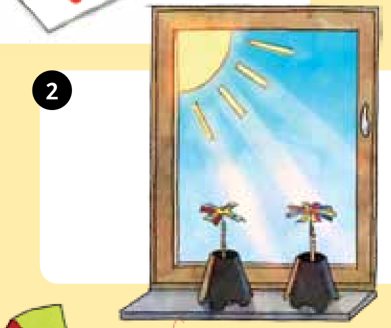
Which Wheel Turns Faster?

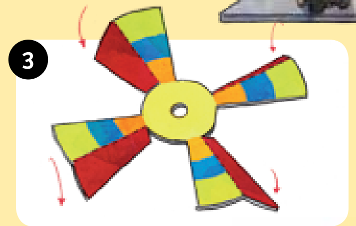
EXPERIMENT 1

YOU WILL NEED:
› Basic solar tower assembly, solar wheel die-cut sheet

1. Remove the 2 solar wheel attachments from the die-cut sheet.



2. Place your solar towers in a sunny spot that is sheltered from the wind. You can perform your experiments either outside or inside near a window.
3. Bend the flaps of the wheels down along the marked lines.

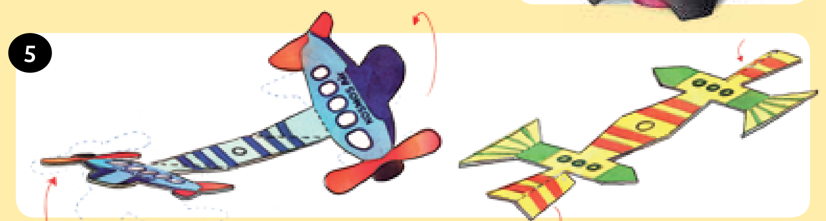


4. Insert each metal cap through the little hole in the center of the solar wheel attachment.

Now you can do an experiment to see which wheel turns faster.

Tip! Bend all of the flaps on the solar wheel attachment the same amount.

5. Test the spiral and the airplanes to see how they turn too. Bend the blue airplane upward along the dotted line, and the wings of the yellow airplane downward. Who wins the race?



WHY ? The heated air streams upward and hits the solar wheels. Because their blades are slightly angled against the stream of air, they move away from it. The stream of air is also deflected a little as it winds its way through the blades. That slows the air down, and it transfers some of its force — which becomes rotational force — to the solar wheel. With the four-bladed wheel, there is more space between the blades than with the wheel with eleven blades. So it produces less resistance with each rotation, and can turn faster than the eleven-bladed wheel, which turns more slowly but with greater rotational force.

Black and White

EXPERIMENT 2

YOU WILL NEED:
› Basic solar tower assembly, solar wheel attachments, white die-cut sheet
› *Glue*

1. Glue together the white card exactly as you did with the black one. Now you have a white solar tower cone as well.
2. Set one wooden stick with clay, needle, and attachment in the white cone and one in the black cone.

Does a wheel placed on the white cone turn too?

WHY ? Dark objects absorb more heat radiation than light-colored ones, and emit heat more readily as well. Light surfaces, on the other hand, reflect almost all the heat radiation that reaches them. That is why black objects become warmer in the sun than white ones do. The black cone uses this heat to make its wheel turn. Nothing moves above the white cone, by contrast.

A See-Through Coat

EXPERIMENT 3

YOU WILL NEED:
› Basic solar tower assembly, solar wheel attachments, clear plastic film
› *Tape*

1. Remove the rubber band from the sheet of film, unroll it, and tape its ends together to form a cone.
2. Place the cone of film over one of the solar tower cones. Set the other solar tower cone next to it.
Which wheel turns faster — the one with or without the film?

WHY ? The cone under the film suddenly finds itself inside a miniature greenhouse. In other words, you are making use of the greenhouse effect: The glass or clear plastic roof of a greenhouse lets more solar radiation in than it lets back out, so the heat accumulates under the roof. That is why it is always warmer inside a greenhouse than it is in the outside air.

Light Versus Heavy

EXPERIMENT 4

YOU WILL NEED:
› Basic solar tower assembly, solar wheel attachments, tracing paper cutout sheet
› *Scissors*

1. Cut the solar wheels out of the tracing paper sheet and bend them along the dotted lines as you did with the other attachments.
Be sure that you only cut along the black lines! Do not cut into the dotted or colored lines!
2. Insert the needle into the hole in the center of the attachments, and then mount the metal cap.
3. Test a normal wheel attachment along with an attachment made of tracing paper.

Which wheel turns faster?

WHY ? The tracing paper attachments are lighter, and they therefore produce less friction resistance between the needle and the metal cap. That means that more power remains for the rotation. In addition, some solar radiation passes through the tracing paper to the cone. The normal wheels, by contrast, don't let any sunlight through.

Check It Out

! PLANES IN THE UPDRAFT

Gliders cannot climb by their own power, and they will naturally descend through the air on a gradual downward path to the ground. In order to climb back up again, pilots look for thermals, which are chimneys of updraft thousands of meters high that form over warm regions (such as fields of ripening grain or mountain masses). These updrafts can attain speeds of over 30 km/h. Gliders can use them to spiral upward, and then coast along to the next thermal.

SOLAR UPDRAFT TOWER

A **solar updraft tower** converts the energy of an updraft into electricity.

This kind of power plant consists of a large collector and a chimney inside of which a turbine and an electrical generator rotate.

An early example of a solar updraft tower was in operation in Manzanares, Spain, from 1986 to 1989. Its collector had a diameter of 240 meters, and its chimney was 10 meters wide and 195 meters high. This prototype was able to supply 40 households with electricity.

Other solar updraft towers with chimney heights of up to 1000 meters and capable of providing electricity to 200,000 households are in the planning stages in the U.S. and Africa.

! HOT AIR BALLOON

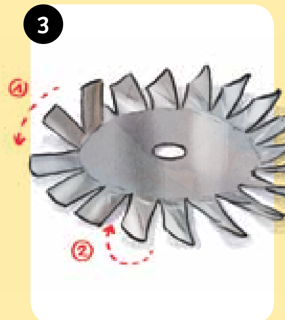
This is nothing more than a "packet" of hot air rising up through cooler air. When the balloon's air cools off, a gas flame is used to heat it back up again.

Homemade Wheel

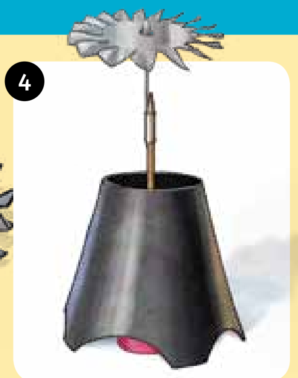
EXPERIMENT 5

YOU WILL NEED:
› Basic solar tower assembly
› *Empty aluminum tealight candle holder, scissors*

1. Make 16 cuts in the side wall of the tealight candle holder from the top edge to the bottom.
2. Use a scissors or needle to puncture a hole in the center of the bottom section for the metal cap. **Be careful not to injure yourself! It's best to have an adult help you with this part.**



3. Press the cut tealight cup wall flat and bend one edge of each blade slightly up.



4. Insert the metal cap through the hole in the center of the tealight wheel, mount it on the tower assembly, and set it in the sun.

Tip! Now that you have made your own solar wheel attachment, you will probably have more ideas for other great attachments. How about a yogurt container wheel, or a glider? First sketch the shape on a piece of paper, cut it out, make a hole in the center, and off you go. Just be sure that each attachment looks identical on the opposite side, or it won't be in proper balance.