



THE SCIENCE OF
**Global
Atmospheric
Change**



MR. SLAPTAIL'S CURIOUS CONTRAPTION

By Barbara Tharp, Judith Dresden and Nancy Moreno
Illustrated by T Lewis

BCM
Baylor College of Medicine



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BioEdSM

Teacher Resources from the
Center for Educational Outreach at
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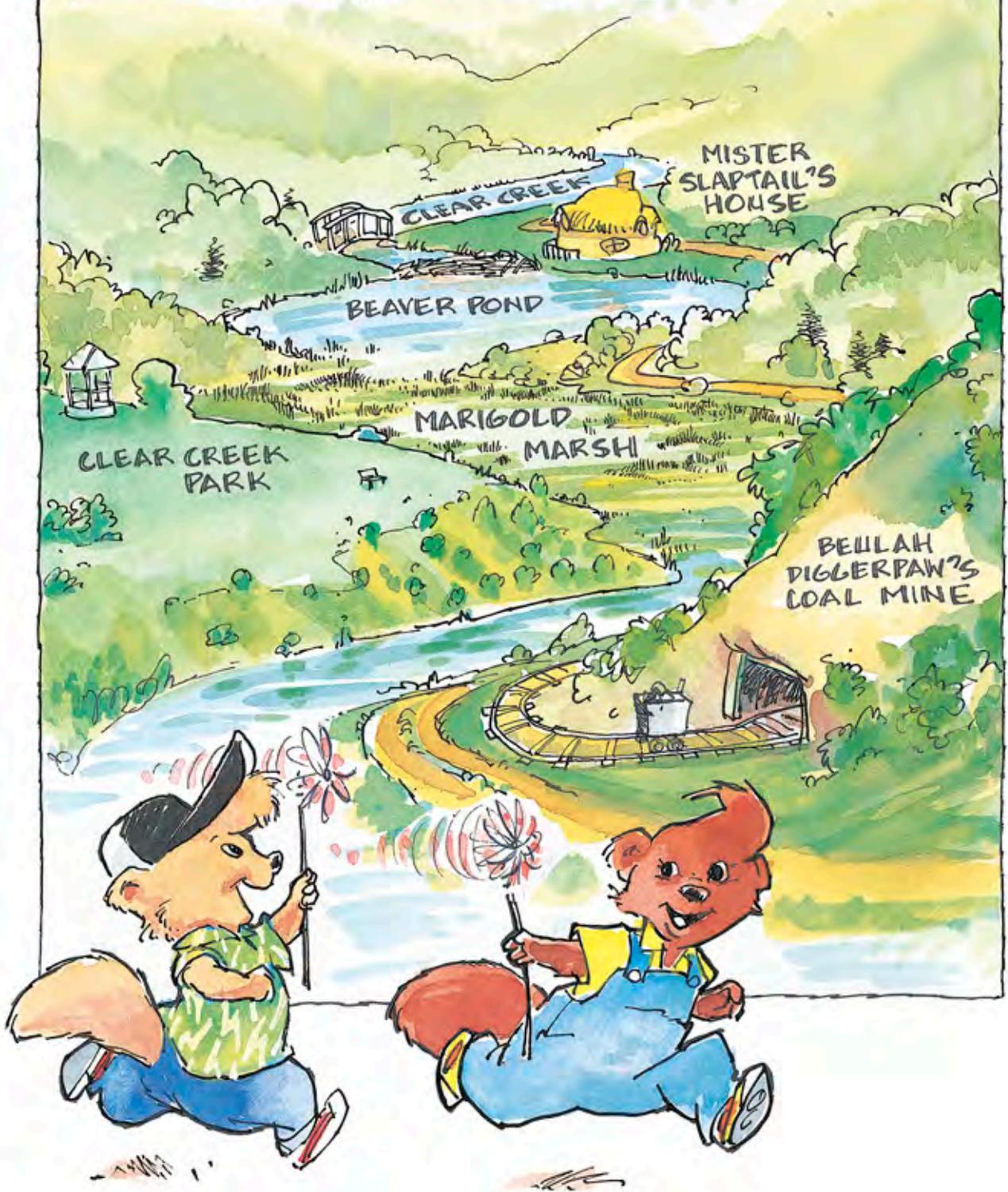


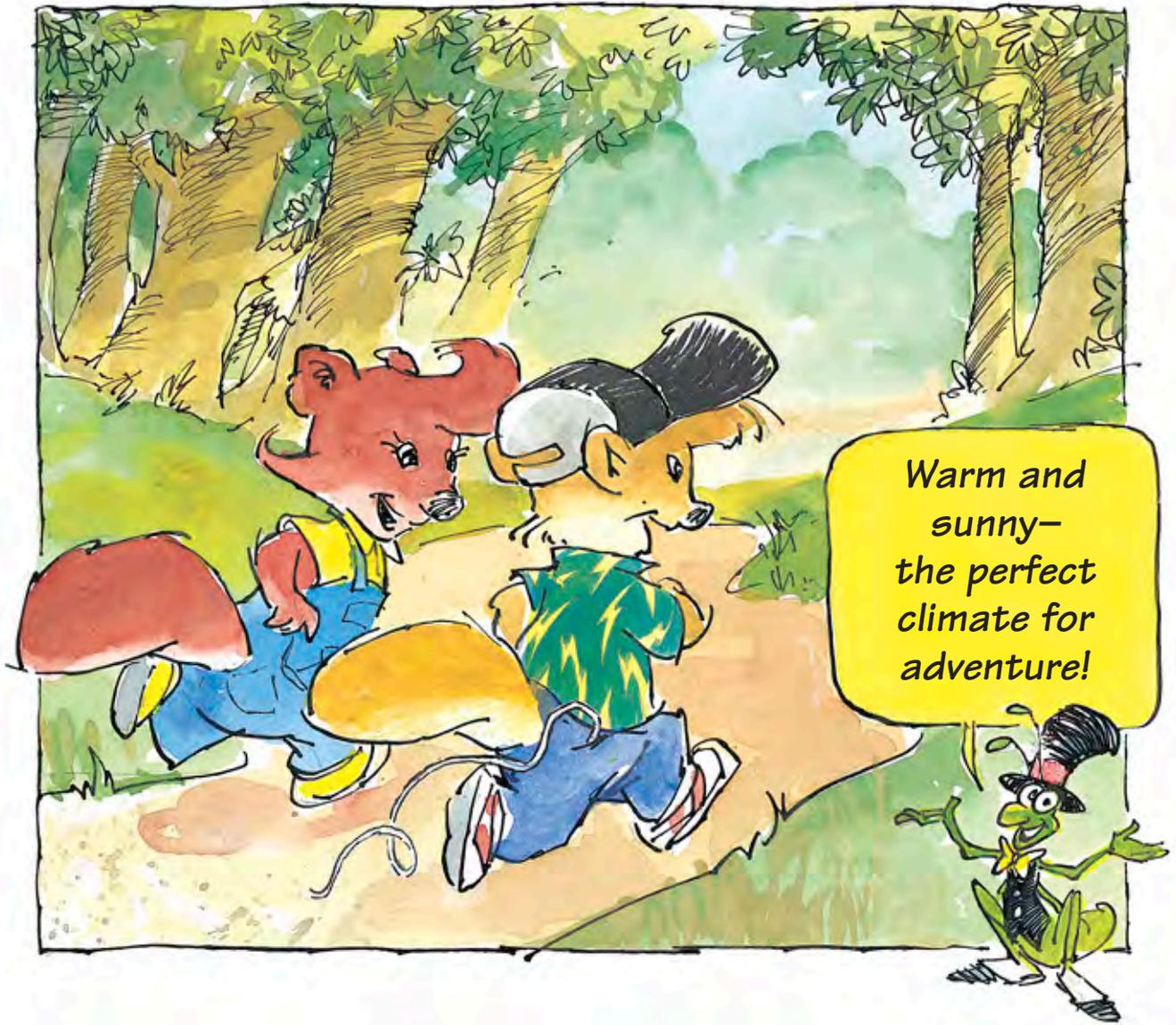
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BRIGHT WATER CORNERS





The Project

“What does Mr. Slaptail want us to do?” Riff called to his cousin, Rosie. They ran together toward her neighbor’s house.

“I don’t know,” Rosie answered. “He just said to come over as soon as we could. He said he needs help with a project.”

“Well, he asked the right kid! I’m Mr. Super-Project!” Riff said.





“Yeah, right—‘Mr. Mess’ is more like it! You’ve always got your pockets full of stuff for making things,” Rosie added, grinning at her cousin. “Look, you’ve got a piece of string hanging out right now!”

Suddenly a loud, banging noise filled the air. “What in the world?!” said Rosie.

Rounding a corner on the sunny dirt road, the two cousins nearly bumped into a small group of their Bright Water Corners neighbors. They were standing in front of Mr. Slaptail’s house. The noise seemed to come from the trees above his house.

“What’s making all that racket?” Riff asked Freda Frog.

Freda chuckled,
“You mean, *Who’s*
making all that racket,
don’t you? It’s just
Castor Slaptail,
building some goofy
contraption on his
roof!”

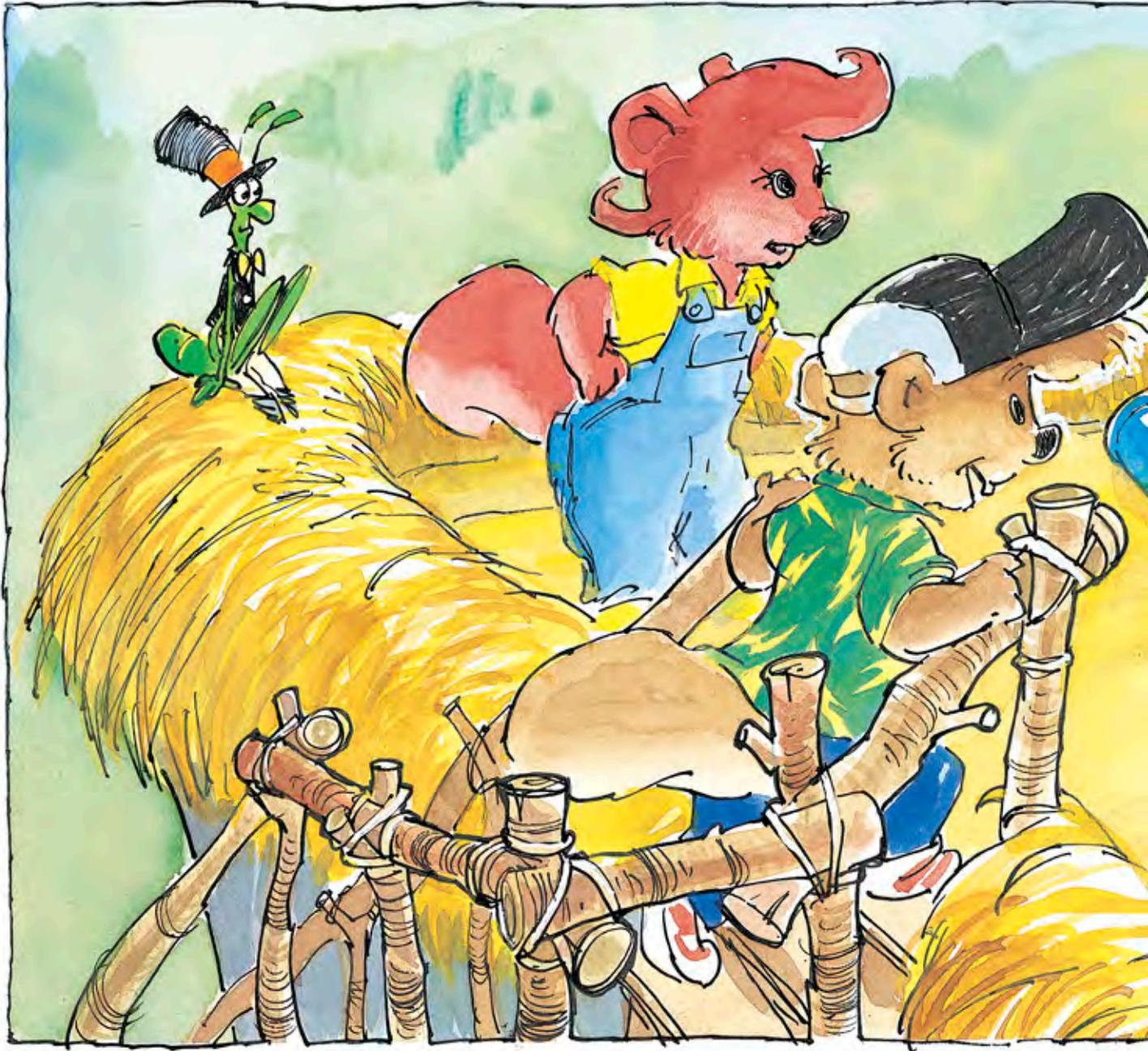
“We were on
our way back from
Beulah’s coal mine with
our fuel,” said Ricardo
Raccoon, “when we
heard all that banging.”

Wally Weasel added,
“—and there was old
Slaptail, crashing and
bashing around up
there! I think he’s lost
his mind for sure!” All
the neighbors laughed.

The noise from
above stopped. Mr.
Slaptail’s face appeared
over the roof’s edge.

“You sound like a
happy group,” he said
brightly. “Ah—Riff!
Rosie! You’re just in
time to give me a hand.
I want to get this done
today. Come on up!”



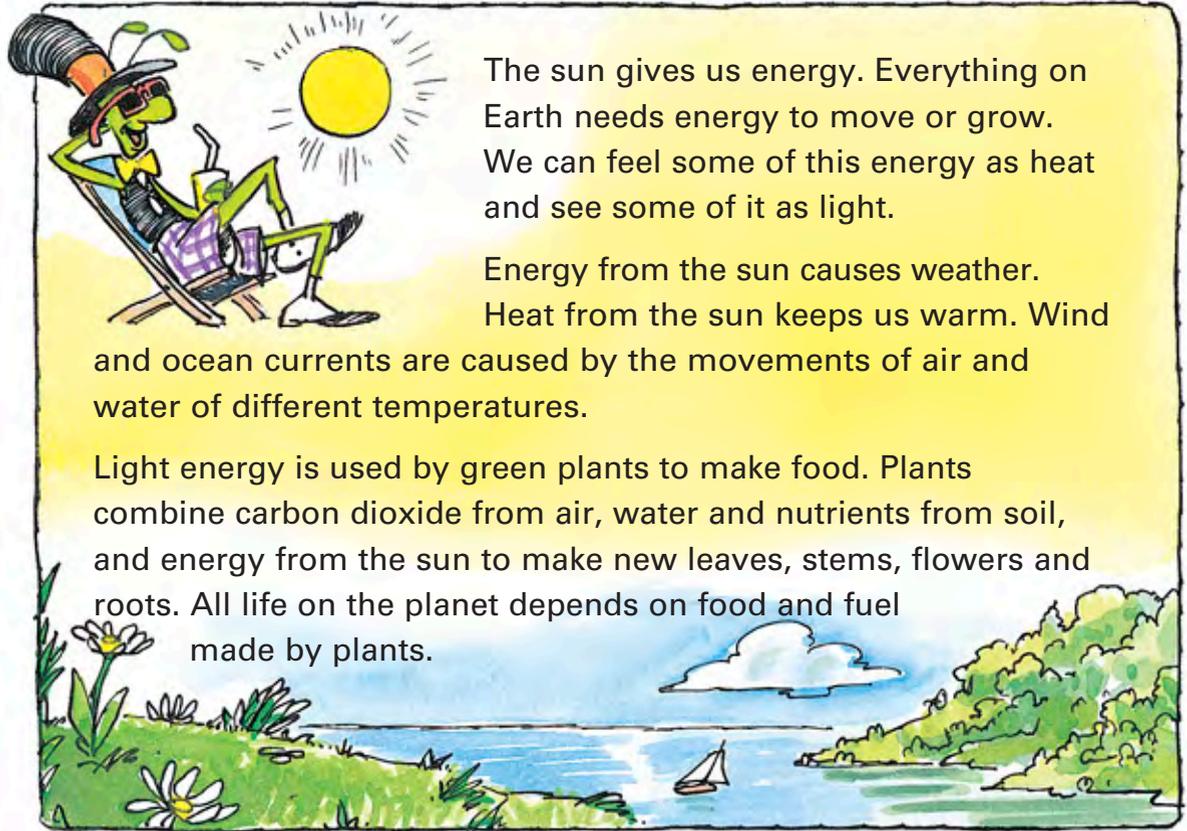


Waving good-bye to the neighbors, the cousins skipped up the stairs to Mr. Slaptail's roof deck. There, they came face to face with . . . *The Contraption*. It looked like an old bathtub turning into a submarine. There were pipes and pieces of metal coming out of it everywhere. "Hey, what are you building?" asked Riff. "It looks cool!"



Mr. Slaptail did not answer. He just went back to his work and said, “Help me with this pipe, will you? I’d like to get out of this sun and take a bath, using my new invention.”

Rosie scratched her head. A bath? With that contraption? On the roof? Maybe the neighbors were right. What was their friend doing now?



The sun gives us energy. Everything on Earth needs energy to move or grow. We can feel some of this energy as heat and see some of it as light.

Energy from the sun causes weather. Heat from the sun keeps us warm. Wind and ocean currents are caused by the movements of air and water of different temperatures.

Light energy is used by green plants to make food. Plants combine carbon dioxide from air, water and nutrients from soil, and energy from the sun to make new leaves, stems, flowers and roots. All life on the planet depends on food and fuel made by plants.

Sun Power

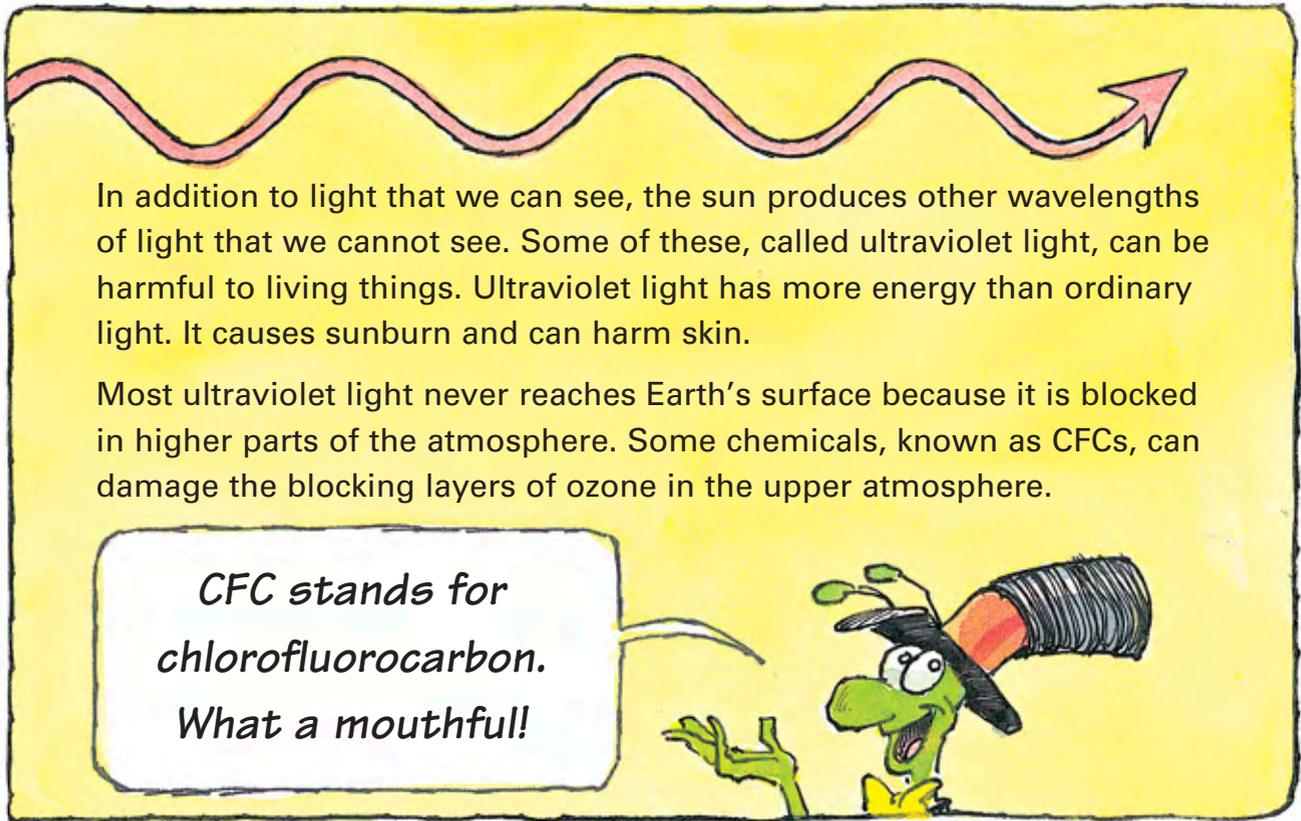
“Mr. Slaptail,” Rosie said, “what on Earth *is* that thing, anyway?”

“You are looking at my new solar water heater!” he said. “You see, I’ll turn on the water. The sun will heat the water in the pipes, and this black lid on the tub will help it stay warm. Then, when I’m ready for my bath, all I have to do is pull the chain, and—whoosh—hot water comes right into my bathtub.”

“How silly!” Rosie said. “Why do you want to take a bath on the roof?”

“Why not?! It sounds like fun!” said Riff. “You can see the trees and the clouds”





Mr. Slaptail laughed. “Take a bath on the roof?! Oh, no! *This* isn’t my bathtub,” he said, still chuckling to himself. “This contraption is my new invention — hot water directly from the sun! With my solar water heater, I won’t have to have a fire to get hot water anymore,” said Mr. Slaptail, “— but my *bathtub* is down in the house.”

“Rats!” said Riff. “It would be great to take a bath up here!”

“The neighbors were right. I think you’re *both* crazy!” Rosie said.

“Crazy?” Mr. Slaptail said. “Just wait ’til you see how it works! But right now, we all could use a cool drink. Let’s get out of this sun for a while.”

“Yeah, this is the worst time of day to be out in the sun,” Riff said. They all headed down the stairs and into the house.



“Whew! Feel how warm it is where the sun comes in these windows,” Rosie said.

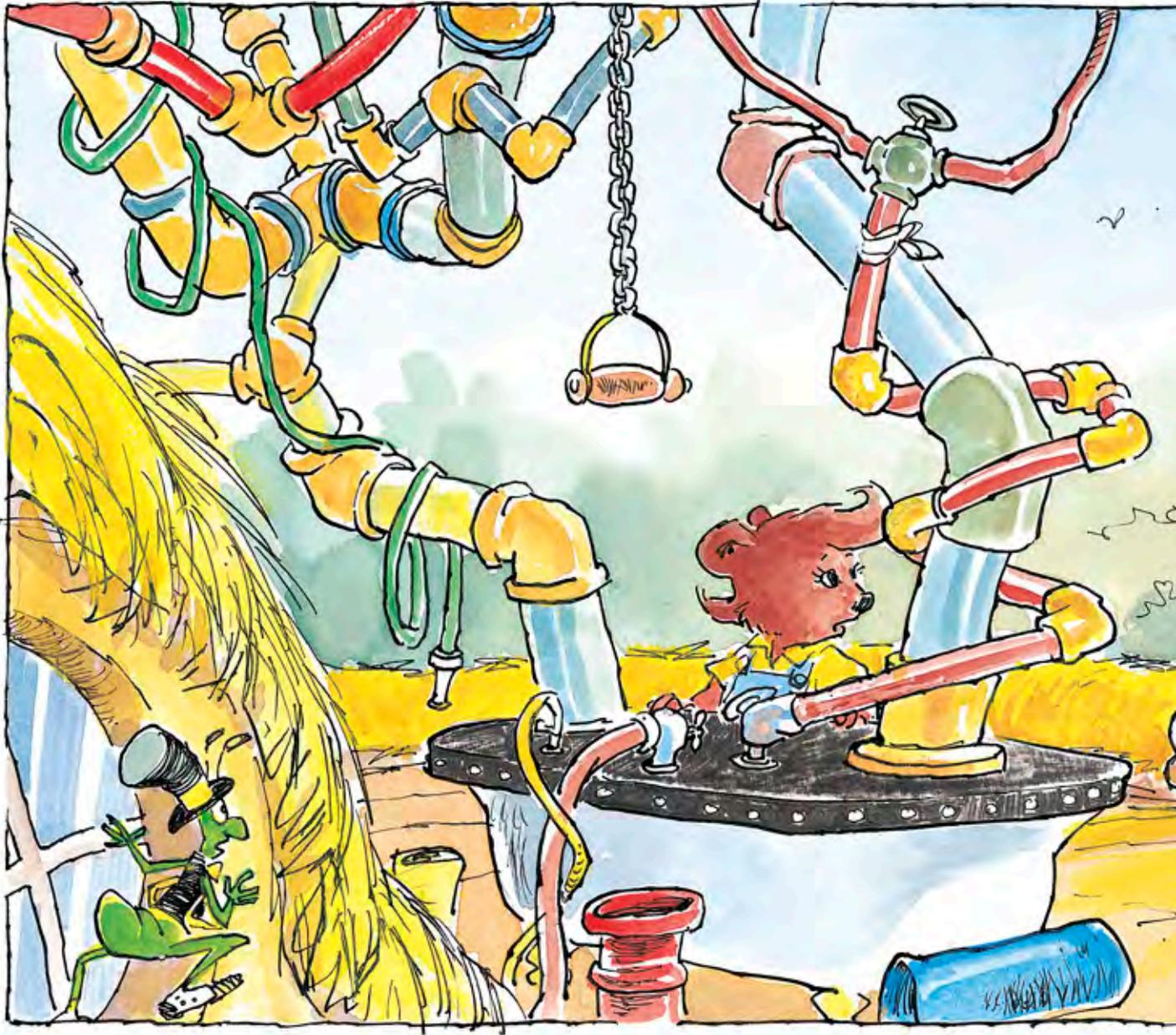
“Yes, but it’s great in our climate,” Mr. Slaptail replied. “It’s almost like having a greenhouse. I can grow lemons right here in the house during our cold winters.”

“Wow! You mean you grew the lemons for this lemonade yourself?” Riff said.

“Right you are,” Mr. Slaptail answered. “Now, drink up and let’s get back to work. Once I get the drain pipe on, we can try it out!”

Sunlight comes through the windows and warms the air. The same thing happens on our planet. Some gases in the atmosphere help keep the Earth’s surface warm, just like Mr. Slaptail’s windows do in his house. Carbon dioxide is one of the heat-trapping gases.





KABOOM!

Riff finished his second glass of lemonade and followed Mr. Slaptail and Rosie back to the roof.

“We have to stick this end of the pipe into that hole. Rosie, you set it over the hole. I’ll push and, Riff, you hold it right there,” Mr. Slaptail explained.



They worked together for a few minutes, pushing and tugging until the pipe was in place. Mr. Slaptail tightened screws and turned on the water.

The job was done! They stood back to admire Mr. Slaptail's curious contraption, when—suddenly, there was a loud BOOM!

Their heads snapped up. Riff yelled, “Look at that smoke over there! There’s a fire at the park—a big one!”

“No, it’s farther away than that,” Rosie yelled. “And look at the smoke. It’s as black as coal!”

“Coal . . . That must be it!” Mr. Slaptail said. “The mine must have exploded at Beulah Diggerpaw’s coal yard and started a fire!”

Off to the Coal Mine

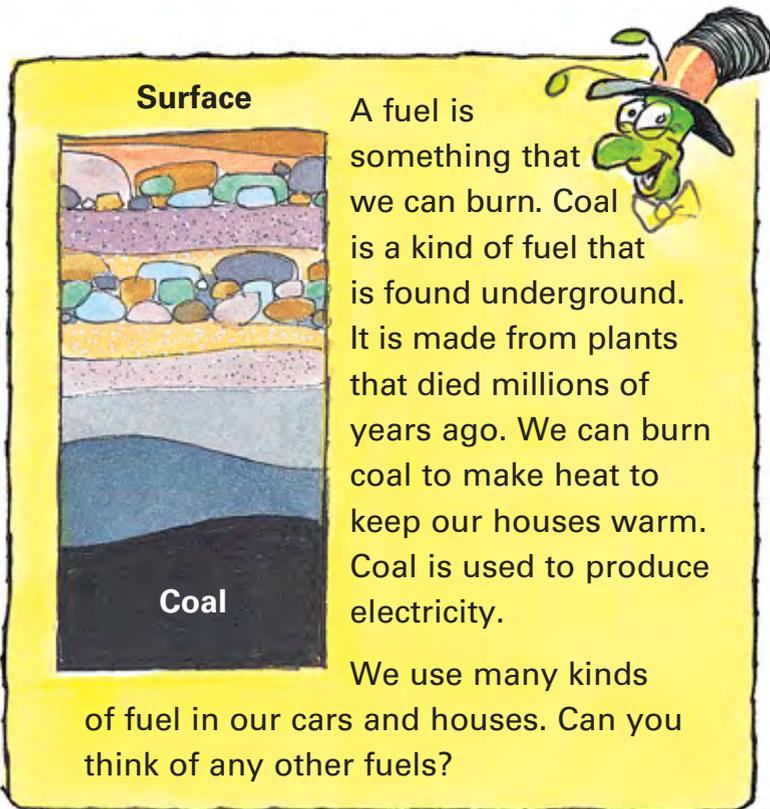
Mr. Slaptail hurried down the stairs again, followed by Rosie and Riff. “I’ve got to get over there!” Mr. Slaptail cried. “Got to see what happened—see if Beulah’s all right”

They ran down the road toward the rising smoke. Soon they met Mr. Blackduck, pushing his wheelbarrow. “What do you suppose that smoke is?” he said. “Do you think it’s the coal mine?”

“I’m afraid so!” said Mr. Slaptail. “Come on—we have to hurry!”

Riff and Rosie ran ahead. Mr. Slaptail and Mr. Blackduck puffed along behind them. All of a sudden, a loud horn startled them onto the side of the road.

“Hoo-hah! Slaptail! Where are you going in such a hurry?” said a voice from an old truck. It was their friend, Oscar Otterbee. He





said, “Need a ride? I’m on my way to pick up some coal. All aboard for Beulah Diggerpaw’s Coal Company!”

“Otterbee, look up! Don’t you see all that black smoke in the sky?” Mr. Slaptail said. “There’s a fire! We think it’s at the mine. Come on, let’s hurry!”

Mr. Slaptail, Mr. Blackduck, Rosie and Riff all leaped into the truck, and off they went. On the way they met other neighbors. They piled into the back of the truck, too.



Wow! Did you know that burning is a chemical reaction?

When wood or a fossil fuel burns, it uses oxygen.

Carbon dioxide and water vapor usually are produced at the same time. When a fuel doesn't burn completely, it can make black smoke or soot.

Soon they arrived at the yard in front of the coal mine. "That smoke is coming from the main entrance to the mine!" Rosie yelled.

"Yes, and the main shaft is blocked," shouted someone who was covered in black coal dust. "There was an explosion! Jake and



I got out just before it caved in. Ms. Diggerpaw's still in there!"

"Oh, no!" all the neighbors cried. "We've got to get her out! How can we get to her? What can we do?"

"There's an old entrance on the other side of the mine. It hasn't been used for years, but maybe we could get in that way," Mr. Slaptail said. He took off in a hurry. Rosie and Riff were right behind him.

"There it is—the old east shaft entrance," said Mr. Slaptail. "It's all boarded up! Let's try to get it open."

Riff tore off a piece of board. Soon they uncovered a small opening.

"Beulah . . ." Mr. Slaptail called. There was no answer—only a spooky silence. They all called Ms. Diggerpaw's name, but still there was no answer.



To the Rescue

“Help me with these boards,” Mr. Slaptail said. “We need to make a bigger hole so I can get in.”

Riff grabbed a board next to the hole. Instead of pulling it, he jumped forward and squeezed into the tiny opening. Before they knew it, he was gone. Only the string coming out of his pocket could be seen, caught on a rusty nail.

“I’ll go look for her!” Riff yelled back to his friends. They could barely hear his voice in the echoing tunnel—“Miiiiz Diggerpawww . . .” And then it was quiet.

Rosie and Mr. Slaptail called, “Riff, come back. Don’t go in there alone!”

It was too late. Riff was gone. They tried to move another board from the hole, but they couldn’t get it loose.

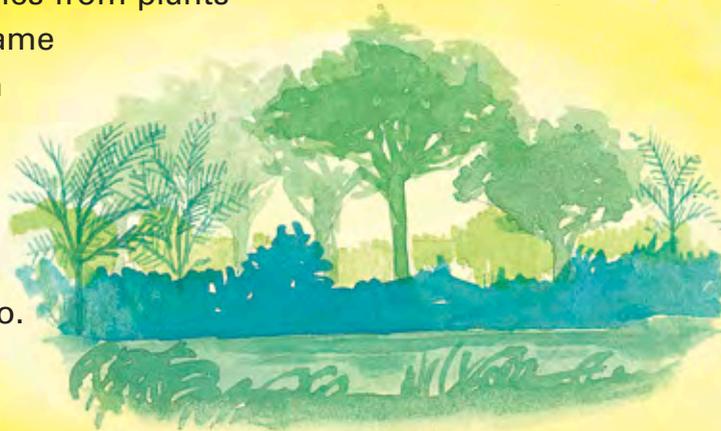
Some neighbors finally joined them and, together, they cleared away the entrance to the tunnel. They all rushed inside.



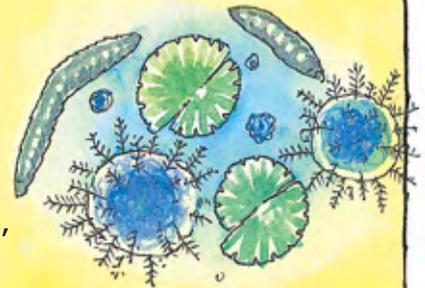
Almost all the fuels we use come from plants. Wood comes from the trunks and branches of trees. Oil, gas and coal come from plants that died millions of years ago. These fuels are called fossil fuels.



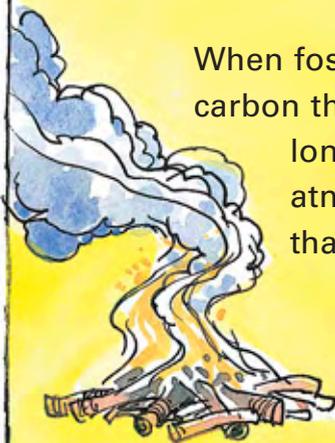
Coal comes from plants that became buried in swamps around 300 million years ago.



Oil and natural gas come from tiny living things that were buried on the ocean floor between 30 and 180 million years ago. The gasoline we use for cars is made from oil.



When fossil fuels or wood are burned, carbon that was trapped in plants a long, long time ago goes back again into the atmosphere as carbon dioxide. Some scientists think that this may lead to warmer temperatures on Earth.



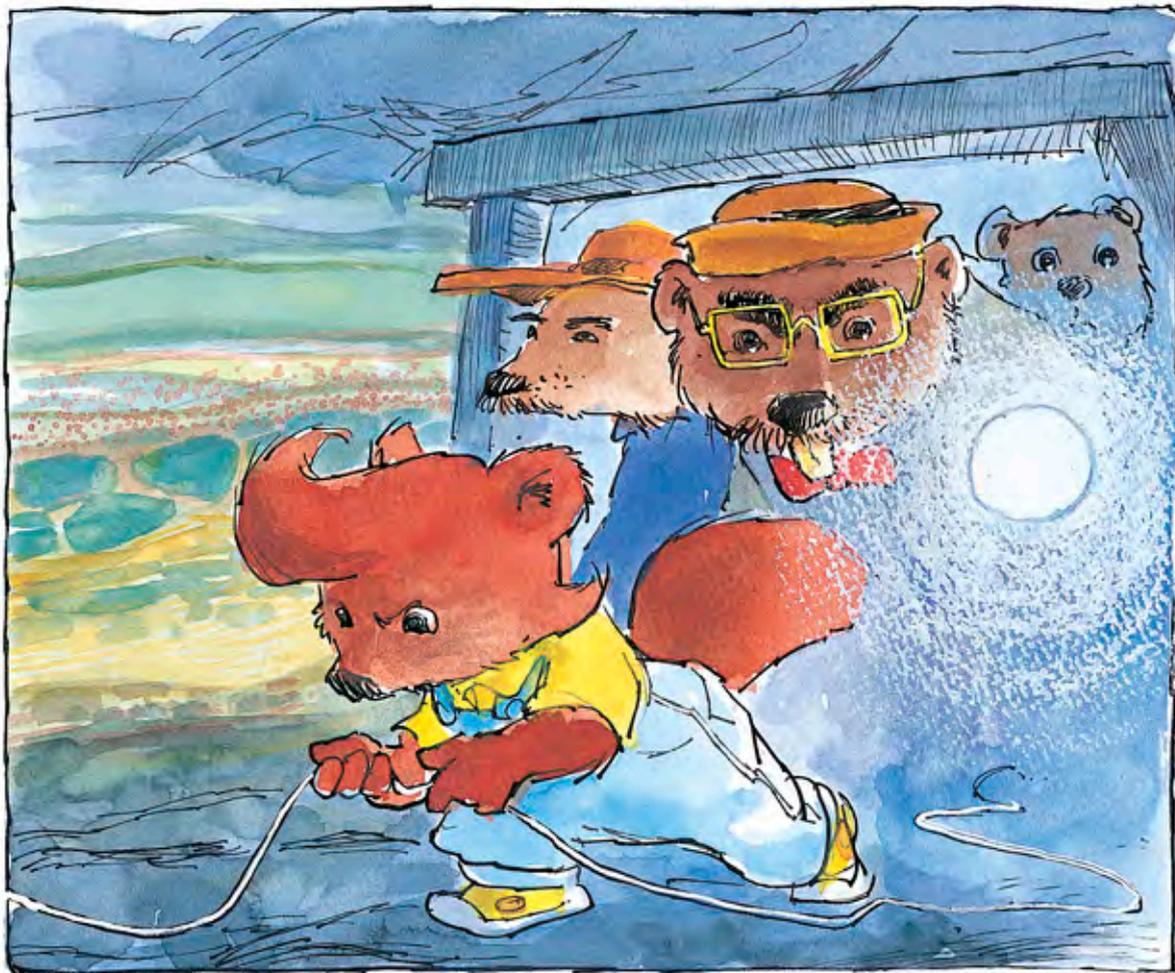
It's important for us to keep planting new plants, because they use carbon dioxide that's in the air.

Mr. Slaptail's flashlight showed the path splitting in three different directions. Everyone stopped. "Which way did he go?" they asked each other.

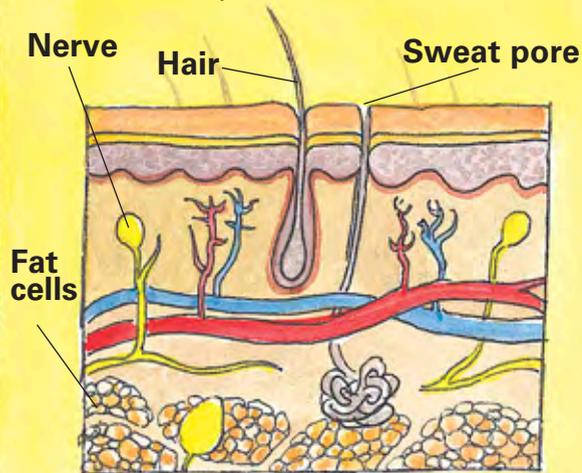
"This way!" said Rosie. She picked up a piece of string, still attached to the nail back at the entrance. "This must be the ball of string in Riff's pocket!" she said.

She led the others down the narrow path, following the string until it ended. With only a tiny light to show the way, the group inched forward.

"Rosie . . . Mr. Slaptail . . ." They heard Riff's voice at last. "Help . . . ," he hollered, "I found her!"



Look at all the dirt and soot on everyone! It's a good thing that skin keeps all that from getting inside our bodies.



Skin is a lot more complicated than you might think. It is made of layers of cells. The ones on top are dead. As dead cells fall off, new ones are made to replace them.

Don't forget to protect your skin. It's important!



Everyone rushed ahead until they found Riff helping Ms. Diggerpaw crawl through the tunnel toward them. They were covered with coal dust, and they both coughed as they crept along. No one spoke, but Mr. Slaptail and Mr. Otterbee quickly grabbed Ms. Diggerpaw and carried her out of the dark tunnel.

“Riff, are you all right?” Rosie asked anxiously.

“I’m okay,” he replied, “but let’s just get out of here, quick!” Rosie took Riff by the hand, as they joined the others leaving the mine shaft.



Ms. Diggerpaw's Decision

Beulah Diggerpaw sat on the ground, coughing and brushing off coal dust. Everyone circled around her.

“Thank goodness, you’re all right!” Mr. Slaptail said. He gave her his handkerchief to wipe her face.

“I’m okay, I think,” Ms. Diggerpaw sputtered, “—but I’m not going back into that mine, ever again!”

“What?!” said Mr. Slaptail.
“What do you mean?”

“I mean I’m going to shut down the mine,” Beulah said sadly.

All the neighbors looked at each other. “But what will we do for fuel?” they said. “We have to have coal for heat and for cooking!”

“Even the electric plant runs on coal,” said Mr. Otterbee.
“You can’t shut down the mine!”

“Yes, I can—and I will! I’m not going in again! It’s all caved in, and it’s too dangerous!”
Ms. Diggerpaw said. “Anyway, almost all the coal in the mine is used up. I would have *had* to close down before long.”



Rosie’s Idea

“But Bright Water Corners has to have fuel!” Mr. Blackduck insisted.
“Where will we get it?”

“We’ll just have to go over to Carbon Mountain. They have plenty of coal,” said Ms. Diggerpaw.

“Oh, no—that’s much too far! Oh, what will we do?” all the neighbors cried.

“We could use wood again,” Mrs. Pondslider suggested.

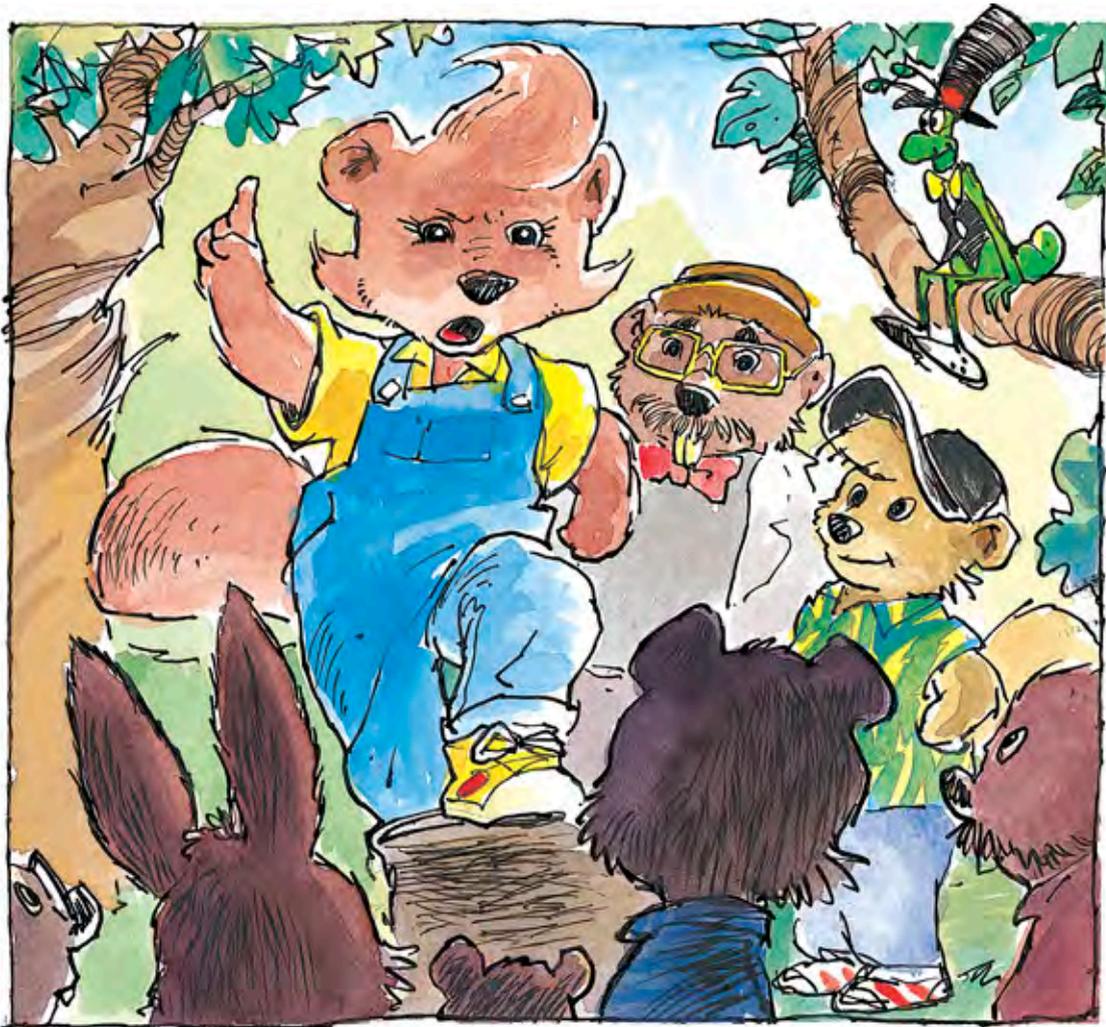
“Yes, but we don’t want to do that,” Mr. Otterbee said. “We need to *keep* our trees.”

“Oh, my, yes! What would we do for food and shelter without our forest?” Dolores Deer agreed.

Rosie jumped up on a tree stump and said, “Wait! Maybe there’s another way.” Everyone stopped talking and looked at her.

“Mr. Slaptail invented a solar heater to use instead of burning coal to heat his water. Why couldn’t *everybody* use power from the sun?” Rosie said.

“Solar heater?!” the neighbors cried. “*What* is that? What crazy thing are you doing now, Slaptail? You don’t really think it will work, do you? That’s nonsense,” they said.



“No, it isn’t,” Riff said. “It’s really going to work! It’s making hot water for Mr. Slaptail’s bath right now.”

“Come on! We’ll show you,” Rosie added.

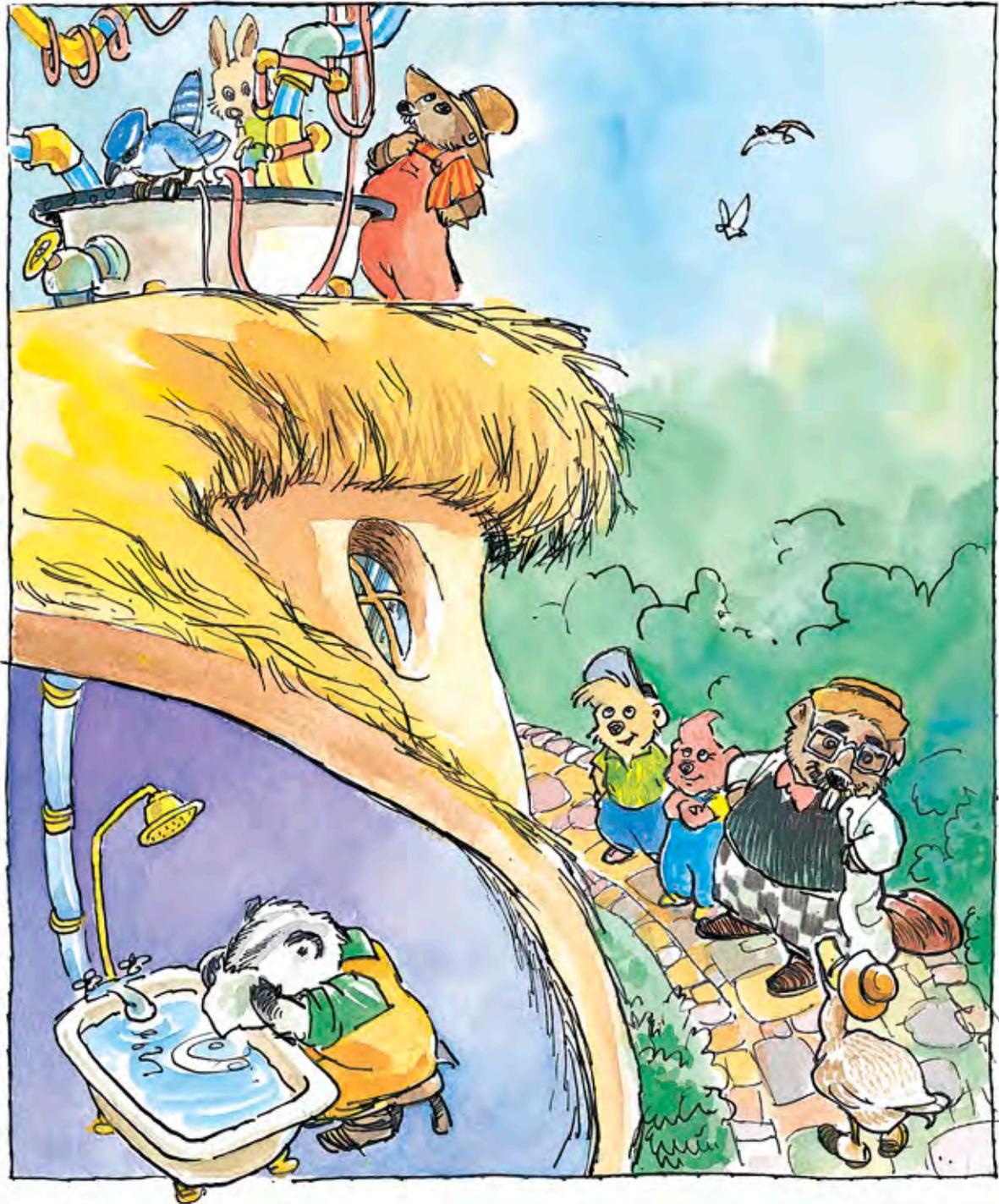
“Beulah, come over to my house. Let’s get you cleaned up!” Mr. Slaptail said, and he helped Ms. Diggerpaw into the truck. Others piled in too, mumbling all the way about Mr. Slaptail’s crazy ideas.



Only the Beginning

“Ooh, this feels good!” Ms. Diggerpaw said, as she splashed her face and arms with water from the bathtub in Mr. Slaptail’s house. “Rosie’s right—the water is nice and warm. You say the water heater is on the roof?”

Mr. Slaptail took his friends outside to see his new solar-powered water heater. One by one, they climbed up the steps to look it over. They left a trail of messy, black fingerprints along the way.



When they came back inside, Mr. Otterbee said, “Move over, Ms. Diggerpaw. Let me see what that water feels like. Hoo-hah . . .” He jumped right in!

Soon all the neighbors were splashing and cleaning their sooty faces in Mr. Slaptail’s warm water.

“Do you suppose we all could use this solar power?” Mrs. Pondslider said. “My children need lots of baths.”



“It’s all very well to have hot water,” said Ricardo Raccoon, “but what about cooking and heat—and power for electricity?”

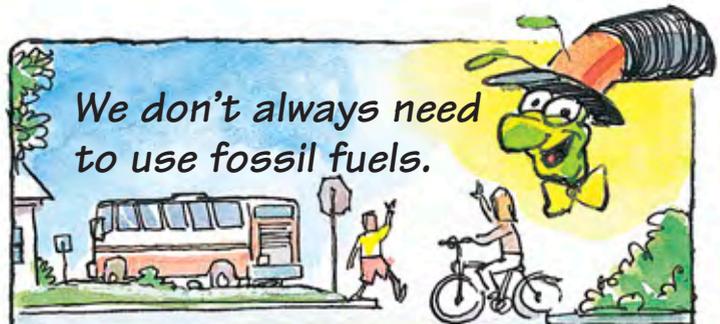
“My solar water heater is only the beginning,” Mr. Slaptail answered. “There are lots of other ways to get energy for all those things!”

“How about using the wind, like my Grandpa used to do with his windmill?” said Mr. Blackduck.

“And how about using the water wheel by the old mill again?” Rosie added.

Sully Salamander said, “If more folks would ride bikes instead of in cars, we wouldn’t *use* as much energy.”

Everyone seemed to have an idea. “Wow!” Riff said. “You won’t even *need* coal. Bright Water Corners is going to be super-energy city!”



We don't always need to use fossil fuels.

We can save fuels by riding a bicycle, walking, taking a bus or sharing rides.



We can use the power of water to make electricity. We can trap energy from the sun like Mr. Slaptail did.



We can use the wind to turn windmills to pump water or make electricity.



We can build houses that are easy to heat and cool.

Even though we usually use them for burning, fossil fuels have many important uses. Did you know that plastics, asphalt for roads and some medicines come from fossil fuels?



We can protect the atmosphere and ourselves!

Ride a bike, walk or share rides. It saves fuel and keeps the air clean.

Energy from the sun can be used for heat.

Water power doesn't add greenhouse gases to the atmosphere!



We can wear clothing that helps us stay warm or cool AND protects us from the sun.

Did you know that wind comes from air heated by the sun?

Saving energy helps everyone.

We all depend on the atmosphere. It protects us from damaging rays from the sun. It gives us air to breathe and keeps us warm. Everyone needs to take care of the atmosphere.



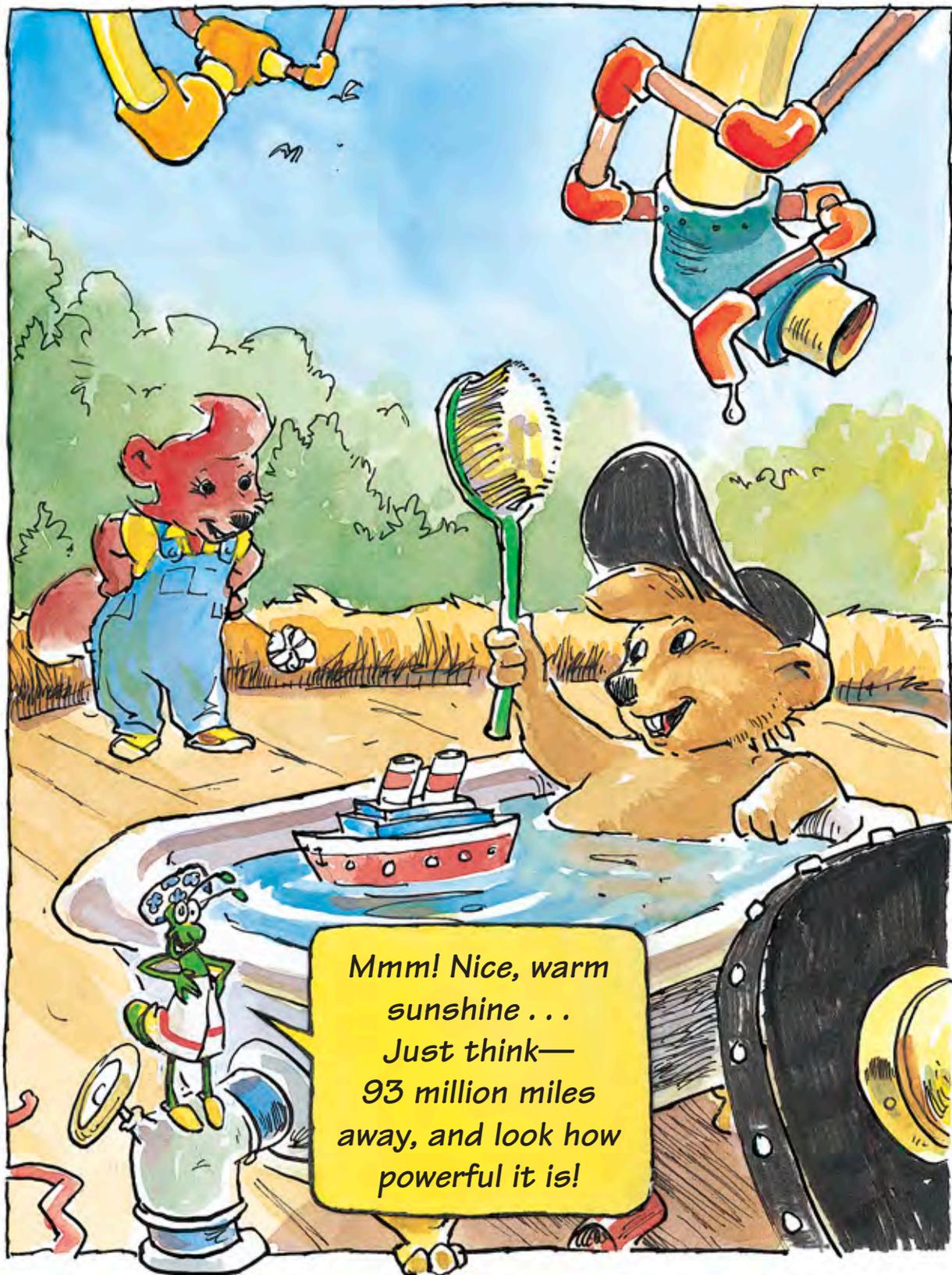
Up on the Roof

“Riff, are you up there? Look at the pinwheel I made!” Rosie called. “It works just like the new windmill!”

Climbing up the steps to Mr. Slaptail’s roof, Rosie held her pinwheel up in the air. The breeze made it spin so fast she could only see a blur.

Then she saw her cousin. “Riff, what are you doing?!” she said.

“Don’t tell Mr. Slaptail, but *I* still like the idea of taking *my* bath on the roof!” said Riff, looking up at the trees and the clear blue sky.



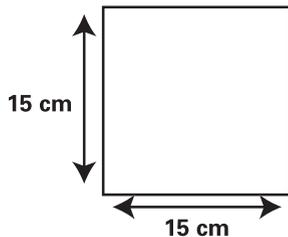
Mmm! Nice, warm
sunshine . . .
Just think—
93 million miles
away, and look how
powerful it is!

How to Make a Paper Pinwheel

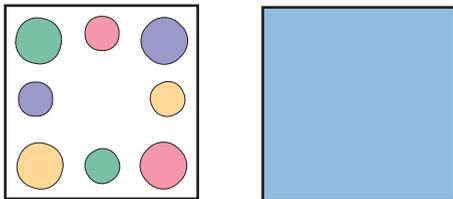
Materials: Square of paper (about 10 to 15 cm), colored markers, crayons or decorative stickers, pencil with full eraser, ruler, scissors, straight pin.

Procedure

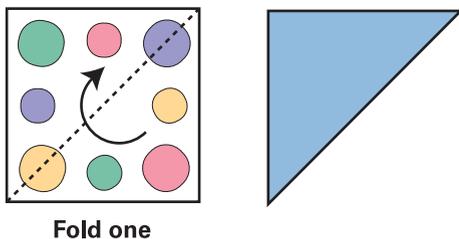
1. Start with a square piece of paper.



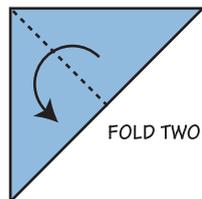
2. Decorate both sides of the sheet of paper.



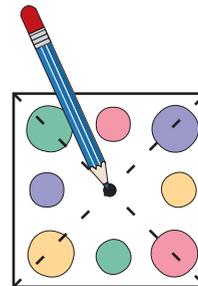
3. Fold the square in half to make a triangle.



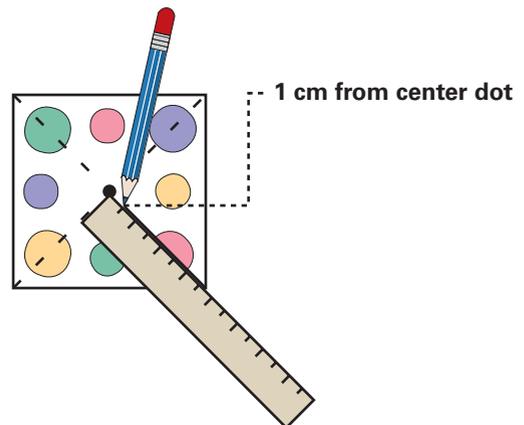
4. Fold the triangle in half, making a smaller triangle.



5. Now, unfold the paper. With your pencil, put a dot in the center of the square, where the four fold lines meet.

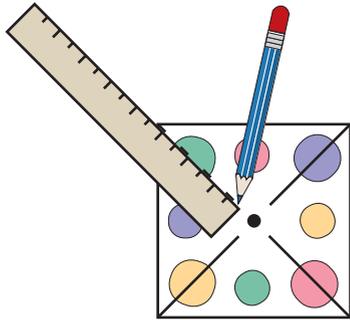


6. Lay your ruler on the paper, from the dot along one of the folds to the corner.

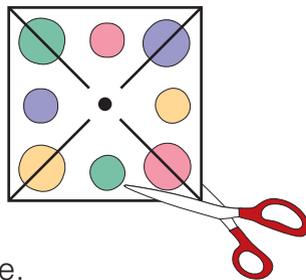


Starting 1 cm away from the dot, draw a line from there to the end of the point at the corner.

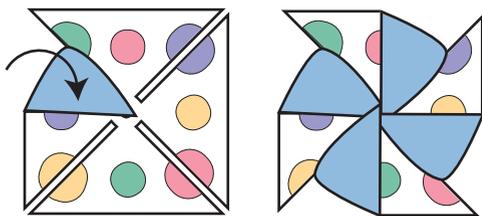
7. Draw a line to each of the other three corners, starting 1 cm from the center.



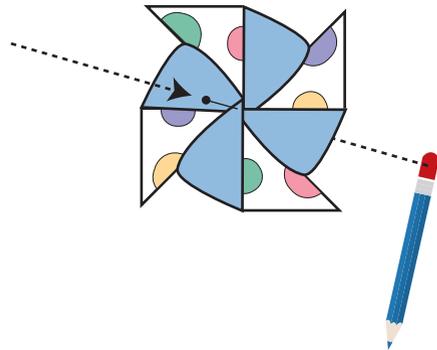
8. Cut on the lines you have drawn. Be sure to stop cutting before you reach the end of each line.



9. Fold every other point in toward the center, over the center dot. The points should reach a little beyond the dot.

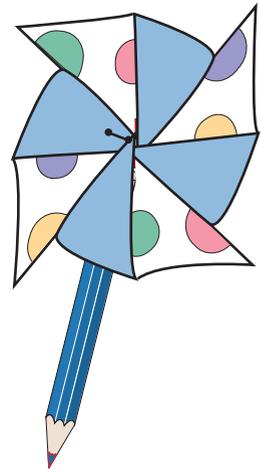


10. With four points folded down over the center, push a straight pin through the center of the paper and all four points. Once the straight pin is all the way through the paper, push the pin into the eraser on your pencil. Do not push the straight pin all the way through the eraser.



11. Smooth out the creased edges a little, to open and puff out your wheel.

You have made a pinwheel!
Wave it in the air or blow on it to make it go around.



I wonder? What kind of power makes this wheel go around? What real-life machines work the same way?

Glossary

asphalt (*AS-falt*) — A black, gooey substance used for roofs and for paving roads and school yards. The materials needed to make asphalt come from coal or oil.

atmosphere (*AT-muh-sfeer*) — The thin layer of air that surrounds the Earth.

carbon (*KAHR-buhn*) — An element found in all living things and also in coal, charcoal and oil. Carbon is in some gases, like carbon dioxide.

carbon dioxide (*KAHR-buhn dy-AHK-syd*) — A gas made up of carbon and oxygen. You cannot see or smell it. It is given off when living things breathe and when things burn or decay. It is used by plants to make food.

cell (*SEL*) — The smallest unit of all living things.

CFC (stands for **chlorofluorocarbon**) (*KLOR-ob-FLOR-ob-KAHR-buhn*) — Chemicals (containing carbon, chlorine and fluorine) used in refrigerators, some aerosol spray cans and foam plastics. When released into the atmosphere, CFCs slowly rise upward and eventually damage layers of ozone that block dangerous radiation from the sun.

chemical reaction (*KEM-ih-kuhl ree-AK-shun*) — When two or more materials combine to create new products.

climate (*KLY-mit*) — The kind of weather a place usually has.

coal (*KOHL*) — A natural, black, solid substance that is formed from partially decayed plant matter buried in swamps long ago. Coal consists mainly of carbon.

current (*KUR-uhnt*) — A flow of water, air or electricity that goes more or less in a definite direction, such as a **wind current** or an **ocean current**.

electricity (*ee-lehk-TRIHS-uh-tee*) — A kind of power that can be used to produce light, heat and motion. Electricity used in buildings is made by generators that change water power or heat from burning fuels into energy that travels along wires.

energy (*EHN-uh-ree*) — Power that can be used to move or lift something, or to make something warmer or cooler.

fossil fuels (*FAHS-uhl FYOO-uhlz*) — Fuels like coal, oil and natural gas that were formed from the remains of living things buried millions of years ago.

fuel (*FYOO-uhl*) — Anything that produces energy as heat when it is burned.



gas (*GAS*) — A substance that is not a solid or a liquid. The atmosphere of the Earth is made up of gases.

greenhouse (*GREEN-hows*) — A room or building made of glass that uses heat from sunlight to provide a warm environment for growing plants.

natural gas (*NACH-uh-ruhl GAS*) — Gas formed in the Earth and often used for fuel.

oil (*OYL*) — A greasy liquid that comes from plants, animals or minerals. Oils usually can burn easily, and they often are used for fuel.

oxygen (*AHK-sih-juh-n*) — An invisible, odorless gas that is needed by almost all living things. Oxygen combines with hydrogen to form water. Oxygen also is needed to make things burn.

ozone (*OH-zone*) — Gas made of oxygen. In the upper atmosphere, ozone blocks harmful rays from the sun. Near the ground, ozone is a pollutant that can hurt eyes and lungs and harm plants.

plastic (*PLAS-tihk*) — Material made from chemicals, that can be shaped or molded into many different forms. The building blocks for most of the plastics that we use come from fossil fuels.

smoke (*SMOHK*) — The cloud-like mass of fine carbon particles rising from burning coal, wood, etc.

solar (*SOH-luhr*) — Having to do with or coming from the sun; **solar power** — Energy that comes directly from the sun.

soot (*SUT*) — Fine, black powder often produced when something burns.

ultraviolet light (*UHL-truh-VI-uh-luht*) — Kind of light with waves that have slightly more energy and shorter wavelengths than light that you can see. Though we can't see it, ultraviolet light can cause sunburn and other damage to skin.

water vapor (*WAH-tuhr vay-puhr*) — Tiny drops of water floating in the air as mist, fog or steam.

wavelength (*WAYV-length*) — The distance between the peaks of a wave.

windmill (*WIHND-mihl*) — A machine that gets its power when a set of blades is turned by the wind. Windmills can be used to grind things, pump water or produce electricity.

The authors of this story are Barbara Tharp, Judith Dresden and Nancy Moreno. Ms. Tharp and Dr. Moreno are members of the Center for Educational Outreach (CEO) at Baylor College of Medicine (BCM) in Houston, Texas. Ms. Dresden was a team member in the CEO while this story was being developed. The team worked together for several years on science education projects involving teachers and students from kindergarten through college and graduate school.

- **Barbara Tharp, M.S.**, originally from California and Oklahoma, once worked for the FBI in Washington, D.C., and later was an economic analyst for an oil company. More recently, she has followed her primary interest of working with children, serving as an elementary school teacher and specializing in her favorite subjects, science and math. Currently, she serves as a full-time faculty member at BCM. In addition to creating instructional materials, she directs science and math teacher enhancement programs with classroom teachers from Houston and throughout the U.S.
- **Judith Dresden, M.S.**, originally from New York and New England, formerly conducted educational research and evaluation for public and private schools, specializing in language arts. Editorial work with a publishing company also led to her interest in writing and editing stories and science activities for young students. As a BCM faculty member, she served as director of the BrainLink project, which brings the complex concepts of neuroscience within the grasp of children. Other activities involved promoting minority student access to careers in science and the health sciences.
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The illustrator, T Lewis, was born in Texas but has traveled extensively, living in such exotic locales as Africa, Switzerland and Alaska, and now makes his home in Washington State. His illustrations were first used in the CEO educational storybook, *Skullduggery*, as part of the BrainLink project. In all, Lewis illustrated 10 storybooks for the CEO, including *Trouble at Tsavo*, *The Cookie Crumbles*, *Danger at Rocky River*, *Mr. Slaptail's Secret*, *Mystery of the Muddled Marsh*, *Mr. Slaptail's Curious Contraption*, *The Mysterious Marching Vegetables*, *Tillena Lou's Day in the Sun* and *Tillena Lou's Big Adventure*.

Lewis co-authors and illustrates the nationally syndicated comic strip, "Over the Hedge," which served as the basis for several books, a video game and the 2006 DreamWorks SKG movie, "Over the Hedge." While his broad range of professional artwork has appeared in many formats, he is especially fond of creating illustrations for children and has illustrated more than 20 storybooks. In 1999, he won the National Cartoonists Society Rueben Award for book illustration.



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