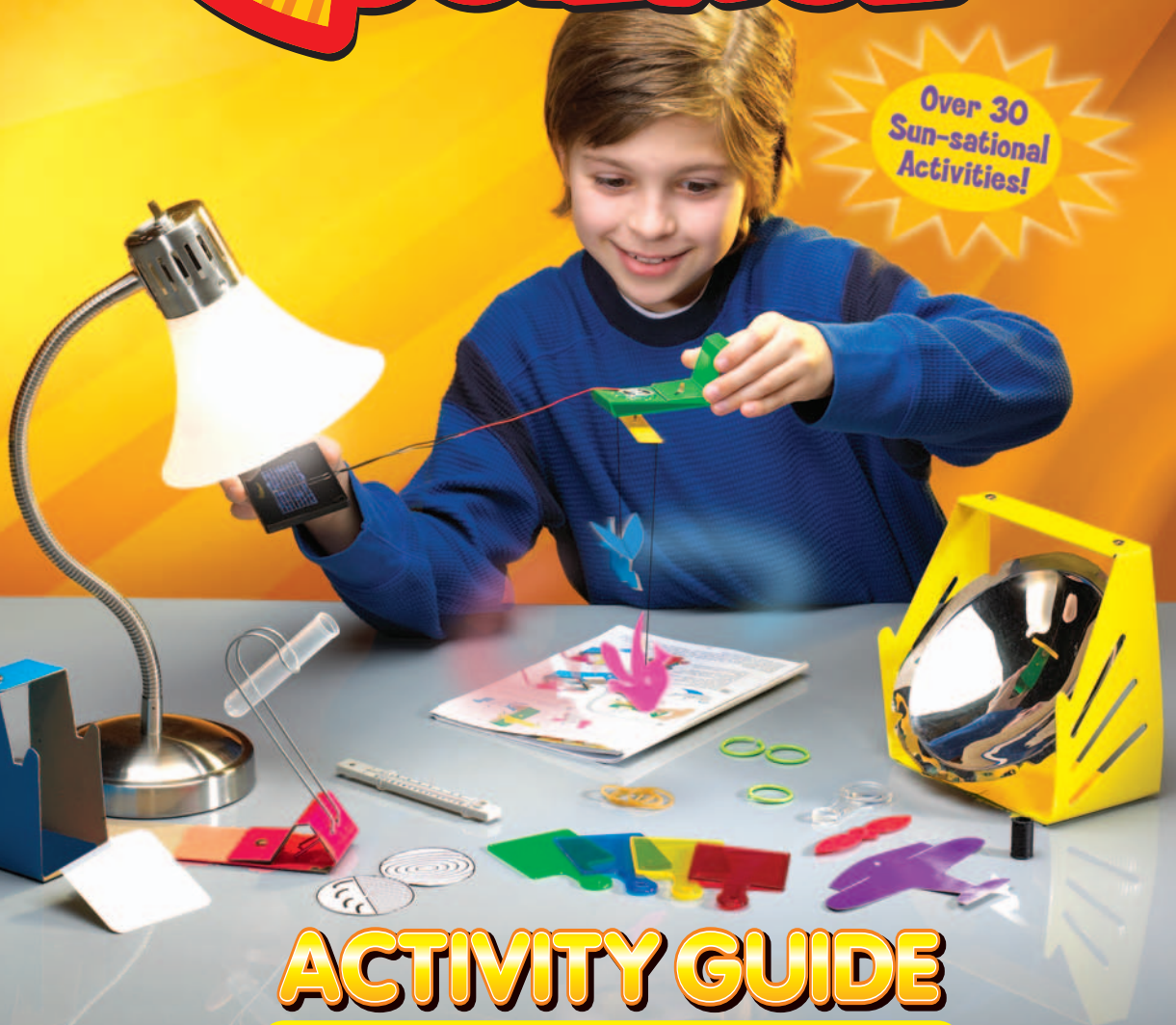


EI-3163
Ages 8+/Grades 3+

SOLAR SCIENCE

Over 30
Sun-sational
Activities!



ACTIVITY GUIDE

HARNESS THE POWER OF HEAT AND LIGHT

WARNING:
CHOKING HAZARD — Small parts.
Not for children under three (3) years.

Educational
Insights®



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INTRODUCTION

About Your Solar Science Lab

This kit contains most of the equipment required to perform the activities described. In addition, you will need some common household objects such as dishes, glasses, and spoons. Please note that the colors of certain objects may differ slightly from the drawings.

Read the related text before you try to assemble the components pictured in the drawings.

Because each activity builds on the previous ones, it is recommended that you complete the activities in the order they are presented.

Parts included:

- Parabolic reflector
- Mirror
- Test tube holder
- Test tube
- Magnifying glass
- Colored filters
- Plastic rings
- Plastic sticks
- Propeller
- Electric motor
- Thermometer
- Thread
- Rubber bands
- Paper fasteners
- Motor support
- Furnace support
- Test tube support
- Solar cell support
- Cut-out sheet
discs, birds, airplane
- Solar cell and wires

IMPORTANT: Activities with sharp points or edges should be completed under the direct supervision of an adult. These activities are indicated by the following icon:



Adult supervision is required for this activity.

IMPORTANT: Be very careful when working in bright sunlight. Always wear sunglasses. Avoid looking directly at the sun or at a concentrated image of the sun, as this can damage your eyes. Activities involving the sun are indicated with the following icon:



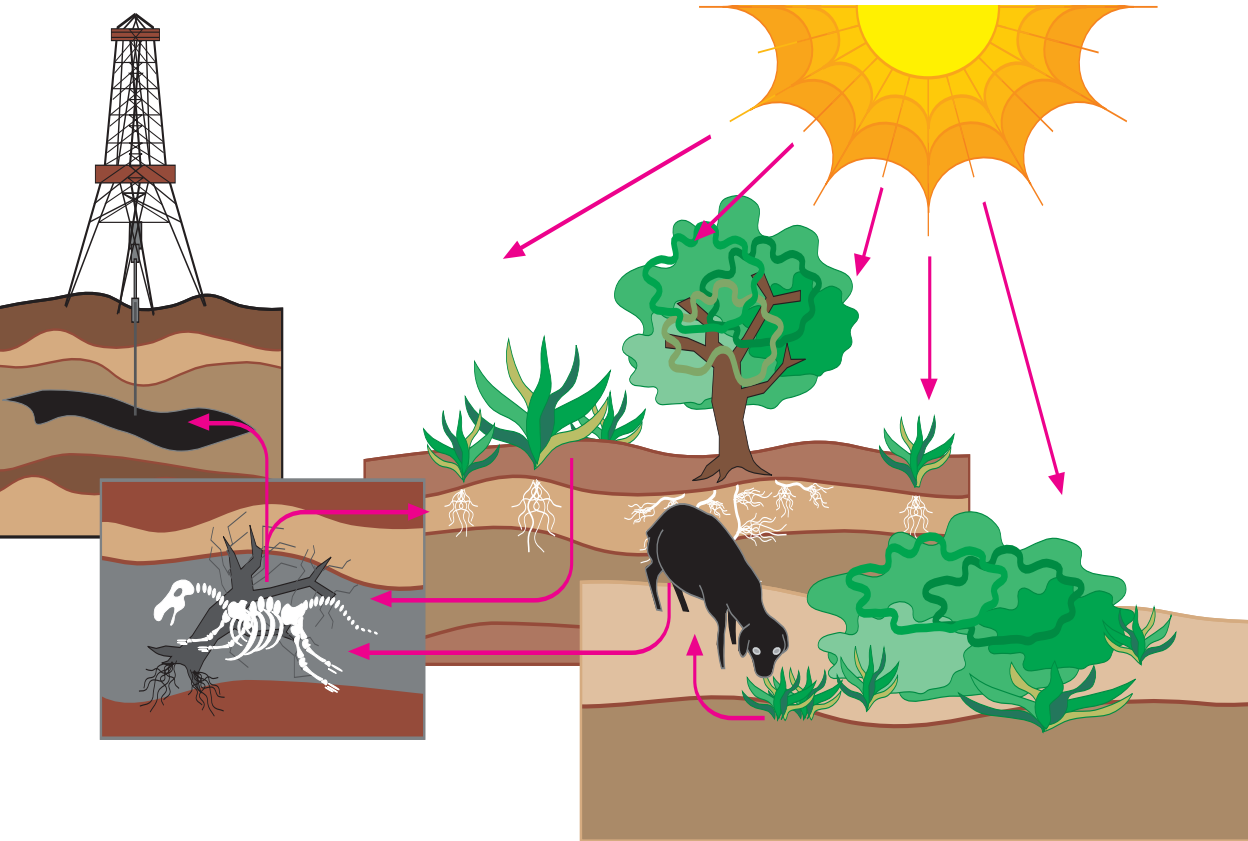
Sun Warning!

Some Facts About Solar Energy

The sun is a great source of energy, and because its energy is non-polluting and inexhaustible, for over two centuries man has been trying to harness it for technological purposes. In fact, in only one day our planet receives from the sun about 200,000 times the energy generated by all the earth's electrical generating plants combined.

And yet, most of the energy we use today is derived from fossil fuels such as oil, gas, or coal—energy sources that will not last forever. The only other reliable sources of energy we have found to meet our future needs are hydroelectric, nuclear, and . . . solar power.

We can capture solar energy both directly and indirectly; directly through fluids heated in solar collectors and by photovoltaic cells that convert sunlight into electricity; indirectly through energy captured by photosynthesis which is stored in plant tissues. Plant tissue can be burned to provide heat or can be converted into alcohol fuels. For example, in the United States during the 1980s, wood fuel provided more energy than nuclear power. Even today, many developing countries use wood as their main source of energy.



ACTIVITY 1



Sun Warning!

How Much Heat Do You Get from the Sun in Your Room?

Equipment:

- thermometer
- mirror
- card

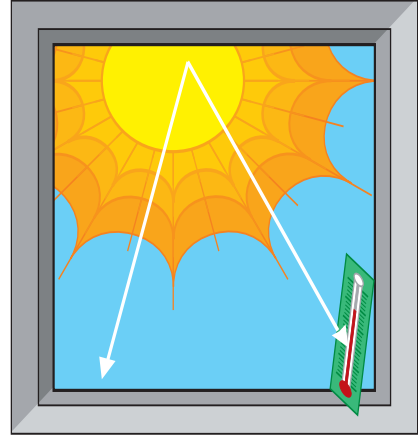
Note:

The mirror in your kit is protected with a thin covering.

Peel this off before use.

- 1 Place the thermometer on the window sill.

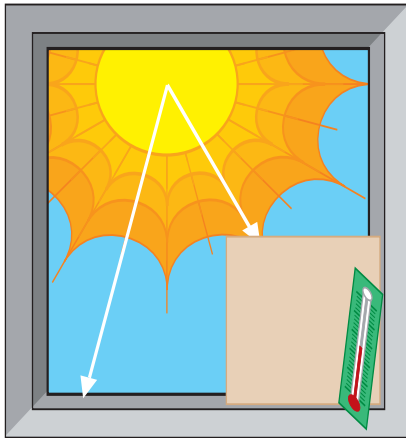
Record the temperature.



- 2 Keep the thermometer on the window sill.

Place a card against the window so that it prevents the sun's rays from reaching the thermometer.

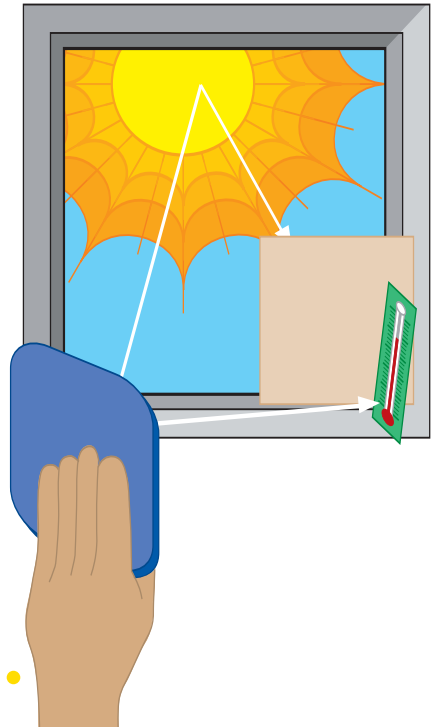
Once more, record the temperature reading.



- 3 Now hold your mirror so that the sun's rays are reflected from the mirror onto the thermometer tube.

Take a new reading after several minutes.

What's the difference?



Note:

The temperature should now be nearly the same as when it was directly in the sun.

ACTIVITY 2



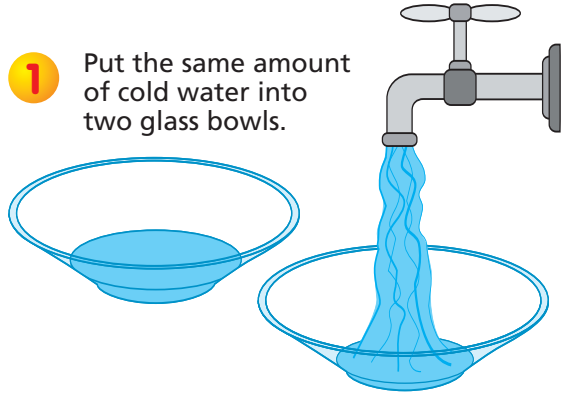
Sun Warning!

The Sun Heats Water.

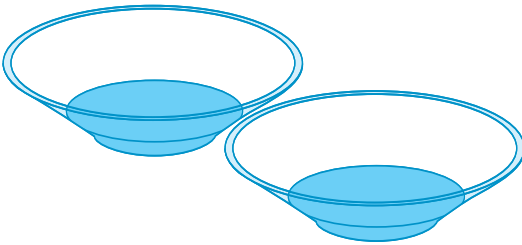
Equipment:

- 2 glass bowls
- 1 transparent saucer
- thermometer
- water

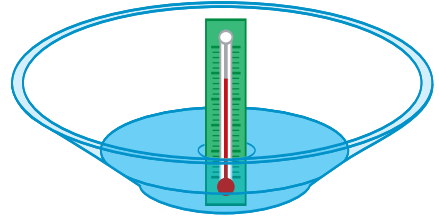
- 1** Put the same amount of cold water into two glass bowls.



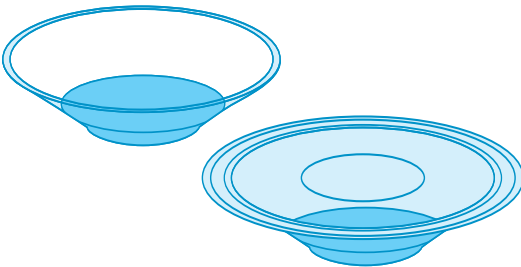
- 2** Place them in the sunlight.



- 3** Without moving the bowls, measure the temperature of the water in both of them and make a note of it.

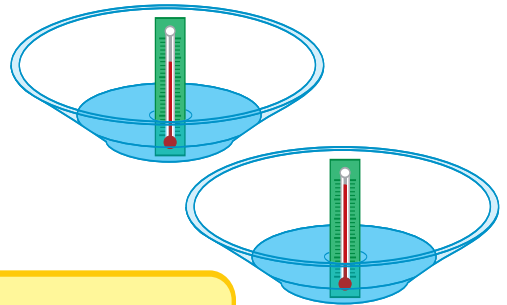


- 4** Cover one of the bowls with a transparent saucer or piece of clear glass.



- 5** Wait about an hour and remove the saucer. Measure the temperature in each bowl.

What did you discover?



Note:

You will find that there was a rise in temperature in both cases.

The water in each bowl is now warmer than it was before, but the water is even warmer in the bowl that was covered.

This is what is known as **the greenhouse effect**.

ACTIVITY 3



Sun Warning!

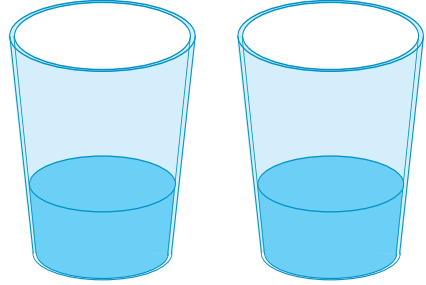


White in the Sun

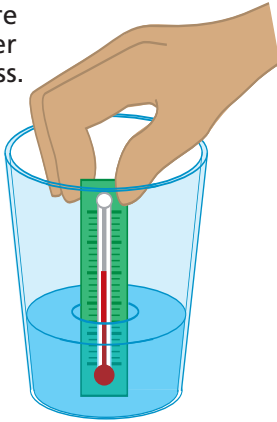
Equipment:

- 2 glasses
- white paper
- black paper
- thermometer
- water

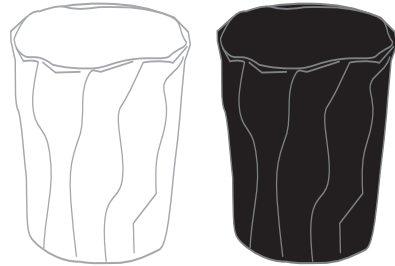
- 1** Place two glasses partially and equally filled with cold water in sunlight.



- 2** Measure the temperature of the water in each glass.



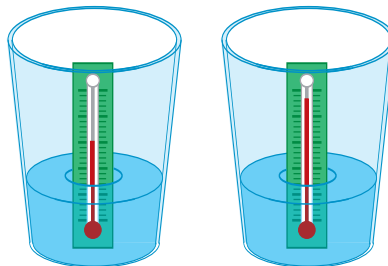
- 3** Wrap one glass with a sheet of white paper and the other with a sheet of black paper.



- 4** Wait half an hour and again measure the temperature of the water in each glass.

What's the difference?

How can this difference be explained?



Explanation:

The water in the glass covered with black paper will absorb heat radiation and will be warmer than the one covered with white paper.

Perhaps it will be easier for you to understand now why people wear light-colored clothing in summer and why heat absorbers are black.

ACTIVITY 4

The Spectrum

Equipment:

- glass
- white paper
- water

1 Fill a glass full of water and place it on a brightly lit window sill on a sunny day.

The glass should extend a bit over the inside edge of the sill.

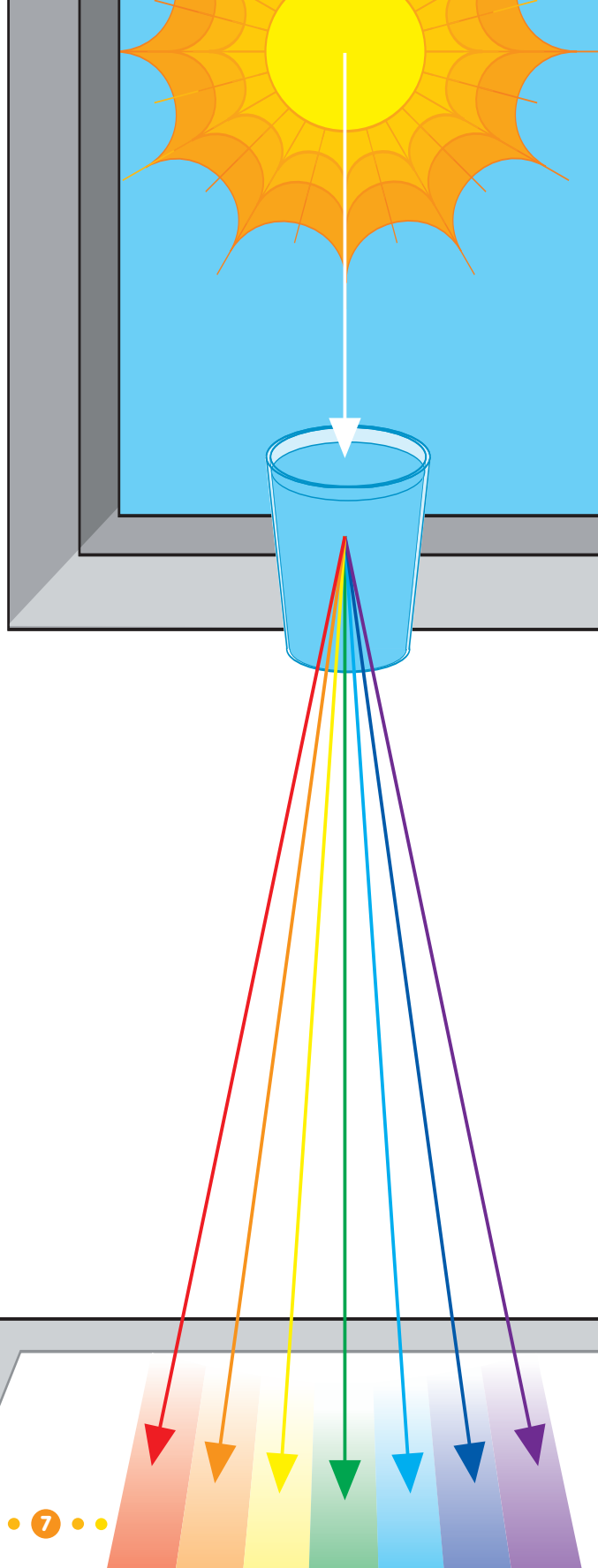
2 Now place a large piece of white paper on the floor directly below the glass.

Observe the spectrum appear!

Note:

The success of this experiment depends on certain specific conditions of the sun.

Try this at various times of the day in order to catch the sun at different heights in the sky.



ACTIVITY 5



Adult supervision
is required for
this activity.

Weather in a Casserole Dish

Equipment:

- clear casserole dish or Pyrex[®] dish
- dried up felt-tipped pen
- scissors
- electric hot plate

When talking about solar energy, it is important to remember how the sun influences the air around us.

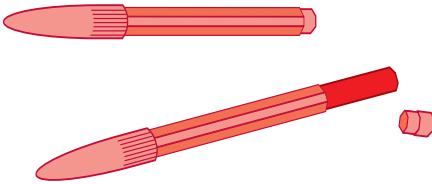
The sun heats the air, causing it to rise. The air descends as it cools, and this is what is responsible for the weather.

Here is an experiment where you should be able to see how this happens.

- 1** Take a dried-up felt-tipped pen.

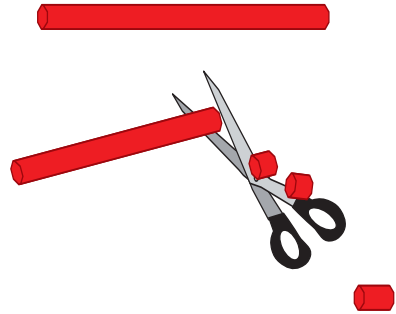
Open it by breaking it or by cutting it.

Notice the cartridge inside.

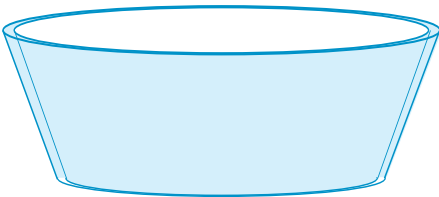


- 2** Remove the cartridge.

Using a pair of scissors, cut off a few pieces of this cartridge.

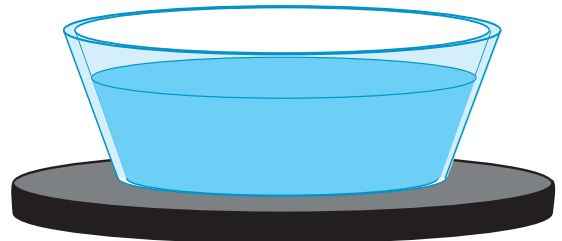


- 3** Find a clear casserole dish or Pyrex[®] dish that can be heated.



- 4** Fill the dish with water.

Place it on top of an unplugged electric hot plate or an unlighted burner on your stove.

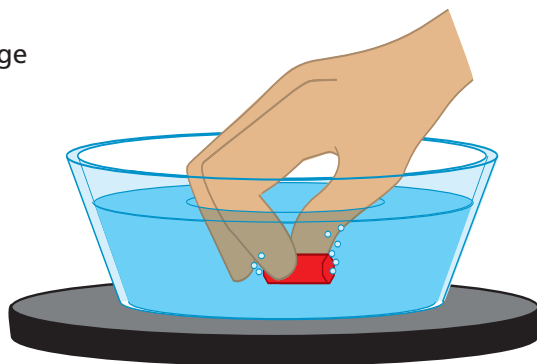


- 5 Take one segment from the ink cartridge and place it into the middle of the casserole dish. It should sink.

If it floats, hold it under the water.

Watch the tiny air bubbles rising from the segment as it absorbs water.

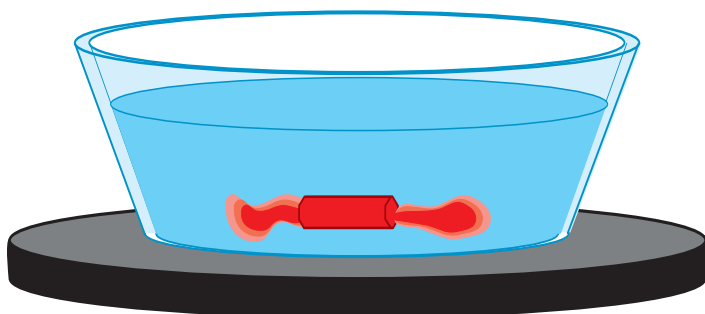
After a short time, the cartridge will sink.



- 6 Wait a few minutes and you will see the ink emerge from the cartridge segment.

As yet, the ink does not mix with the water.

It first makes two colored pools below the water's surface.

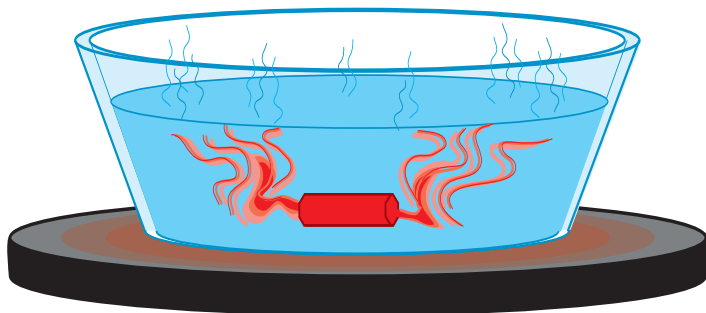


- 7 Use your hot plate or stove burner to carefully warm the water in the casserole dish at **low heat** and see what happens.

The colored bands demonstrate how hot air rises in the atmosphere and cool air sinks.

This demonstrates how winds and cyclones are produced.

A similar pattern of circulation between hot and cold areas in the atmosphere causes Earth's wind and storms.



ACTIVITY 6

A Scientific Explanation of a Magnifying Glass

Equipment:

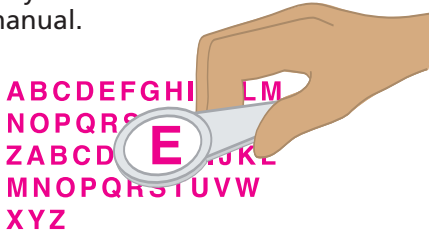
- magnifying glass
- table lamp
- sheet of paper

Note:

The magnifying glass enclosed in your kit is a **double convex converging lens**.



- 1 Hold your magnifying lens over any letter **E** in this manual.



- 2 Increase the height of the lens over the letter **E**. The letter grows and grows until a point is reached where the image seems to become blurred.

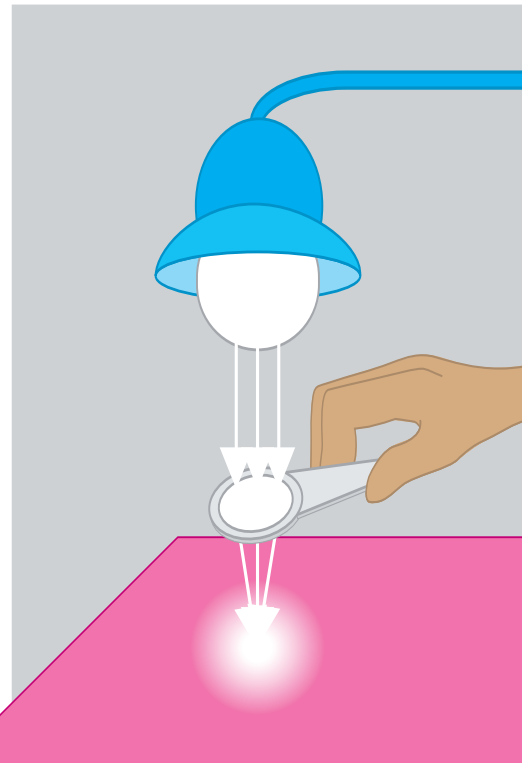


- 3 Try focusing the light of a table lamp through the lens onto a sheet of paper. You will see the focal point. Find the exact focal length by measuring the distance between the lens and its focal point.

Explanation:

All parallel light rays striking your lens on one side will meet at a single point about 1w" (40 mm) away from the other side of the lens. This single point is the **focal point** of the lens.

The distance between the lens and its focal point is the **focal length**. The letter **E** you were examining became blurry exactly when you passed the focal length.



ACTIVITY 7

Converging Light Rays

Equipment:

- magnifying glass
- fluorescent light
- white paper

- 1 Reflect the light from a fluorescent light through your lens onto a sheet of white paper.

What do you see?

Explanation:

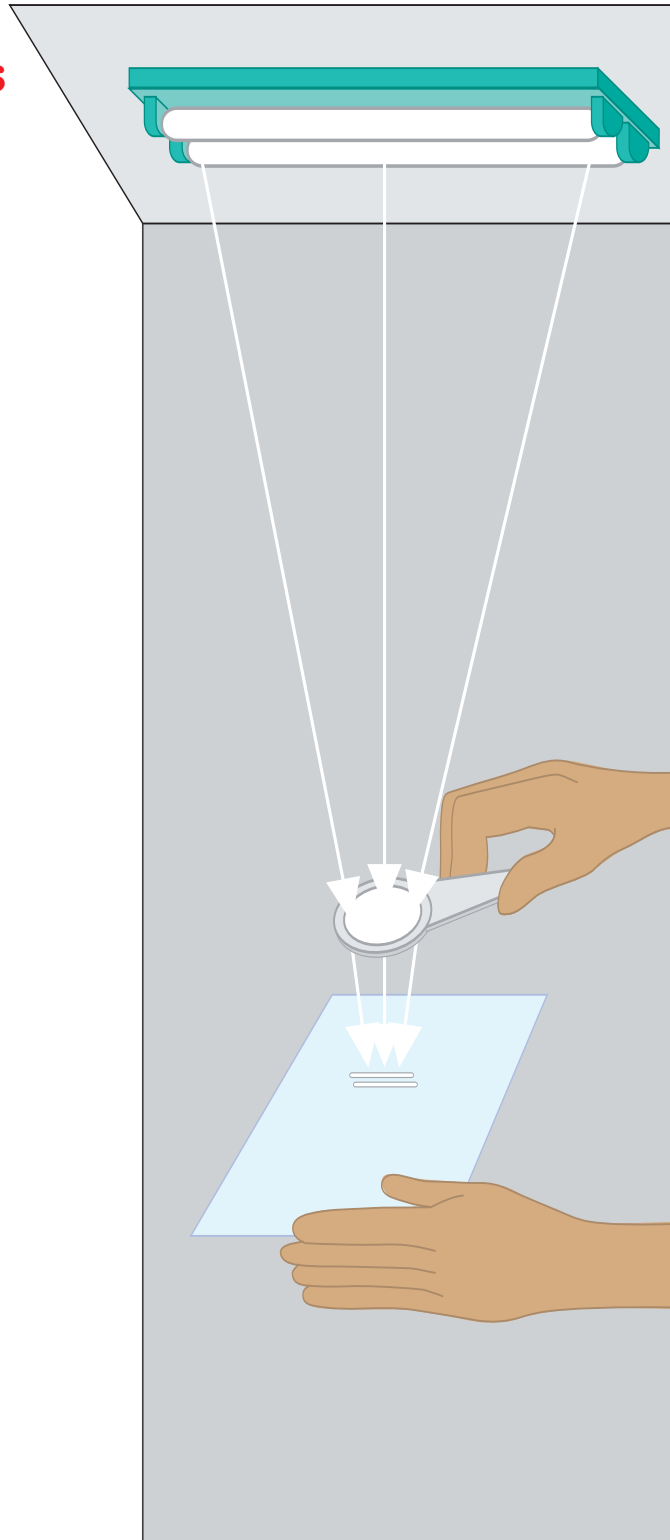
A **converging lens** focuses all the **light rays** received on its surface to a considerably smaller area than the area of the light source.

The clear and reduced image of the fluorescent light that appears on the paper helps you visualize this relationship.

Concentrated energy

As you have already learned, all of the energy striking a converging lens will meet at a single point.

This is true for light rays, as you have seen in this activity and in the previous one. It is also true for **heat waves**, as you will see in the next activity.





Maximum Temperature

Equipment:

- magnifying glass
- thermometer
- candle
- water

- 1 Take your lens outside to bright sunlight.

Place a bit of candle wax at the focal point of the lens. What happens?

Explanation:

If the candle melted, you can be sure that it reached the temperature of 129°F (54°C) or more because 129°F (54°C) is the **melting point** of the wax.

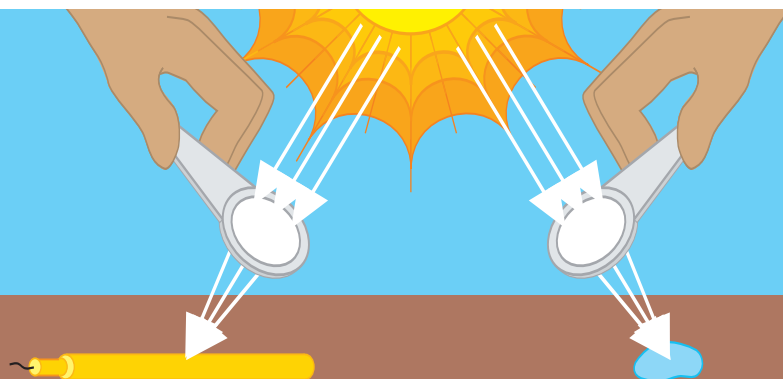
- 2 See if you can boil water in sunlight.

Place a drop of water at the focal point of the lens. What happens?

Explanation:

The **boiling point** of water is 210°F (100°C).

If you succeeded in boiling the water, then you at least reached that temperature.



Now try this:

Look up the melting and boiling points of various household items in a chemistry book or encyclopedia. This will be helpful if you choose other materials to work with.

Expose these items to “concentrated” sunlight and try to determine the highest temperature you can achieve with your lens.

Since the sun is the source of heat in this activity, the amount of available heat will vary and so will your results.

The hour of the day, the season of the year, the weather, and the location on Earth, are a few of the factors which can influence the results.

ACTIVITY 9

Left – Right

Equipment:

- mirror

The sun's energy is often focused and reflected to harness its power.

- 1 Stand in front of a mirror and scratch your right ear with your right hand.
What do you discover?



Explanation:

Mirror images are laterally inverted, they transpose right with left and left with right.

This is the reason why you appeared to be scratching your left ear with your left hand when you looked at yourself in the mirror.

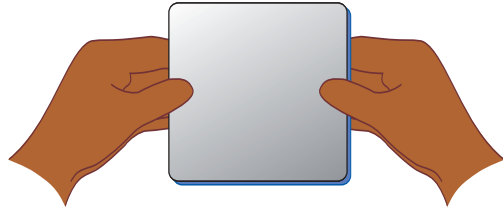
ACTIVITY 10

Convex Mirror

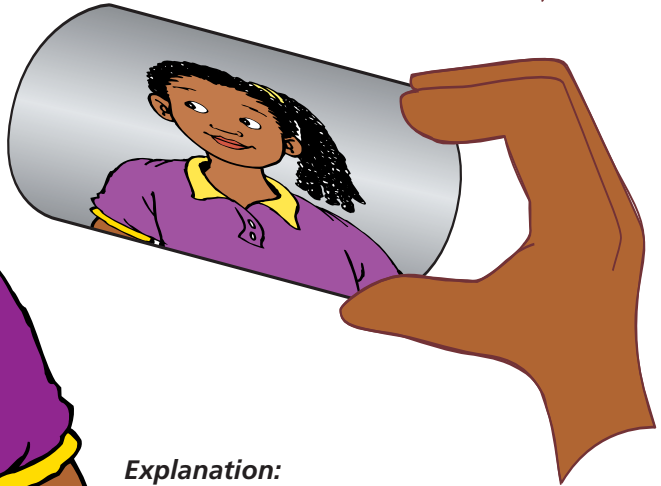
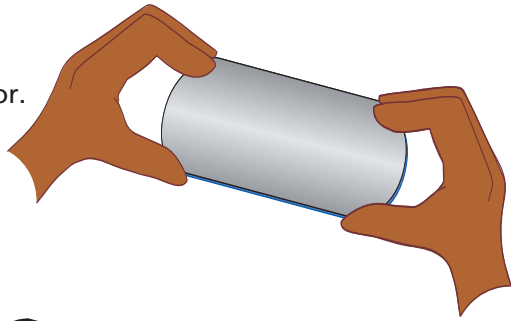
Equipment:

- mirror
- soup spoon

1 Take the mirror from the kit and hold it in your hands.



2 Bend the mirror outwards. Look at your reflection in the mirror. What do you see?



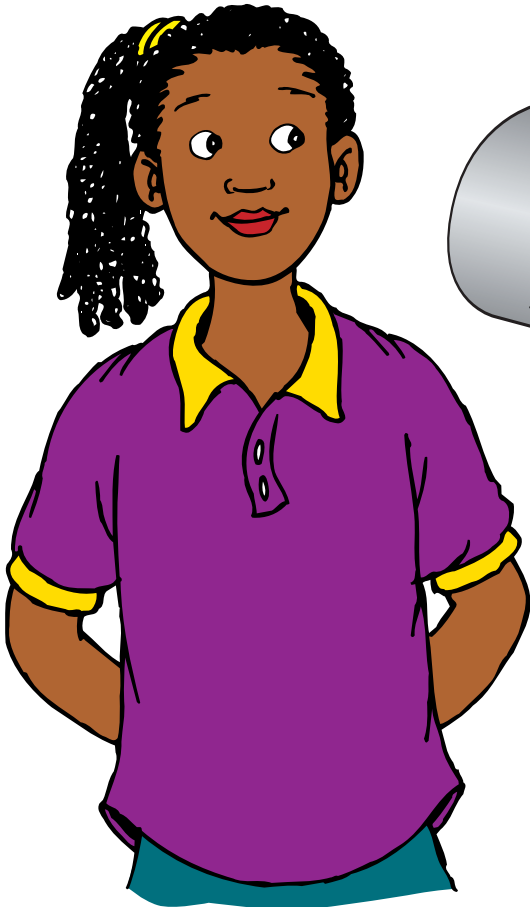
Explanation:

An outward-bulging reflecting surface is called a **convex mirror**.

A convex mirror reduces the size of the reflected image.

Now try this:

You can also see this phenomenon by examining the outward curving, back surface of a shiny soup spoon.



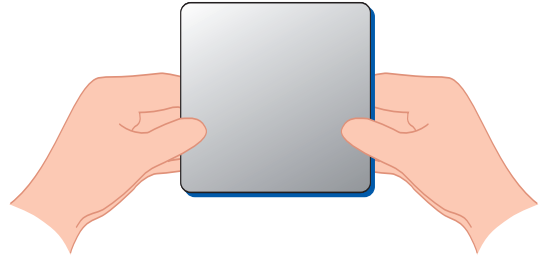
ACTIVITY 11

Concave Mirror

Equipment:

- mirror
- soup spoon

1 Again, take the mirror from the kit and hold it in your hands.

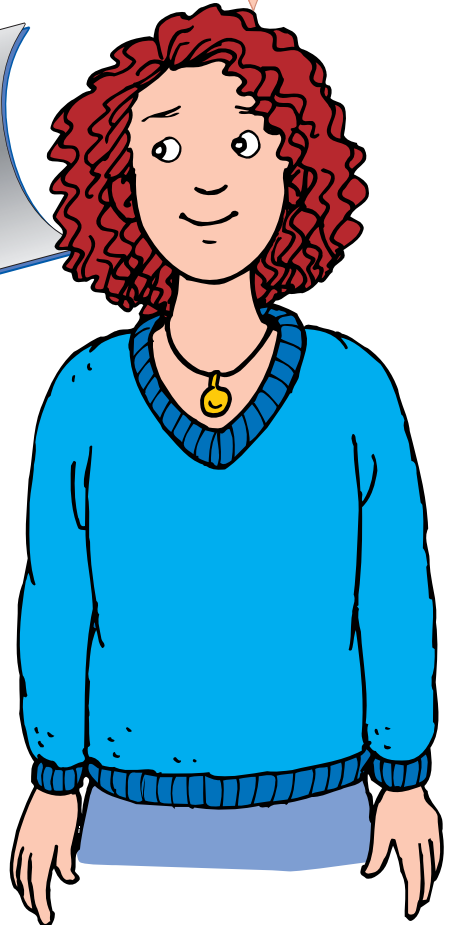
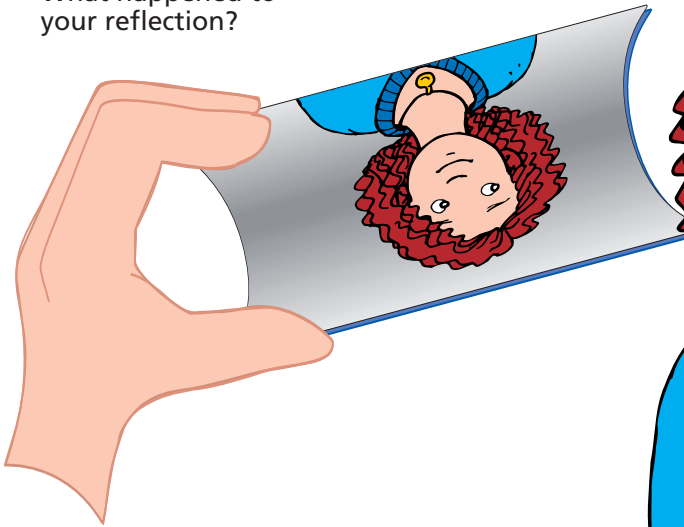
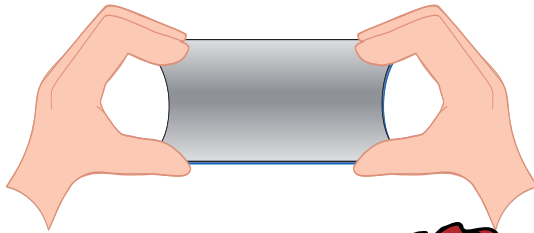


2 Bend the mirror inwards, towards you.

Look at your reflection in the mirror.

What do you see?

What happened to your reflection?



Explanation:

An inward-bulging reflecting surface is called a **concave mirror**.

A concave mirror reduces and inverts the image of the object if it is not close to its surface.

Now try this:

You can also see this phenomenon by examining the inward-bulging, inner surface of a shiny soup spoon.

ACTIVITY 12

Assembling the Solar Furnace

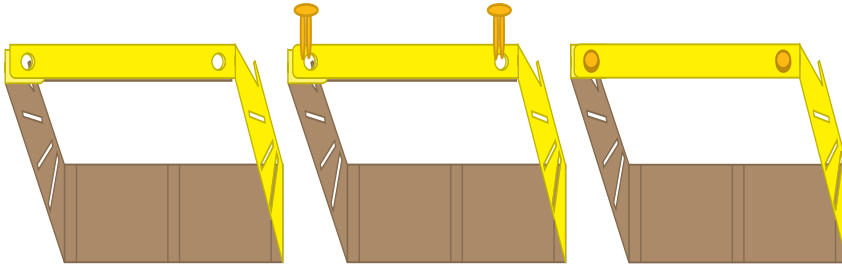
Equipment:

- parabolic reflector
- solar furnace support (cardboard)
- paper fasteners

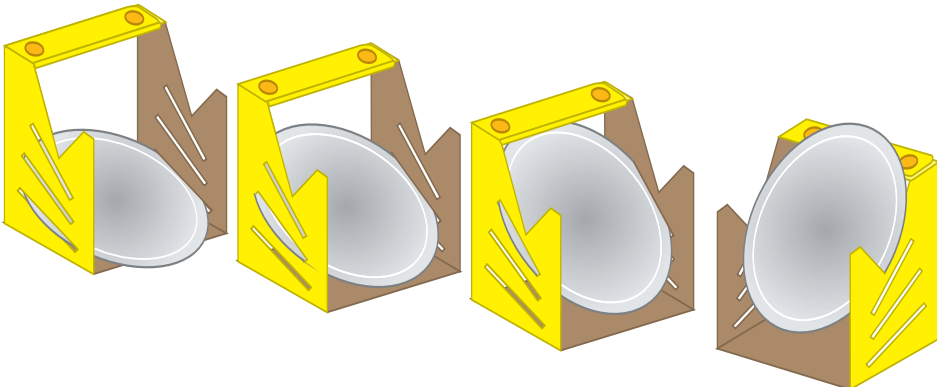
- 1 Place the cardboard solar furnace support, with the colored side down, on a flat table.



- 2 Fold each end of the cardboard towards the middle so that the two small round holes are directly above one another. Insert the paper fastener, from the top down, through the two small holes.



- 3 This support can hold the parabolic reflector in four different positions. In the next activity you will learn how to place the parabolic reflector in the most convenient position.



ACTIVITY 13



Sun Warning!

How Does a Solar Furnace Work?

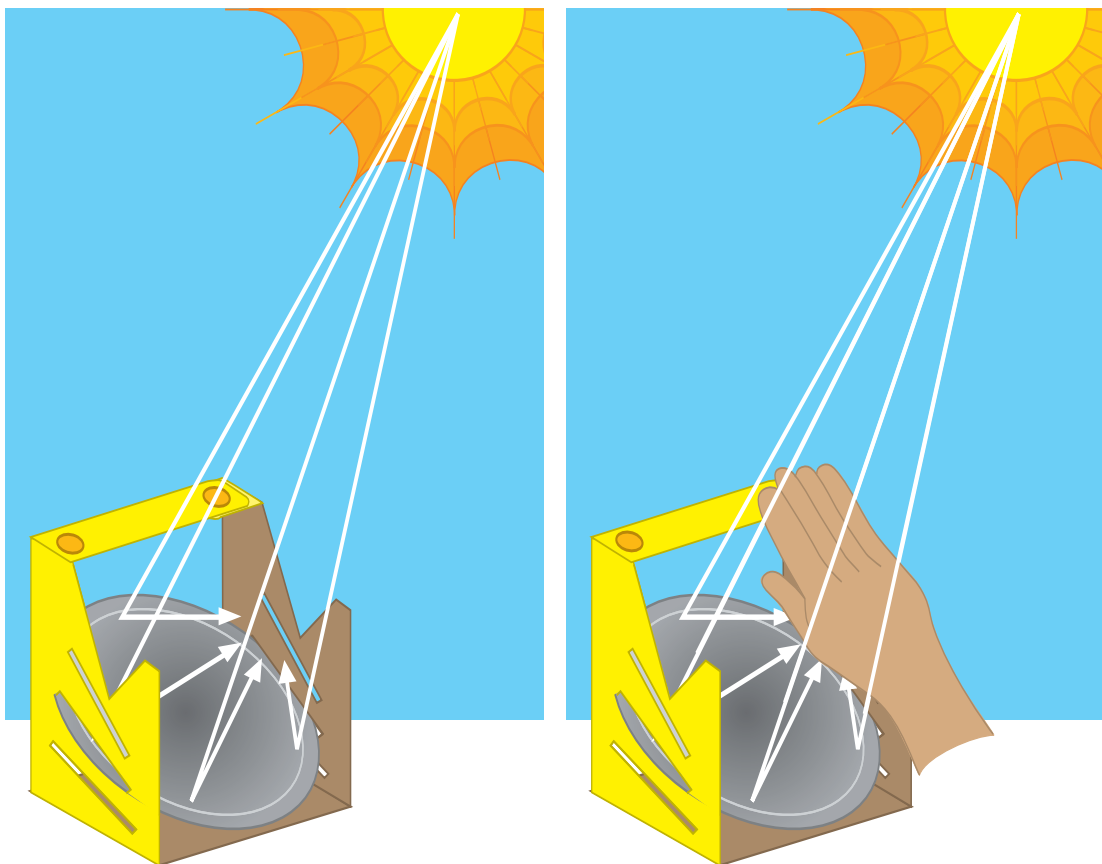
Equipment:

- solar furnace

The purpose of a solar furnace is to concentrate the sun's rays into a small area and increase its heat output to a level where it becomes useful to us.

The key to your solar furnace is its **spherical parabolic mirror** which reflects parallel light rays to a single point. This single point is its **focal point**.

- 1 Go outside and find a sunny spot for your solar furnace.
Place the parabolic reflector in the position that reflects the greatest amount of the sun's rays.
Move the palm of your hand in front of the reflector, about 4" (10 cm) away from it, searching for the focal point.
Once you find it, keep your hand still for few minutes and you will feel the concentrated heat.



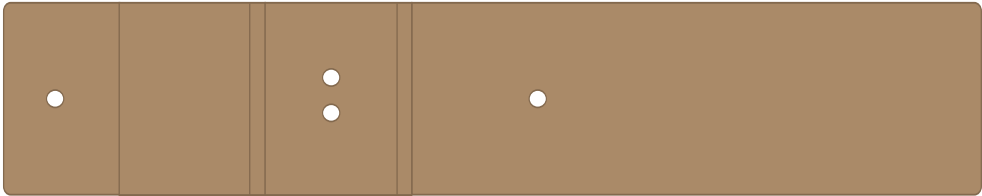
ACTIVITY 14

Assembling the Test Tube Stand

Equipment:

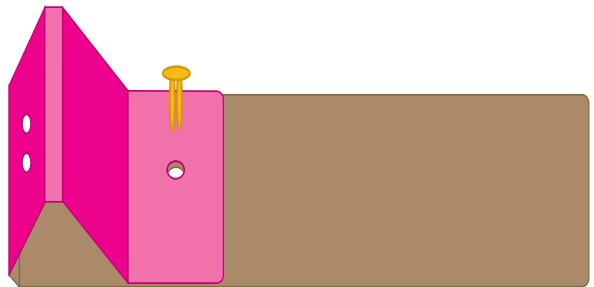
- test tube
- test tube support (cardboard)
- test tube holder (metal wire piece)
- paper fastener

- 1 Place the cardboard test tube support, with the colored side down, on a flat table.



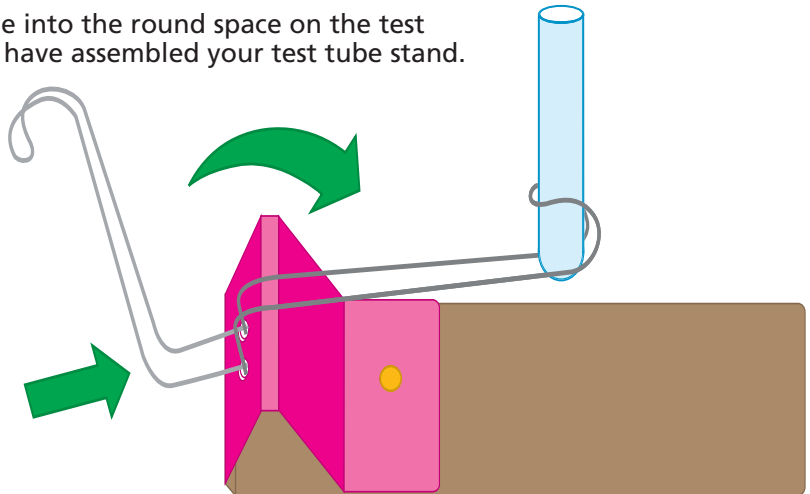
- 2 Fold the shortest end of the cardboard towards the middle so that the two small round holes are directly above one another.

Insert the paper fastener, from the top down, through these two small holes.



- 3 Insert the ends of the test tube holder into the pair of holes on the cardboard, and then move it down, as shown.

Place the test tube into the round space on the test tube holder. You have assembled your test tube stand.



Note:

You can move the test tube holder in the support until you find the best position for it to absorb the sun's rays from the parabolic reflector.

ACTIVITY 15



Sun Warning!

Boiling Water

Equipment:

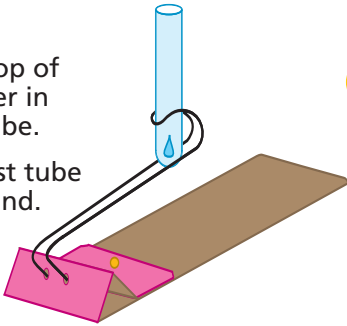
- test tube
- test tube stand
- solar furnace
- water

- 2** Place the solar furnace in direct sunlight.

Choose the best position for the parabolic reflector.

- 1** Place a drop of clean water in the test tube.

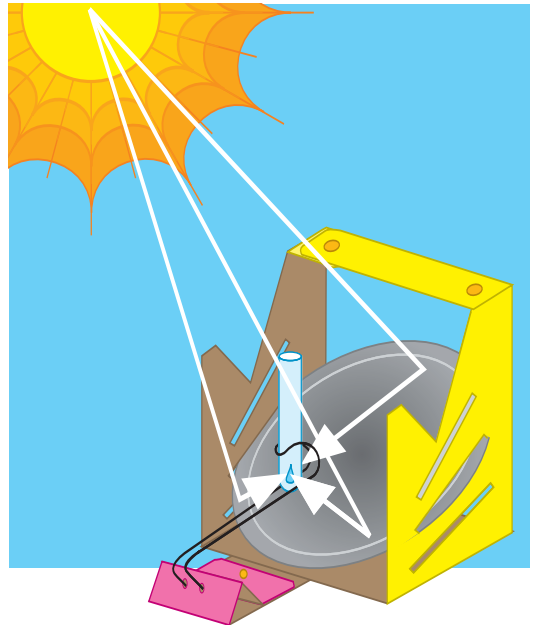
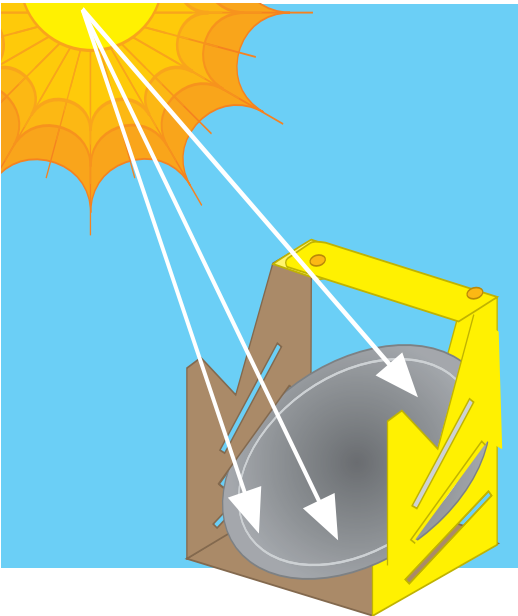
Put the test tube into its stand.



- 3** Place the test tube stand in front of the furnace.

Move the test tube holder up or down until you are sure that the water in the test tube is at the **focal point** of the reflector.

How long does it take for the water to boil?



Explanation:

You will achieve the best results if you work with the solar furnace when the sun is directly overhead. This is due to the fact that the sun's rays are strongest when they strike the earth at an angle of 90° .

The wind, or even a breeze, will affect this activity; it will cool what you are trying to heat.

On a cloudy day, you will not be able to work with the solar furnace.

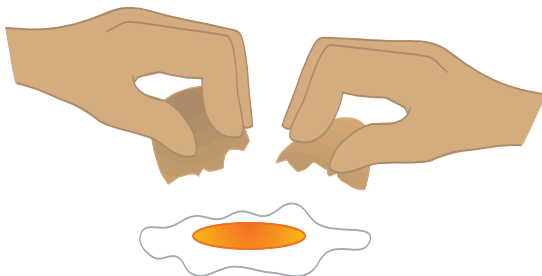


Can You Cook an Egg? (the Egg White)

Equipment:

- solar furnace
- test tube stand
- test tube
- raw egg white

1 Break open a raw egg.



2 Pour a little bit of the egg white into the test tube.

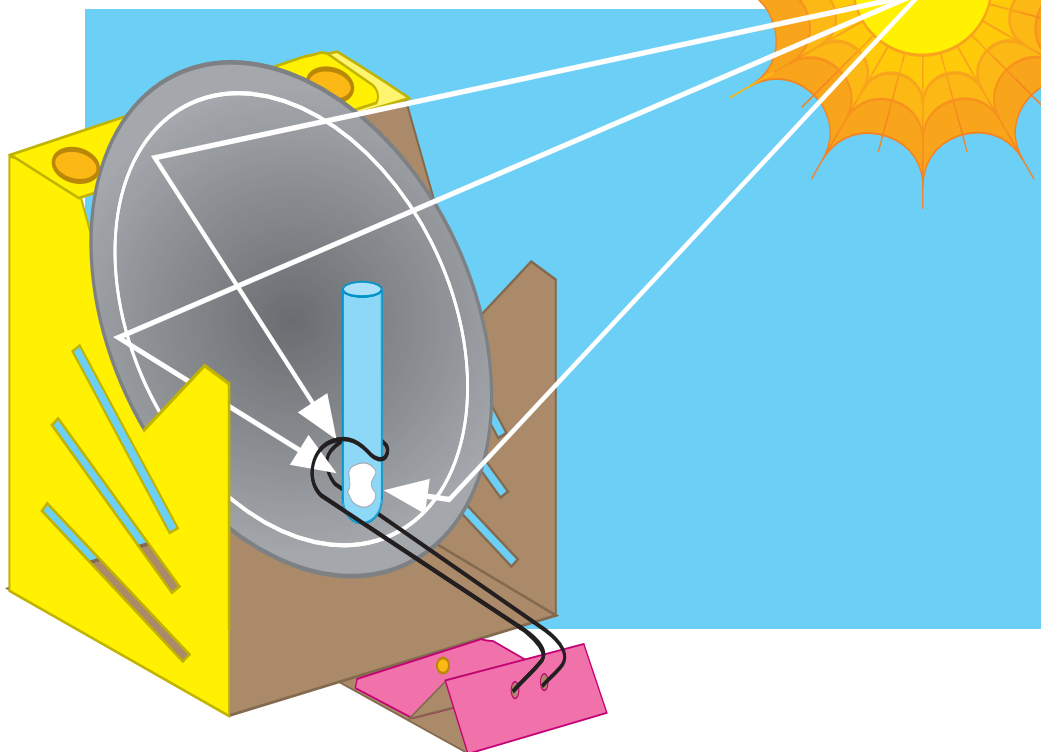
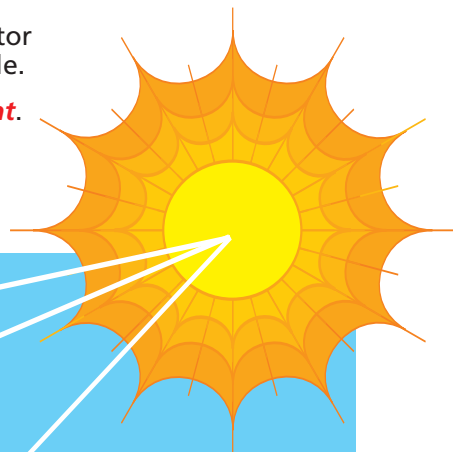
Place the test tube stand in front of the solar furnace.

Choose the best position for the parabolic reflector and for the test tube, according to the sun's angle.

Make sure that the egg white is at the **focal point**.

Can you cook the egg white?

How long does it take to harden?



ACTIVITY 17



Sun Warning!



Adult supervision is required for this activity.

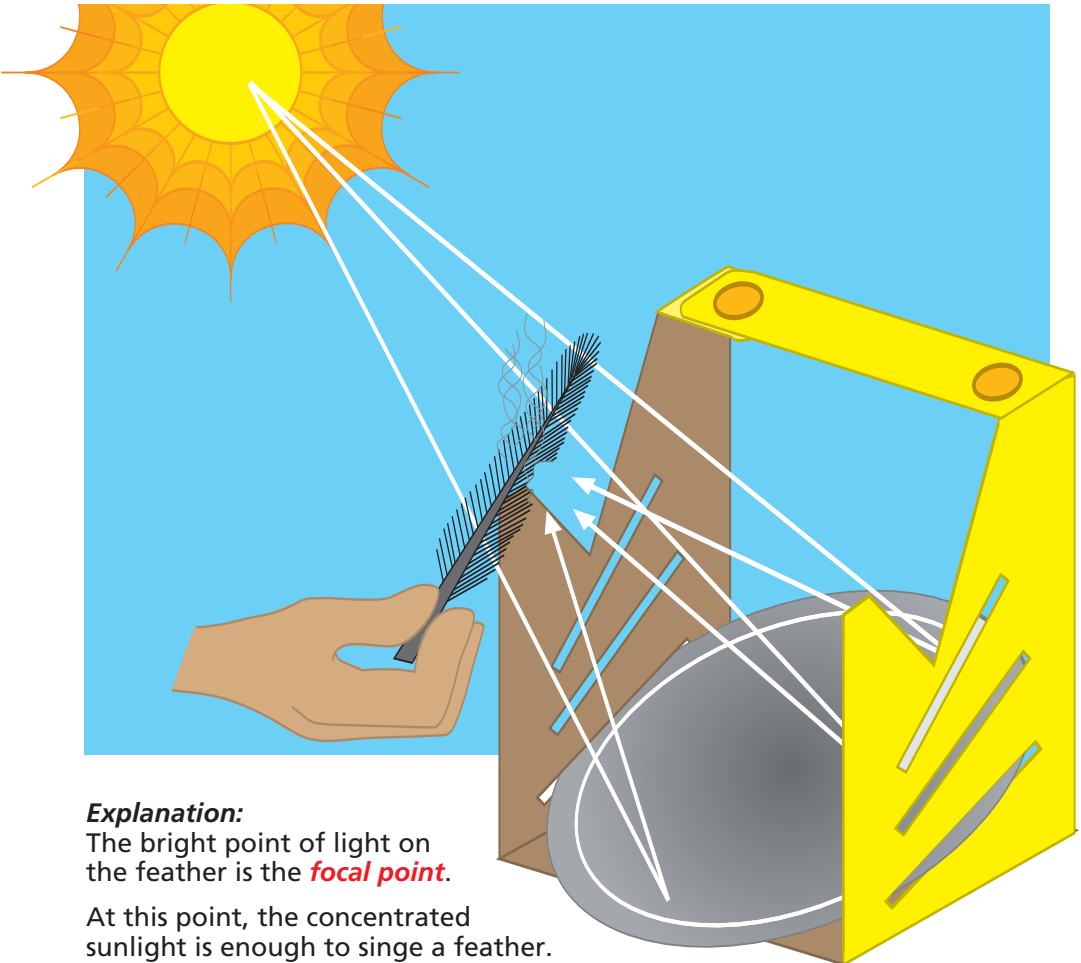
Burning a Feather

Equipment:

- solar furnace
- feather

For this activity you will need a small, dark bird feather (check under any tall tree) or you can use a single ply of facial tissue.

- 1 Choose the best position for the parabolic reflector so that it points to the sun. Hold the feather above the reflector, move it a little bit up and down, left and right, until you see a very bright point of light on it. Soon the feather will start to smoke.



Explanation:

The bright point of light on the feather is the **focal point**.

At this point, the concentrated sunlight is enough to singe a feather.

ACTIVITY 18



Sun Warning!

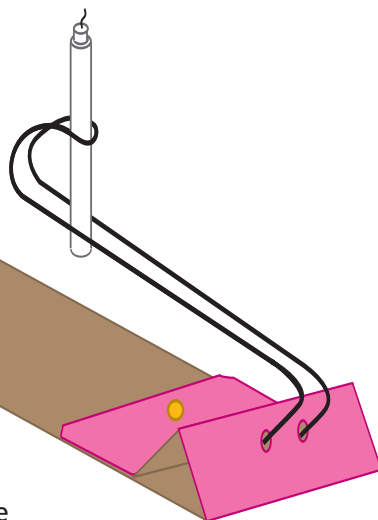


Adult supervision is required for this activity.

Melt a Candle

Equipment:

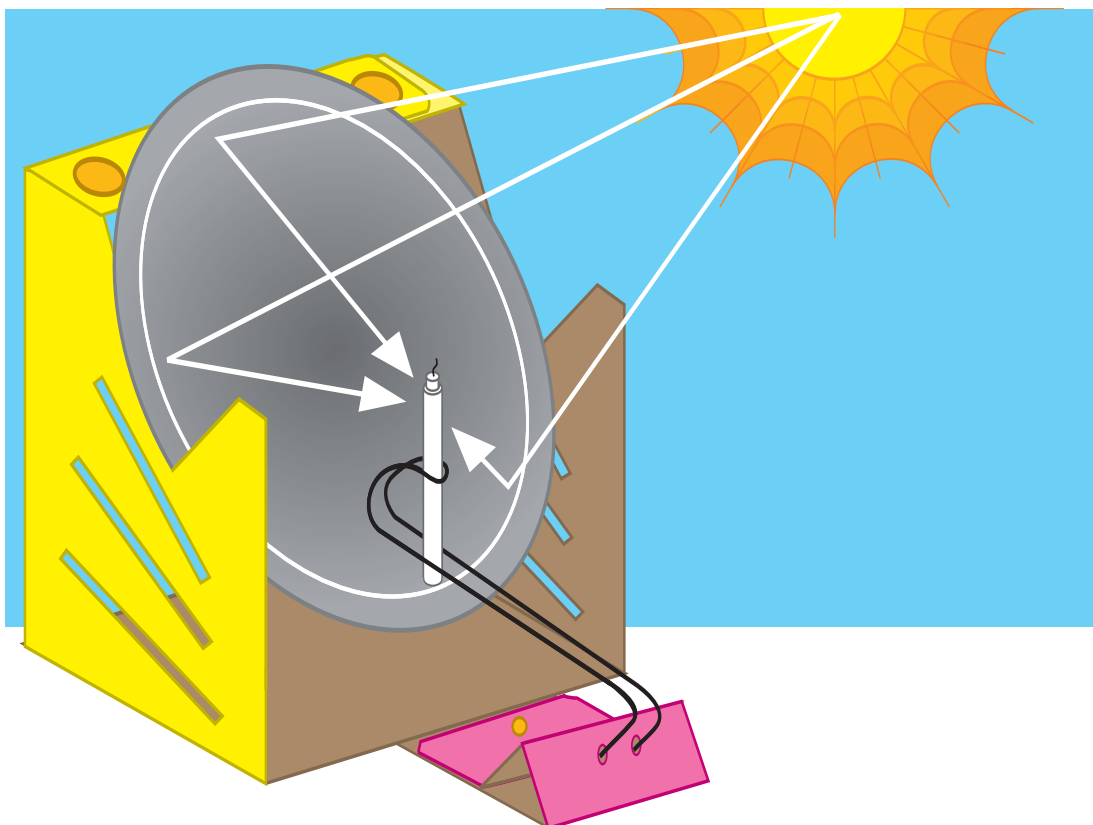
- solar furnace
- test tube support
- candle



1 Insert a candle into the test tube holder, as shown.

2 Place the test tube stand in front of the solar furnace, making sure that the candle is at the **focal point** of the parabolic reflector.

Keep the whole set up under sunlight for about one hour and then touch the candle at the focal point. It will be much softer because it is starting to melt!





A Little Outside Help

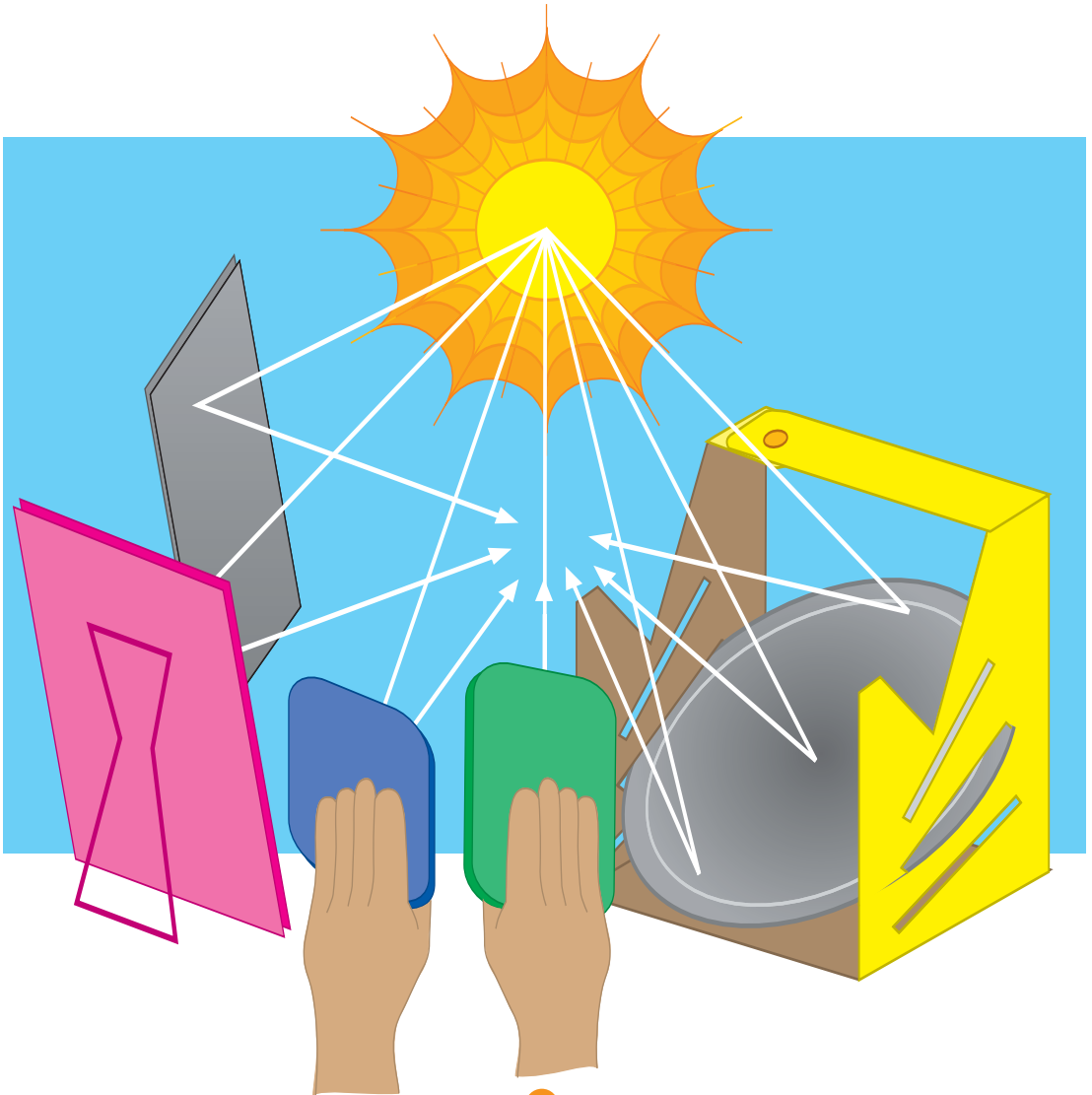
Equipment:

- solar furnace
- several mirrors

The parabolic reflector on the solar furnace faces the sun. It collects all the sunlight that falls on it and concentrates it at the focal point.

What would happen if you reflected some additional sunlight by means of an ordinary mirror, or even several mirrors?

- 1 Try building a set-up like the one below, and then try performing the last few activities again. Compare your new results with the previous ones. Can you increase the heat at the focal point significantly?



ACTIVITY 20

How Do Solar Cells Work?

The basic principle of the solar cell is not very difficult to understand.

Photons are the energy particles from the sunlight.

Electrons are the negatively charged electrical particles.

Protons are the positively charged electrical particles.

When photons strike any surface on your solar cell, they cause electrons in the material to move about. Since electric current is simply a flow of electrons, if we can get the electrons to flow instead of move around randomly, we will have a usable electric current.

A solar cell does exactly that; it causes the moving electrons to flow in a specific direction.

The solar cell is constructed of three different layers:

- The top layer, called the **P layer**, is composed of fixed electrons and free protons and is positively charged.
- The bottom layer, called the **N layer**, is composed of the exact opposite; fixed protons and free electrons and is negatively charged.
- The middle layer (a barrier layer), called the **P-N junction**, prevents the free particles of opposite charges from uniting.

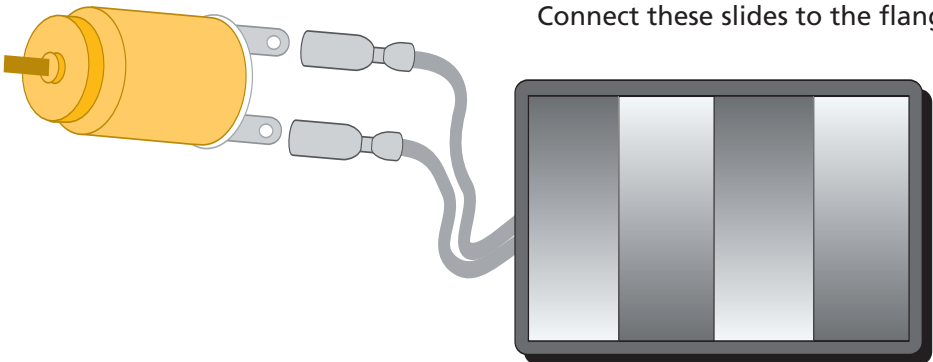
When the photons strike the top layer of the cell, they penetrate through the ultra thin N layer far enough to cause some of the free particles of each layer to move. Since the P-N junction prevents them from uniting, they are forced to flow through the wires.

This flow is **electricity**.

How to connect the solar cell to the motor

- 1 Look at the motor.
Notice the two flanges.

- 2 Examine the solar cell.
Notice the two metal slides at the ends of the wire.
Connect these slides to the flanges.



ACTIVITY 21

Assembling the Solar Cell Support

Equipment:

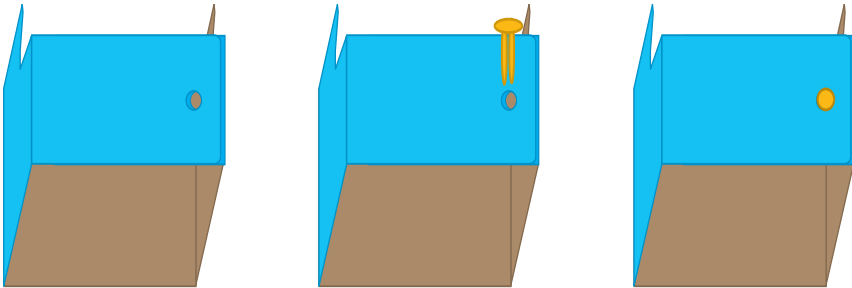
- solar cell
- solar cell support (cardboard)
- paper fastener

- 1** Place the cardboard solar cell support, with the colored side down, on a flat table.



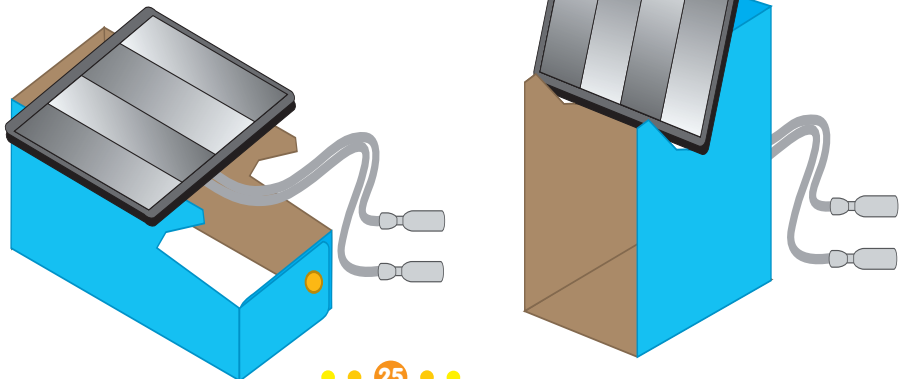
- 2** Fold each end of the cardboard towards the middle so that the two small round holes are directly above one another.

Insert the paper fastener, from the top down, through the two small holes.



- 3** This support can hold the solar cell in two ways.

Choose which way is more convenient for you to work with.



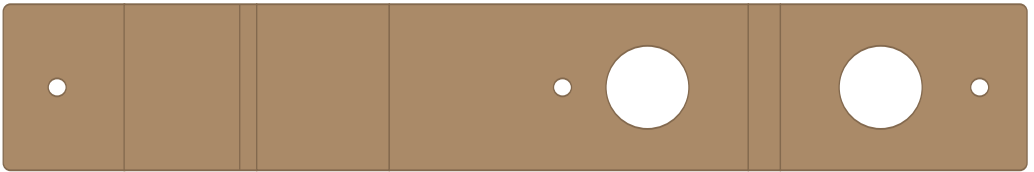
ACTIVITY 22

Assembling the Motor Support

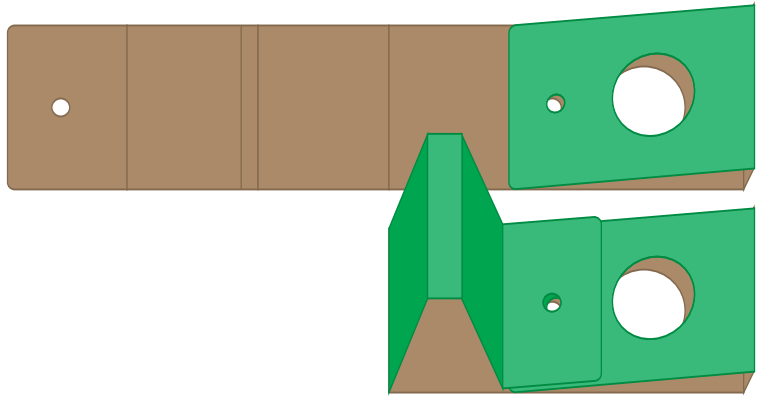
Equipment:

- electric motor
- motor support (cardboard)
- paper fastener

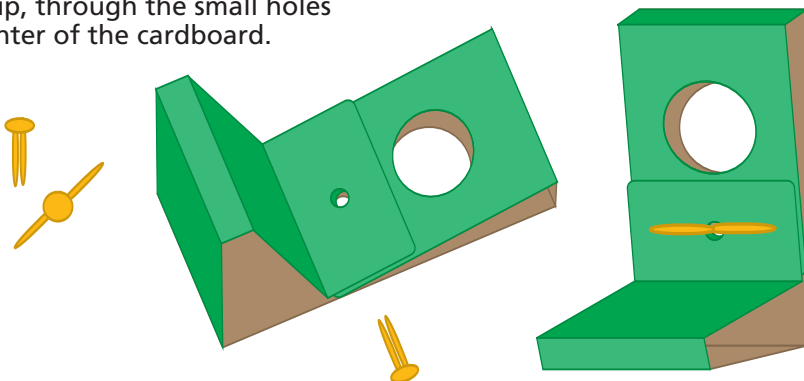
- 1 Place the cardboard motor support, with the colored side down, on a flat table.



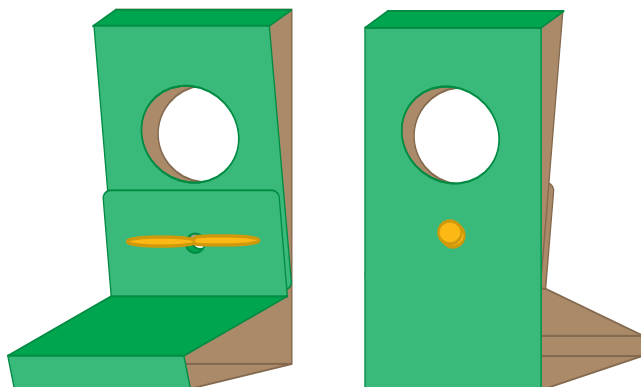
- 2 Fold each end of the cardboard towards the middle so that all of the round holes are directly above one another.



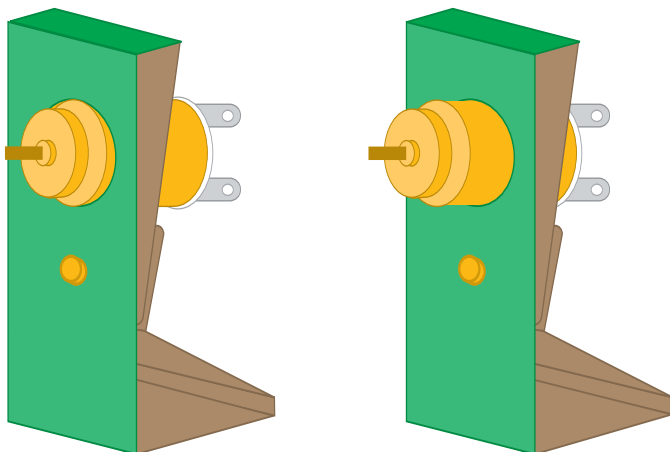
- 3 Insert the paper fastener, from the bottom up, through the small holes in the center of the cardboard.



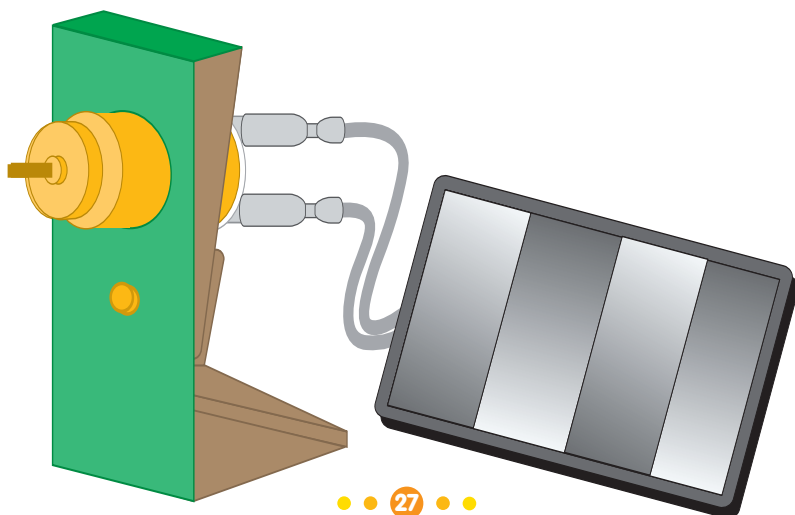
4 If you stand the motor support on the table, it should look like this.



5 Slide the motor into the large round hole. Push the motor forward as much as possible. The completed assembly should look like this.



6 Attach the slide ends of the solar cell to the flanges on the electric motor.



ACTIVITY 23



Sun Warning!

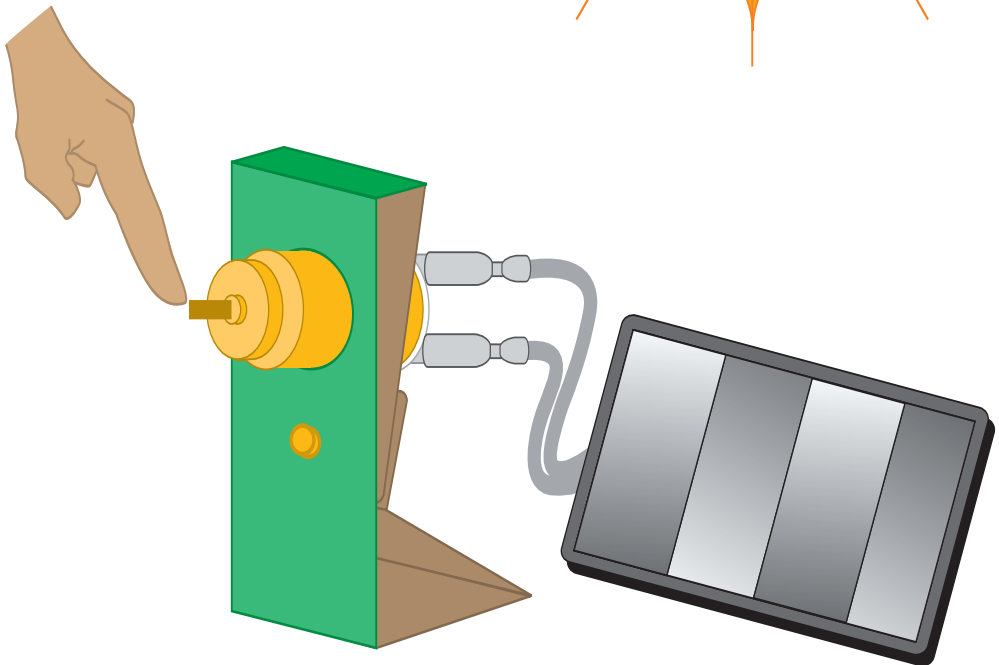
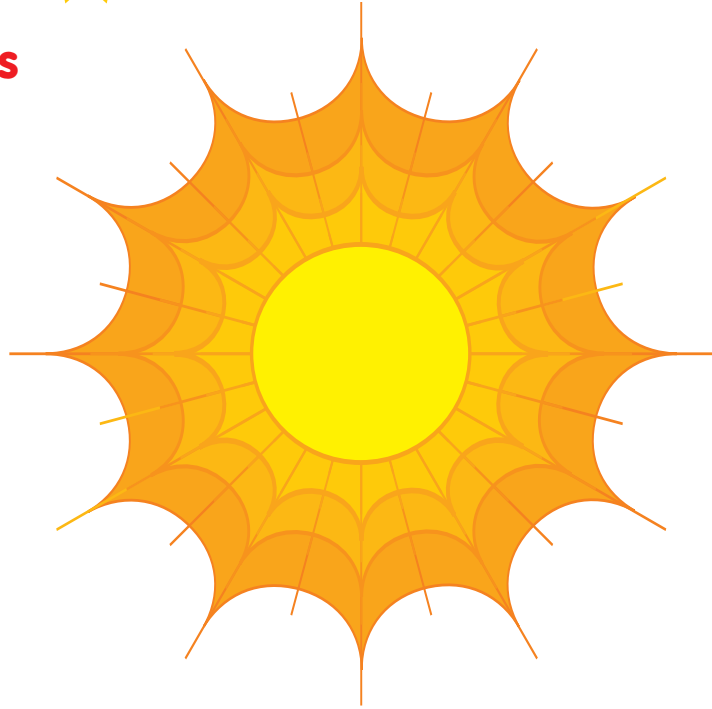
Solar Energy Powers an Electric Motor.

Equipment:

- solar cell
- electric motor
- motor support

1

When you point the solar cell towards the sun, the shaft on the electric motor will begin to rotate. Gently touch the shaft with your finger to feel the movement.



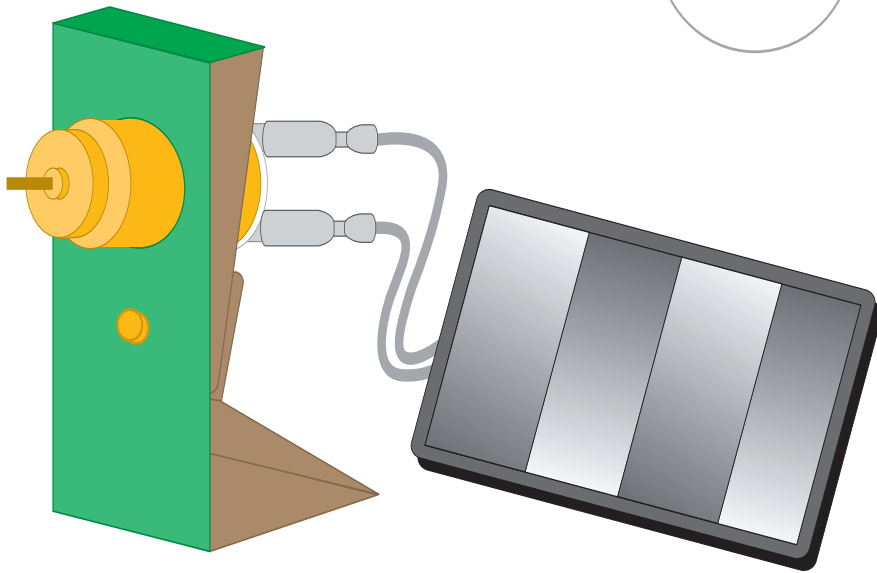
ACTIVITY 24

Can You Make the Motor Spin Even on a Rainy Day?

Equipment:

- solar cell
- electric motor
- motor support
- table lamp (light bulb)

- 1 Hold the motor and solar cell near a bright electric light bulb. The motor will rotate as before.



Note:

If you use a **fluorescent (neon) light**, the electricity produced by the solar cell will not be enough to turn the motor.

Interesting isn't it? The fluorescent light *seems* to be brighter than an ordinary light bulb, but it doesn't produce as much electricity.

ACTIVITY 25

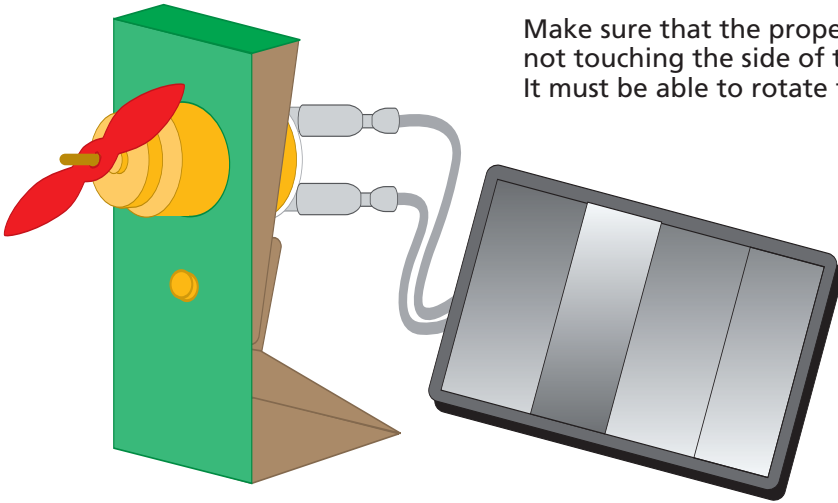
The Propeller

Equipment:

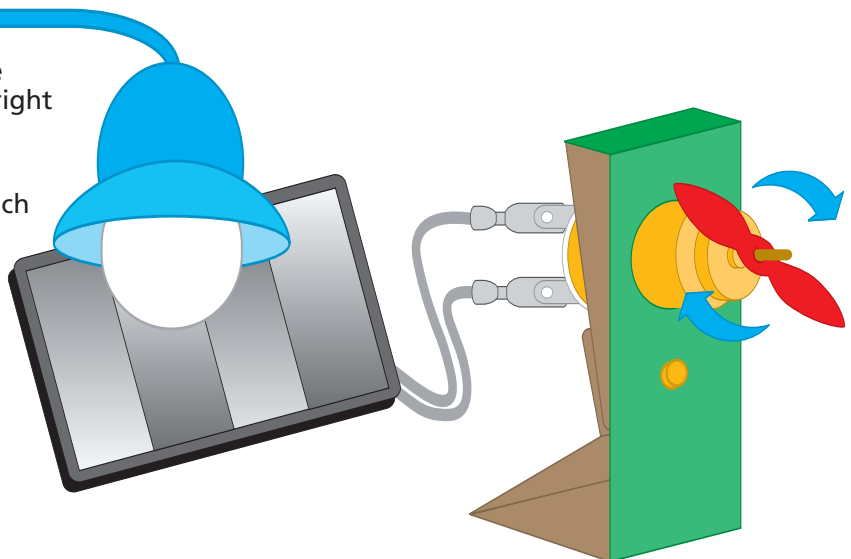
- solar cell
- electric motor
- motor support
- propeller
- table lamp (light bulb)

- 1 Attach the propeller to the motor. Place the center hole of the propeller over the motor shaft and push it gently.

Make sure that the propeller is not touching the side of the motor. It must be able to rotate freely.



- 2 Place the whole set up near a bright electric bulb. Observe the direction in which the propeller turns.



Reversing the polarity

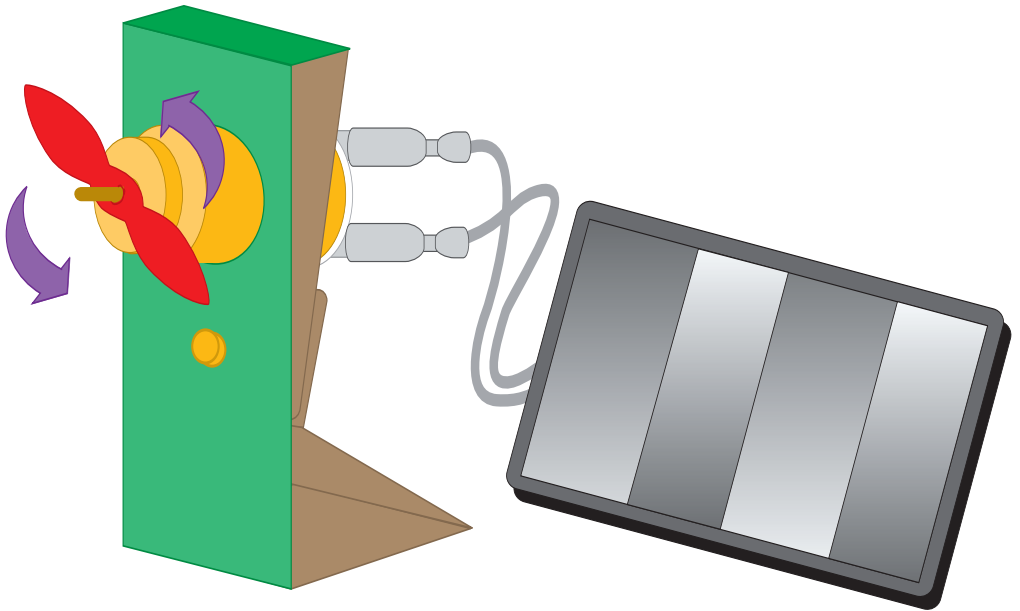
1 Slide the ends of the flanges off of the motor and reattach them in reverse.

- The “slide end” which was on the right flange should now be connected to the left flange.
- The “slide end” which was on the left flange should now be connected to the right flange.

Explanation:

You have “crossed over” the wires, and the motor will now rotate in the opposite direction.

This is called **reversing the polarity**.



ACTIVITY 26



Adult supervision
is required for
this activity.

Shaping the Propeller

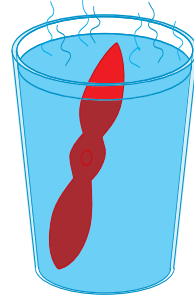
Equipment:

- solar cell
- electric motor
- motor support
- table lamp (light bulb)
- propeller
- glass
- hot and cold water
- small candle
- matches

You may have noticed that your propeller is pretty useless!

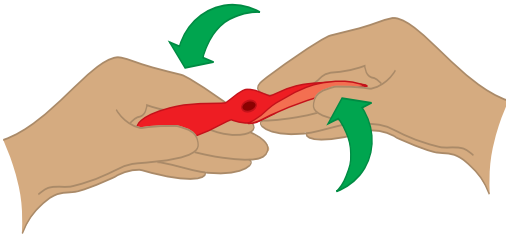
If you want the propeller to do “some work,” you need to modify it a bit by making it into the shape of a screw.

- 1** Place the propeller into hot water until it softens.

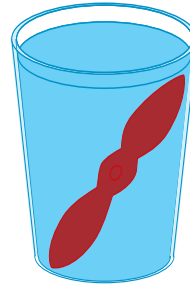


- 2** Hold the propeller with both hands and twist slightly.

Twist the right-hand side of the blade away from you, the left-hand side towards you.



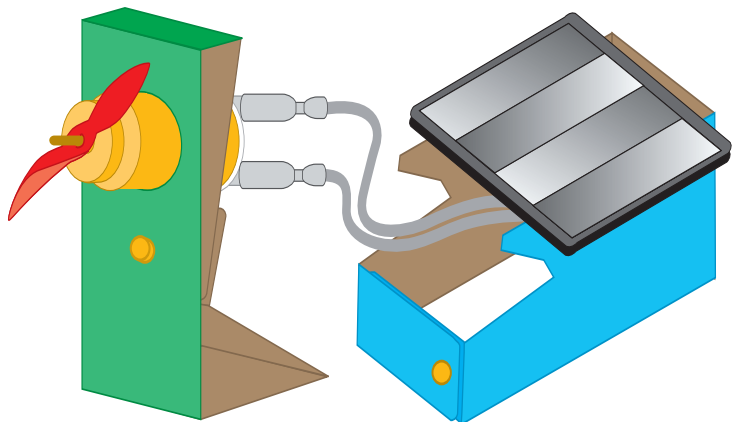
- 3** Immerse the propeller in cold water in order to reharden it.



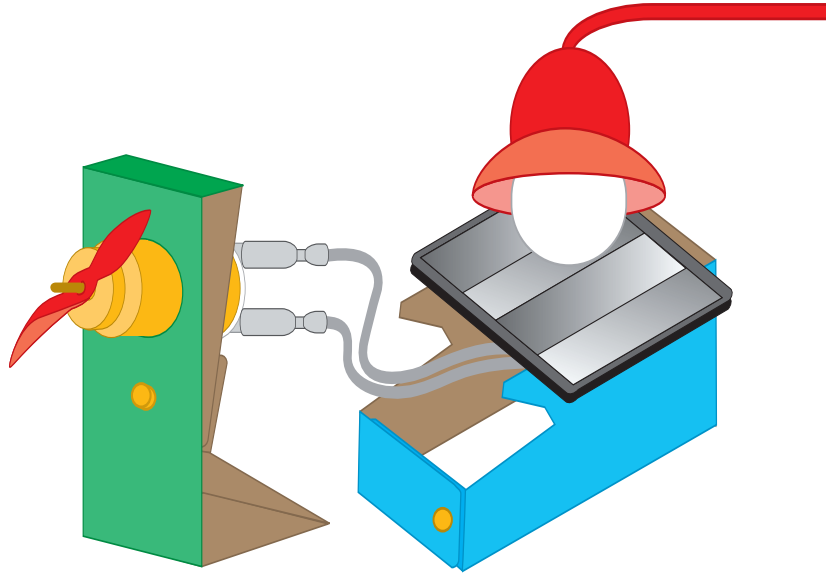
- 4** Place the motor into its support.

Attach the modified propeller to it.

Connect the motor to the solar cell, and if you choose, place it in its support.



- 5** Place the solar cell under a bright light bulb so that the propeller rotates.
It is now able to move air.



A Ventilator (fan) or an Exhaust?

The direction in which the propeller moves the air, whether away from the motor or towards it, depends in which direction the motor rotates.

If the air moves away from the motor, you have made a fan or ventilator.

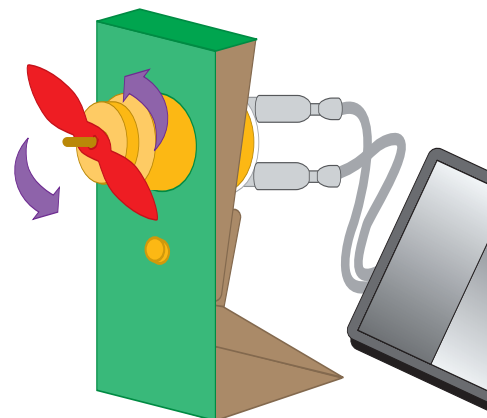
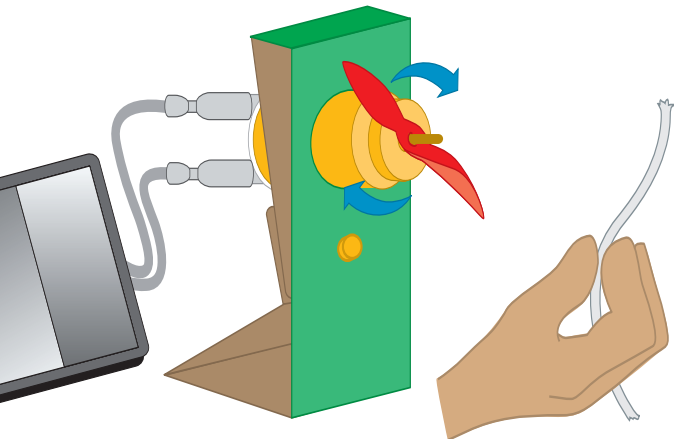
If the air moves towards the motor, then you have made an exhaust.

Carefully try this:

You can easily find out in which direction the air is moving by looking at a piece of thread.

- 6** Hold a piece of thread in front of the rotating propeller.
Look at the thread.
In which direction does the air move?

- 7** Now reverse the polarity as you did in **ACTIVITY 25**.
Look at the thread again.
Do you have an exhaust or a ventilator?



ACTIVITY 27

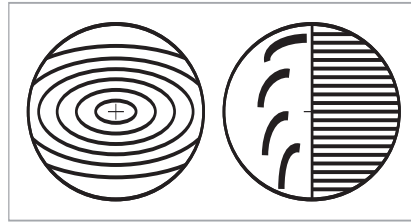
The Moving Patterns

Equipment:

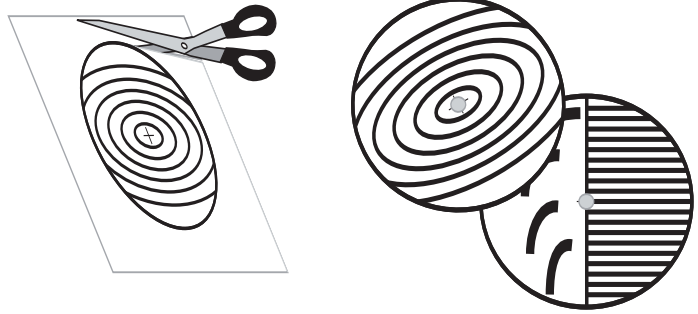
- solar cell
- electric motor
- motor support
- table lamp (light bulb)
- pattern discs
- cardboard
- pen
- scissors

You may use your electric motor to spin printed patterns which create optical illusions.

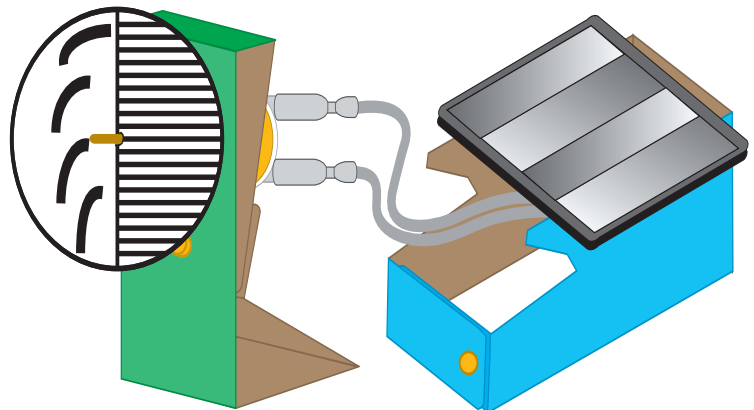
- 1 Find the cut-out sheet with the two discs illustrated below.



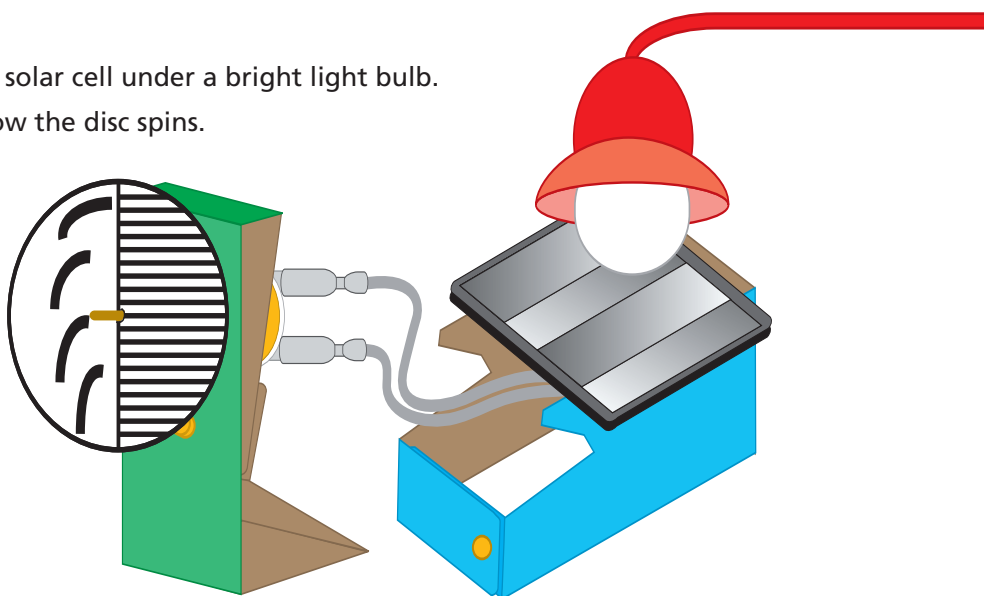
- 2 Carefully cut out the two discs.
Make a small hole in the center of each disc.



- 3 Place the motor into its support.
Attach one of the discs to the shaft.
Connect the motor to the solar cell, and if you choose, place it in its support.



- 4 Place the solar cell under a bright light bulb.
Watch how the disc spins.

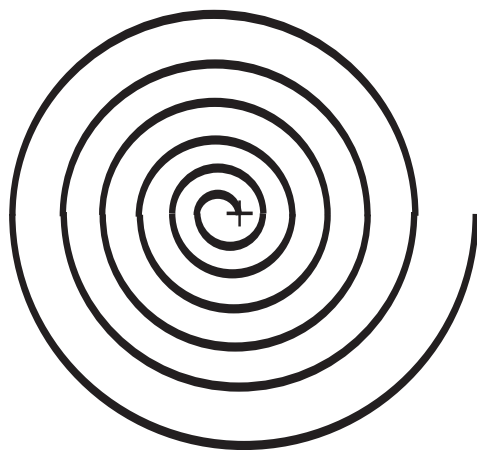
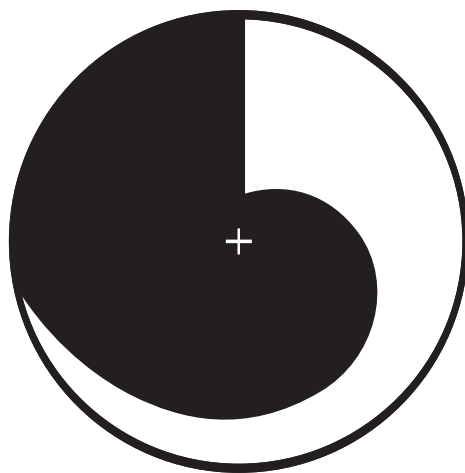


- 5 If you would like to see more patterns in motion, you can prepare some discs of your own.

Copy the following patterns to a piece of white cardboard.

Cut out the discs and make a small hole in the center of each one.

Repeat steps 4 and 5.



ACTIVITY 28

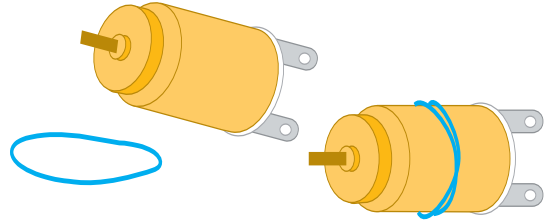
Airplane Mobile

Equipment:

- solar cell
- thread
- propeller
- cardboard airplane
- rubber band
- adhesive tape
- scissors

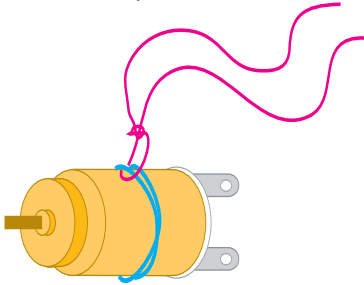
- 1** Place a rubber band around the middle of the motor.

Make sure it is secure.



- 2** Tie a length of thread, at least 20-inches (about 50 cm) long, to the rubber band.

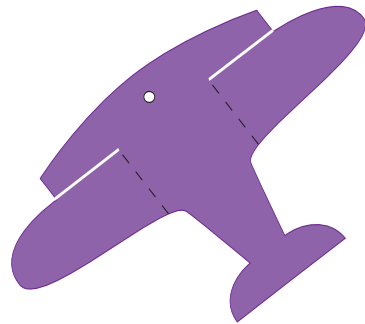
Do this by placing the thread between the motor and the rubber band, as shown.



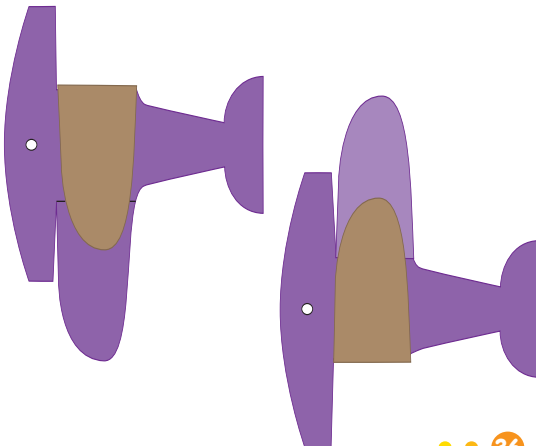
- 3** Find the airplane on the cut-out sheet.

Cut it out carefully with a pair of scissors.

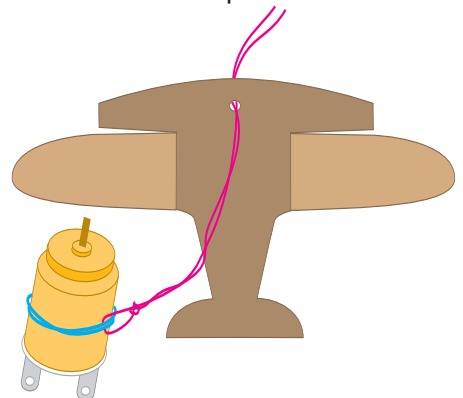
Make a hole in the white circle, and also cut along the two white lines, making two slots.



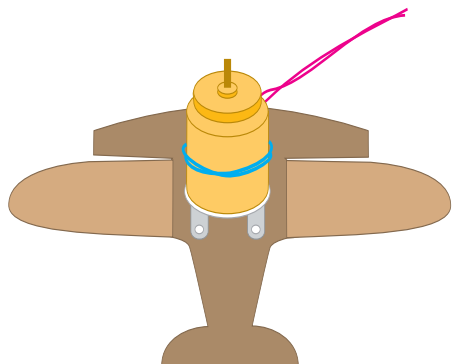
- 4** Fold each airplane wing along the dotted lines, as shown.



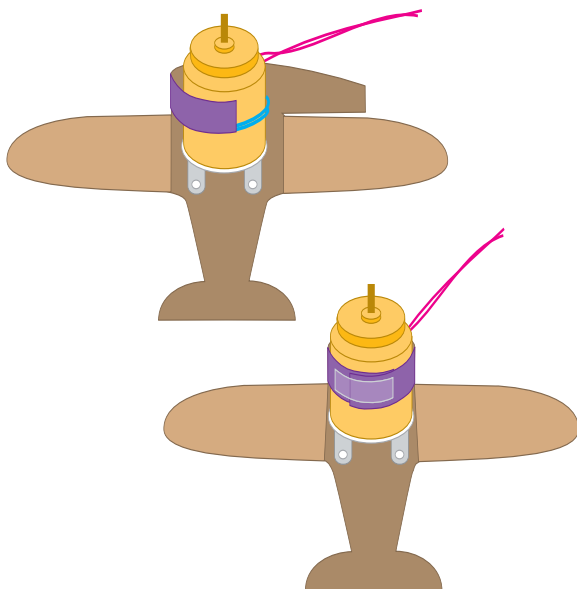
- 5** Hold the motor by the thread, and insert the thread through the hole on the airplane.



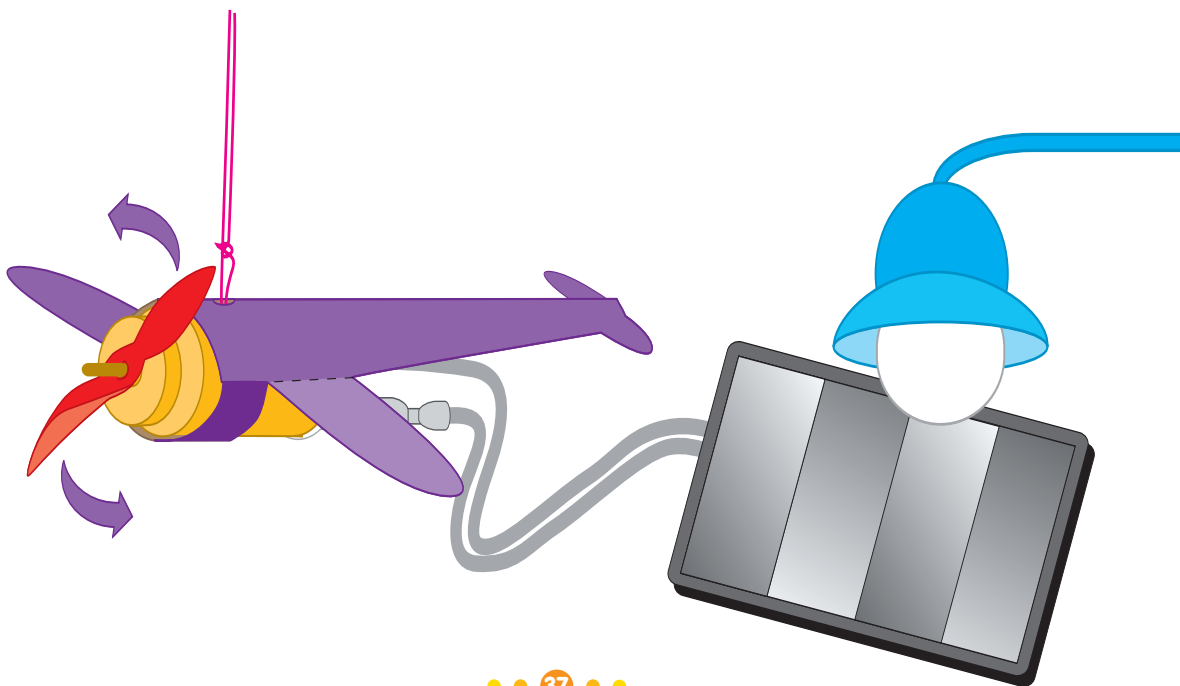
- 6** Pull the thread so that it is taut. The motor should be at the edge of the airplane with the shaft sticking out.



- 7** Fold the two front tabs together around the motor, like a belt. Tape them together so that they hold the motor securely.



- 8** Attach the propeller to the motor. Attach the motor to the solar cell. Find a convenient place to hang the airplane, and place the solar cell under a light bulb. Watch the propeller spin! Does it move the plane?



ACTIVITY 29

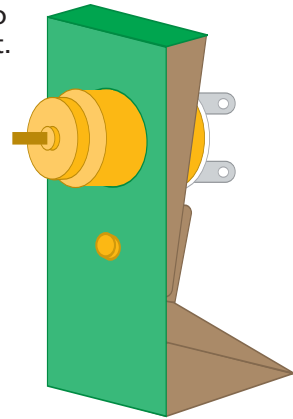
Make a Carousel (The Function of Distance)

Equipment:

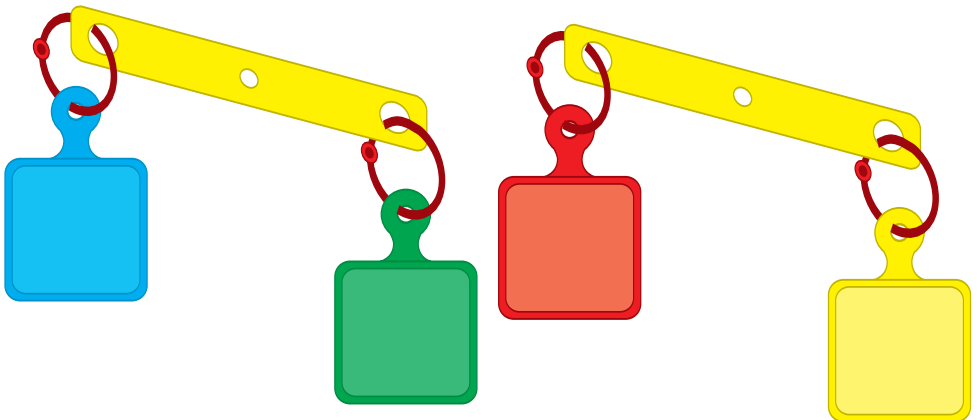
- solar cell
- electric motor
- motor support
- table lamp (light bulb)
- 4 colored filters
- 2 plastic sticks
- 2 plastic rings

By now, you probably discovered that the speed at which the motor turns depends on the distance between the solar cell and the lamp.

- 1 Place the motor into its support.



- 2 Connect two colored filters to each plastic stick, using the rings.

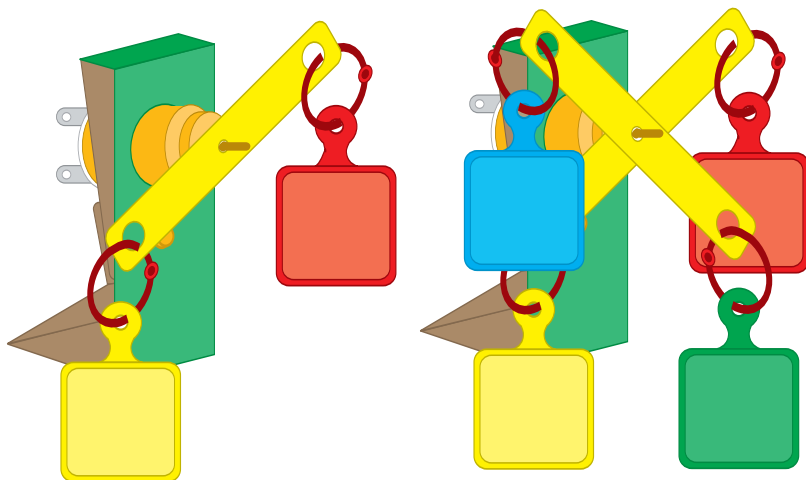


Read this after you complete the experiment.

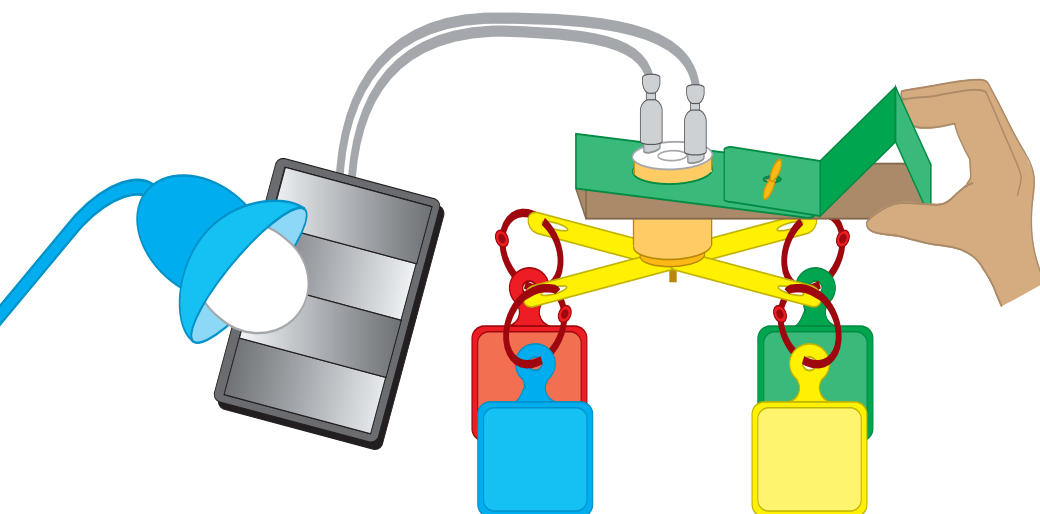
Explanation:

The bulb gives out energy. The distance between the solar cell and the bulb influences the amount of absorbed energy. The solar cell absorbs the energy and produces electricity from it. The motor's speed is determined by the amount of electricity produced.

- 3 Attach the two plastic sticks to the motor. Place the hole at the center of each stick over the motor shaft and push gently.



- 4 Connect the motor to the solar cell and place it under a table lamp. Hold the motor support horizontally and watch what happens. The colored carousel starts to turn. At first it turns very slowly, then it gains speed and the beautiful colors spin around and around.



- 5 Now move the solar cell a little bit away from the light bulb. Does the carousel slow down or stop? Can you control the carousel's speed? Can you demonstrate the relationship between the amount of electricity produced by the solar cell and its distance from the bulb?

ACTIVITY 30

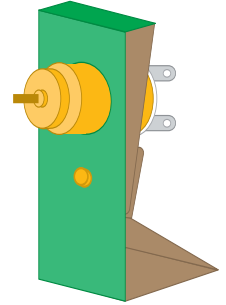
Make a Bird Mobile (The Function of Quantity)

Equipment:

- solar cell
- electric motor
- motor support
- table lamp (light bulb)
- 4 colored filters
- 2 cardboard birds
- plastic stick
- thread

In **ACTIVITY 29** you demonstrated the relationship between the amount of electricity produced and the distance from the solar cell to the bulb.

In this activity you will find another way of influencing it.

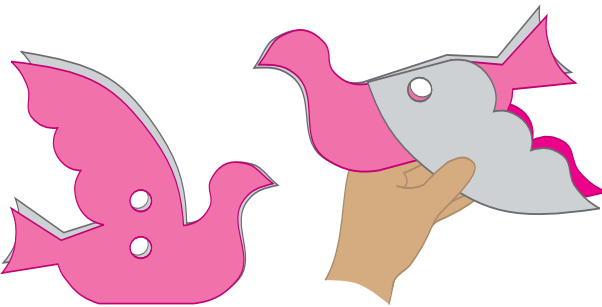


1 Place the motor into its support.

2 Identify the two birds on the cut-out sheet. Carefully cut them out with a small pair of scissors. Make a hole in each white circle.

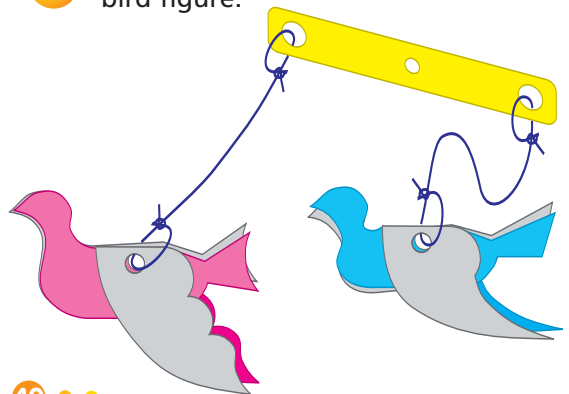
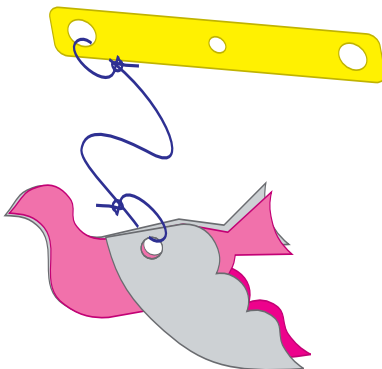
3 Fold the birds' wings down so that the four holes are aligned.

4 Now tie a length of thread through the four holes, as shown.

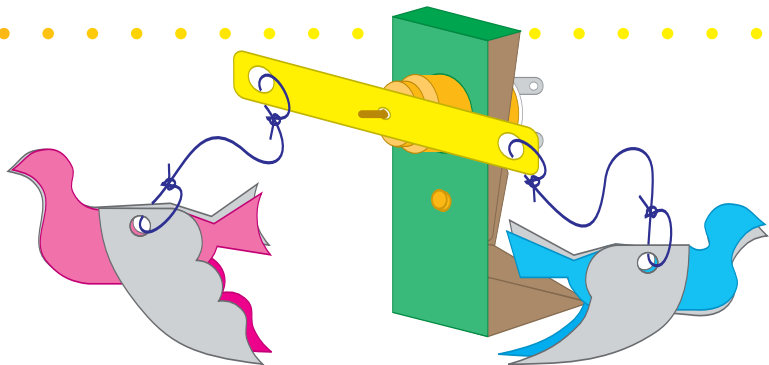


5 Tie the other end of the thread to the plastic stick.

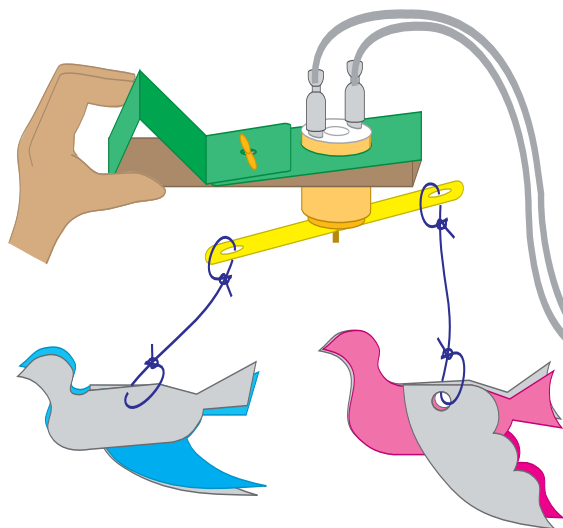
6 Do the same with the second bird figure.



7 Attach the plastic stick to the motor by placing the hole at the center over the motor shaft and pushing gently.

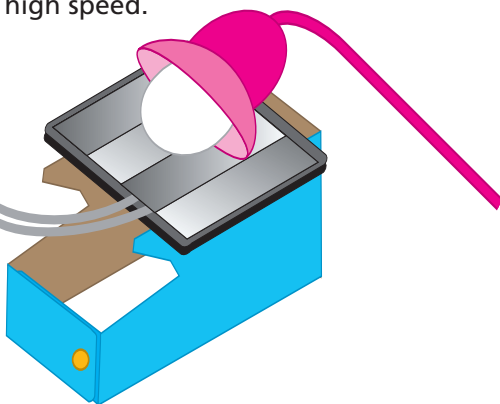


8 Hold the motor support horizontally.



9 Connect the motor to the solar cell and place it under a table lamp.

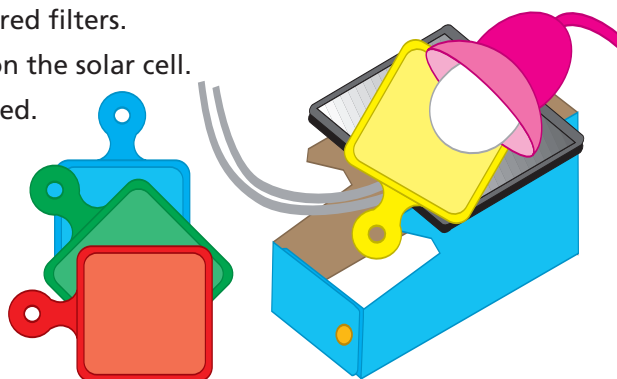
Make sure that it is close enough to the bulb so that the "bird mobile" will turn at high speed.



10 Now start to experiment with the colored filters. Place each one of them, one at a time, on the solar cell. Notice how the mobile changes its speed.

Later on, combine two or even three filters, placing them on the solar cell at the same time.

Is there a combination that stops movement completely?



Explanation:

As you already know, the bulb gives out energy (light and heat). Each colored filter, by filtering light rays, stops part of the energy from reaching the solar cell. If less energy reaches the solar cell, less energy is absorbed and less electricity is produced. Therefore, the motor will turn at a lower speed, or will even stop.



Combining the Solar Furnace and the Solar Cell

Equipment:

- solar furnace
- solar cell
- electric motor
- motor support
- table lamp (light bulb)

You can use the solar furnace to reflect the light from a bulb to the solar cell which will then power the electric motor.

Knowing that this is true, assemble the set-up as illustrated below.

Try repeating all of the previous activities with the electric motor using this set-up.

- 1 Place the solar furnace so it faces towards a light bulb.
Put the solar cell on its support facing the furnace.
Place the electric motor in its support and connect it to the solar cell.
Turn on the light bulb, and the motor shaft will start to turn.

