

# LEARN HOW WIND IS CREATED WITH THE PIE-PLATE WIND MAKER.

## ! SAFETY FIRST !

Ask an adult to help you when using matches and candle flames. Use caution when handling lit matches. Make sure that each match flame is completely out and that the tip has stopped glowing and smoking, then place the match on a surface that cannot catch fire.

## WHAT YOU WILL NEED

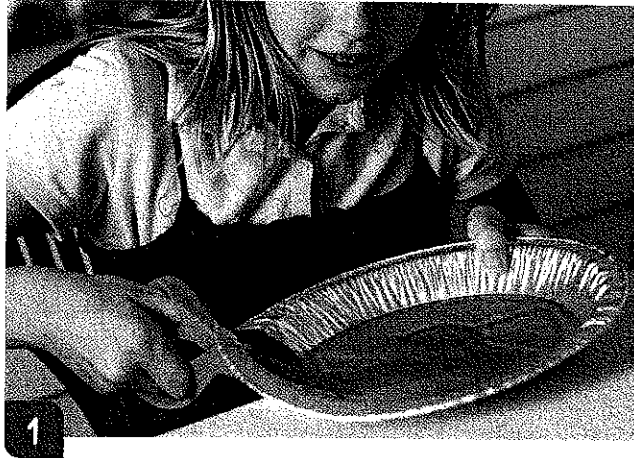
- \* Scissors
- \* Aluminum pie plate
- \* Fine-tipped permanent marker
- \* Ruler
- \* Small Phillips-head screwdriver
- \* Small jelly jar or glass with an opening about 2 inches (5 cm) wide
- \* Pair of cutting pliers to cut the tail off the pen cap
- \* Pen cap that is pointed at the closed end
- \* Modeling clay
- \* Clean, dry, short glass soda bottle with a narrow neck, 8- to 16-ounce size (0.25-0.5 L)
- \* 3-inch (7.5 cm) sewing needle
- \* Four tea light candles
- \* Matches

## MAYBE YOU'VE BEEN ASKED THIS OLD RIDDLE:

"If someone on a ship flushes a toilet and the water in the bowl starts to drain clockwise and then the ship crosses the equator, will the water start draining in the opposite direction?" (For the answer, see page 141).

## DO THE DEED

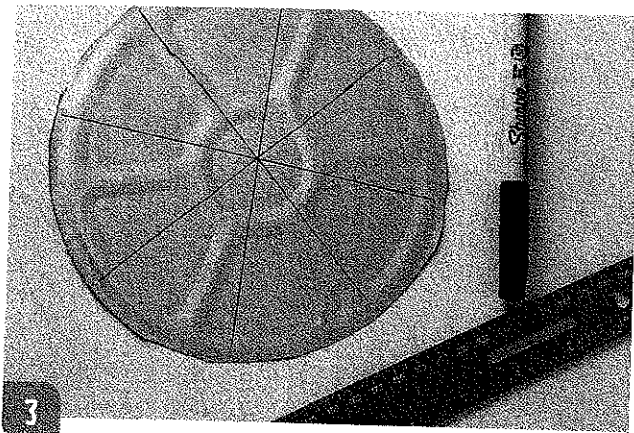
Are you ready to manipulate the forces of nature to create wind power?



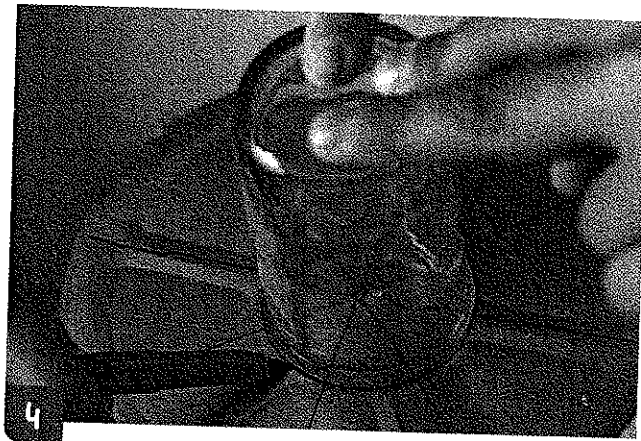
Use scissors to cut the edge from an aluminum pie plate, leaving just the flat center disk. Be careful to not cut yourself on the edge of the aluminum.



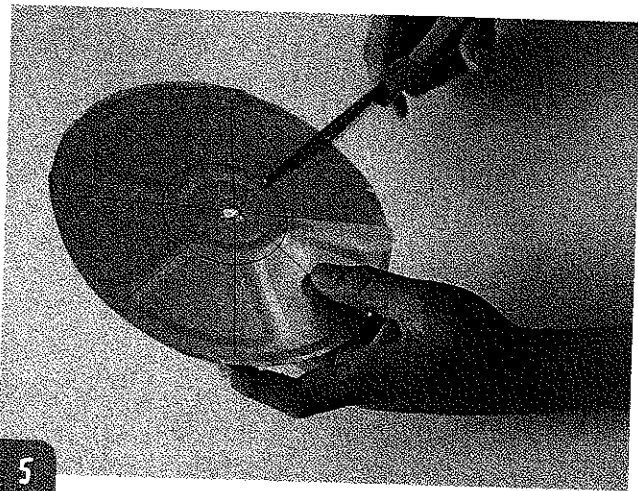
Locate the center of the aluminum circle: Place the disk on a table and with the marker and ruler draw one line from the top of the disk to the bottom, passing directly through the center. Draw another line from the left side to the right side, crossing the first line in the center. Your lines will look like the lines of a compass drawn north to south and east to west. The place where the lines cross marks the center of the aluminum disk.



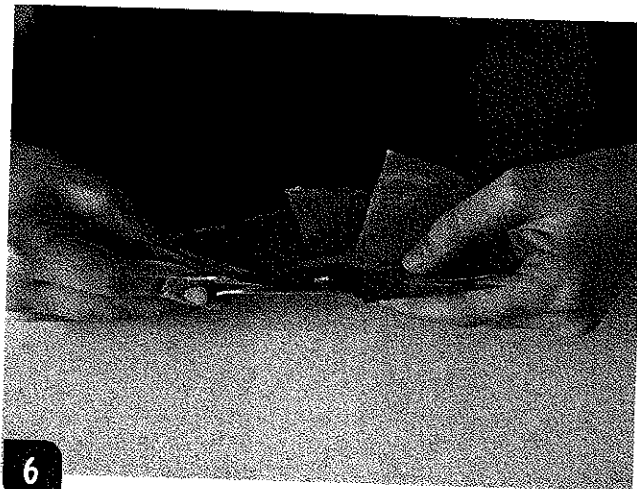
3 You've already drawn two lines that make your aluminum disk look like a pie cut into four pieces. Now you want to make eight equal-size pie wedges, so draw two more lines from one side of the plate to the other, cutting each of the four "pie" pieces in half.



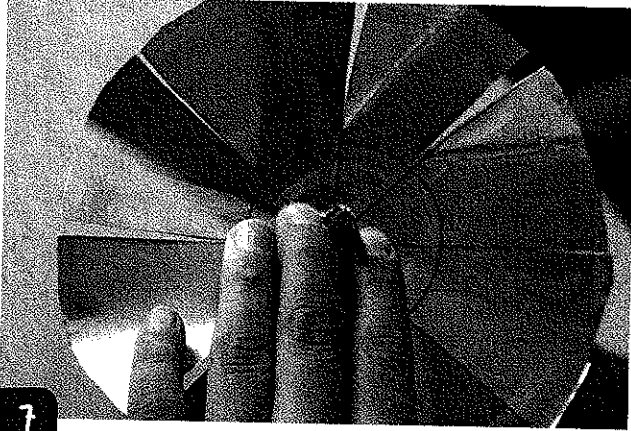
4 Use the Phillips-head screwdriver to poke a small hole through the center of the disk. Using the bottom of a drinking glass or jelly jar as a stencil, trace a circle about 2 inches (5 cm) wide around the center hole while keeping the hole directly in the center of the jar.



5 With the scissors, cut along all the lines from the edge of the disk up to the outer edge of the circle drawn in the center. (Don't cut into the center circle.)



6 Twist each blade slightly by about 30 degrees so they are all angled in the same direction, like the blades of a windmill or propeller. This will make the disk turn in the rising warm air.



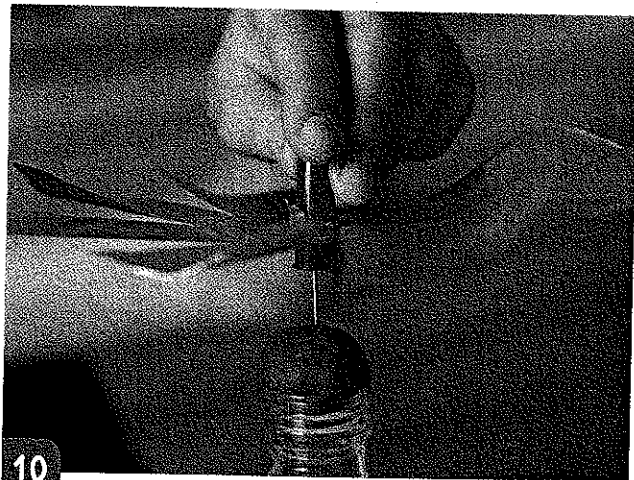
Cut the tail off the plastic pen cap with the cutting pliers. Then push the tip of the pen cap through the center hole of the pie plate. Use the screwdriver to expand the hole if necessary. Set this aside.



Roll the modeling clay into a ball about the size of a golf ball. Push the ball halfway into the opening in the neck of the soda bottle.



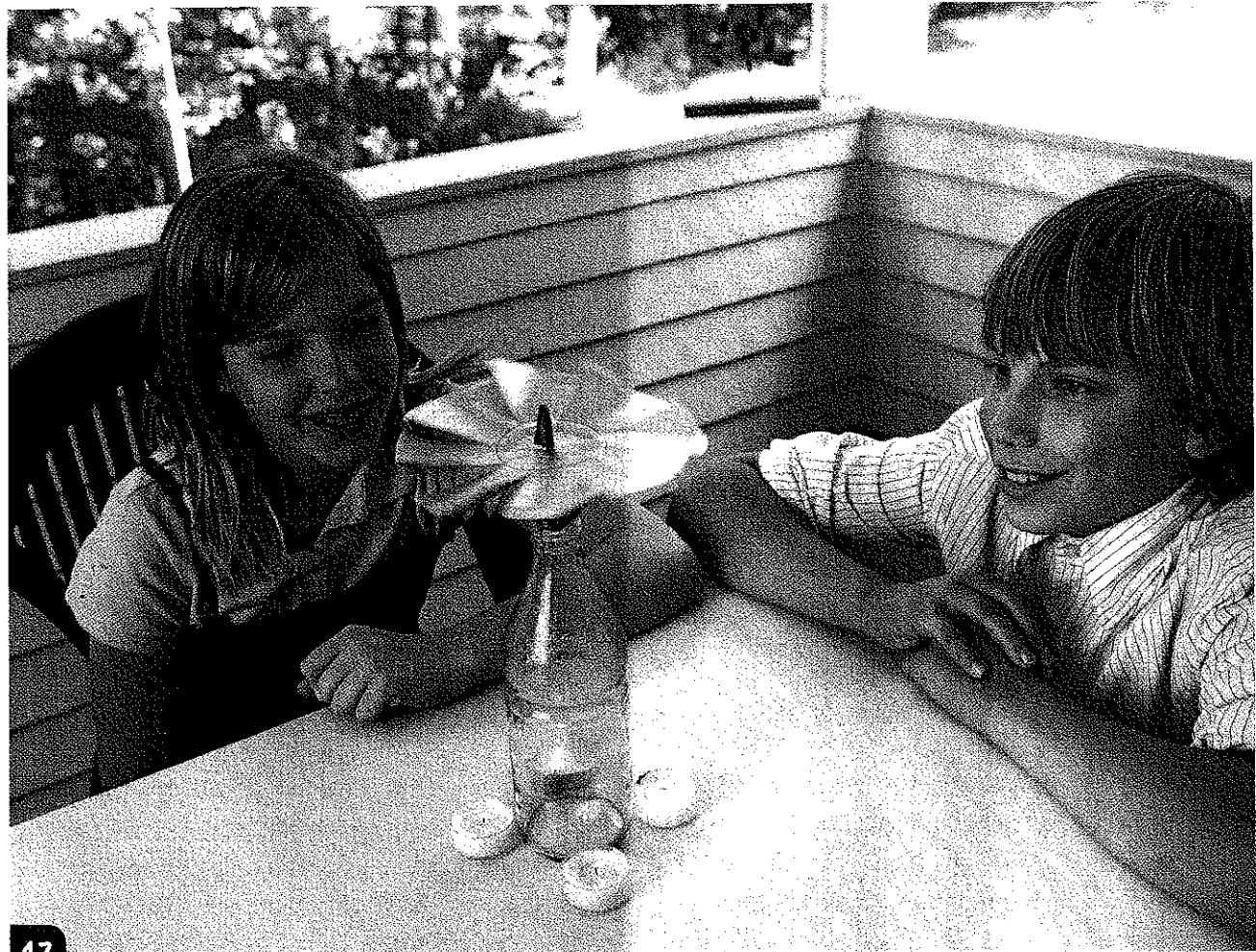
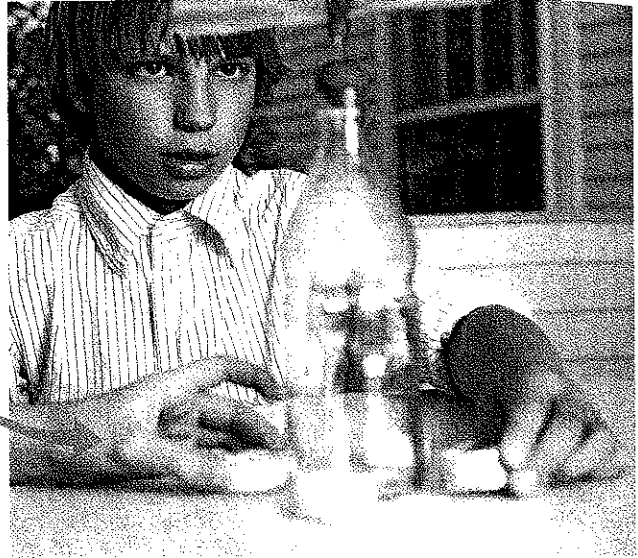
Push the thread-hole end of the sewing needle down into the clay about an inch (2.5 cm), leaving the sharp point sticking up. The part of the needle sticking up above the clay must be long enough so that the pen cap will spin freely without touching the clay along the bottom edges.



Set the open end of the pen cap over the needle. If the pen cap drags in the clay, either raise the needle up a bit higher or use the cutting pliers to cut enough off the bottom of the pen cap so that it spins freely.

**11** It's important that the windmill be well balanced. If it is tilting to one side, trim about  $\frac{1}{8}$  of an inch (3 mm) off two or three blades on the heavy side. Repeat if necessary until the windmill rides evenly on the pen cap.

**12** Place the four candles around the base of the soda bottle, evenly spaced, with each wick directly underneath the middle of the windmill blades.



**13** Light the candles; the rising warm air will cause the windmill to spin.



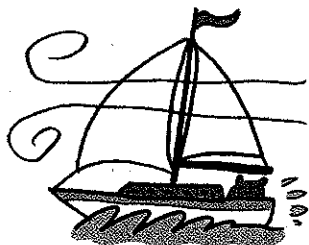
## THE BIGGER PICTURE

Why does the pie-plate windmill turn? As the air warms, it becomes less dense and weighs less, so it rises. In this activity, the wind is generated by the energy of the burning candles; in nature, the wind is driven by energy from the Sun.

Pilots of hot-air balloons use large gas torches to fill giant bags with hot air. The light-weight hot air rises and carries the balloons up into the sky.

### THINK ABOUT IT

- ① If you live near a lake or pond, go down to the water's edge on a calm, clear morning just before sunrise and float a toy sailboat, or even a leaf, upon the water.



What happens to the sailboat when the Sun rises? Why? Be careful if you do this at the end of the day, however, because the land breeze will blow your boat out toward the open water.

- ② Hang a lightweight piece of fabric outside by tying it, as high as you can reach, to a fence, to the branch of a tree or shrub — to whatever is available. The next time there's a still, sunny morning, watch the cloth just before sunrise, and continue to check it periodically for about an hour afterward. What happens? Why? Make similar observations during several other calm sunny days and compare the results.

### THINK HARDER

- ① Since colder air is heavier than warmer air, what should happen when you open the door to a refrigerator or freezer? Will you feel the cold breeze by placing your hand in the crack above the door as it opens or in the crack below it? Try doing both to see what happens.

### NOW, REALLY THINK

- ② How could you use a small, toy electric motor and some wire to make this power-plate turbine generate electricity? Design and sketch your own invention.

### ANSWER TO RIDDLE ON PAGE 137:

No. If the water has started draining, it will not change direction when the ship crosses the equator. The direction water drains depends more on the shape of the toilet bowl and the direction of flow from the water jets in the toilet. The Coriolis effect (page 133) doesn't tend to affect the movement of such a small amount of water.