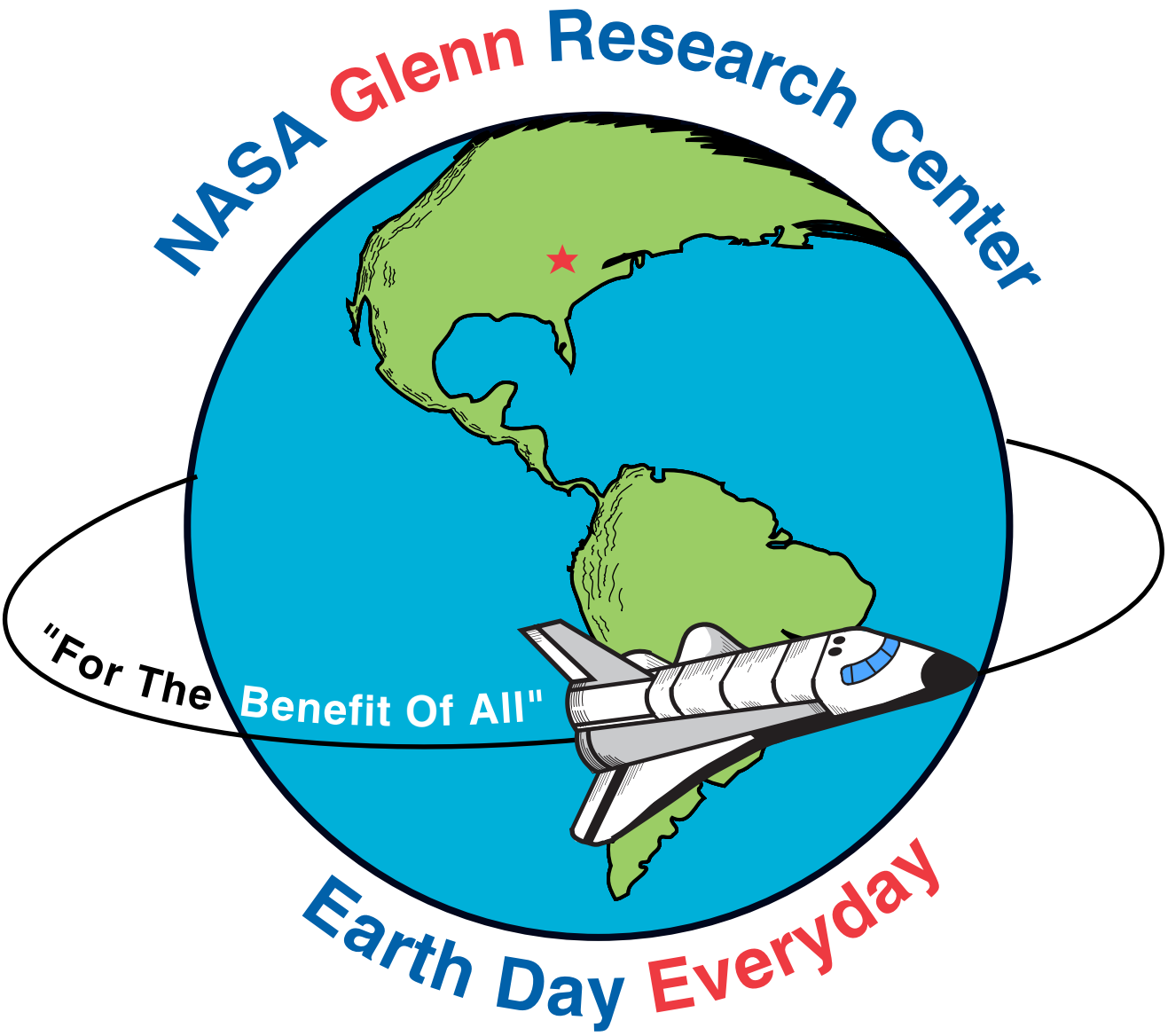

The Earth Day Committee of NASA Glenn Research Center was created in 1993. Its purpose is to help educate and enhance the awareness of Glenn employees and the general public regarding NASA environmental activities, issues, and concerns.

NASA Earth Day Committee:
Dan White, Team lead
Rich Kalynchuk, Co-lead
Michelle Kenzig, Treasurer

Sponsored by
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Michael Blotzer, Chief
NASA Glenn Recycling Coordinator,
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