Problem-Solving Strategy

Just like Aristotle and Galileo a long time ago, most scientists do not always look for explanations and answers in exactly the same way. But most do work through a process. They don't always follow these steps exactly the same way every time they look for answers and solutions to problems. But they usually do each step.

Problem-Solving Steps	
1. Define the problem	What am I trying to find out?
2. Gather evidence	What do I already know? And what else do I need to know?
3. Make a prediction	What do I think will happen?
4. Experiment	How can I test my prediction?
5. Gather results	What did my experiment show?
6. Draw a conclusion	What did I learn about the problem?
7. Raise new Questions	What do I still not understand? What new problem does my conclusion or solution create?

Look back at the activities and experiments you've done before. Can you think of any activities or experiments in which you followed steps like these? Now, as you work through this book, remember these steps and try to follow them with every new investigation and experiment.

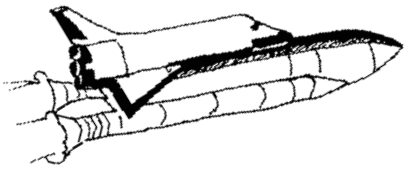
Techniques of Scientists

Scientists try to work in systematic, careful ways. They have created different ways of organizing information.

Scientists use equipment to organize information. They can look at tiny atoms, distant galaxies, and the secrets of nature with such modern equipment as telescopes and electron microscopes.

Scientists organize information by very careful measurement. They are careful when they measure enormous distances between stars or the tiny dimensions of a cell.

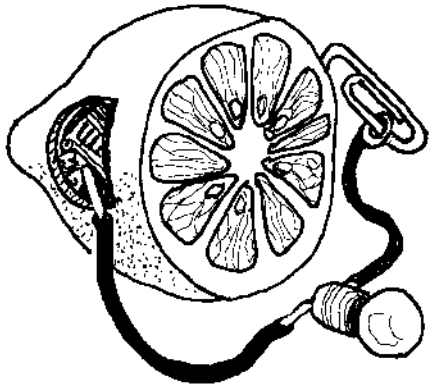
Scientists organize information by classification. Scientists classify many objects around us. They classify things to give nature some kind of order. For example, scientists classify plants and animals. The charts on pages 15 and 16 show how some scientists classify plants and animals today.



Getting a Charge from a Lemon

Getting electricity from a comb or a balloon is neat. But you can get electricity from some other real interesting things, too. You can make a very weak battery from a lemon. A battery really needs only two kinds of metal and an acid to make electricity. A car battery has sulfuric acid, which is a very powerful and dangerous acid. A lemon has citric acid, which is not real powerful and is not dangerous.

Make a Lemon Battery



What you need:

a paper clip
a lemon
a piece of copper wire or a penny
a flashlight light bulb

What to do:

1. Make sure there is no insulation on the ends of the copper wire. Put one end of the copper wire into the lemon. Make sure it goes through the skin to the fruity part.
2. Straighten part of a paper clip. Put one end of the paper clip into the lemon. Make sure it goes into the fruity part.
3. Hold the ends of the paper clip and the copper wire sticking out of the lemon. Touch the metal end of the flashlight light bulb with both wires (or the paper clip and the penny) at the same time.

Describe what happened. You may have to look very closely at the bulb. A lemon makes a very weak battery. If you touch your tongue to the two wires, you will probably feel a very tiny tingle. The water on your tongue makes a good conductor. Remember, this was just a lemon. NEVER touch other bare wires.

Try to think of another way you can get energy from a lemon. This other kind of energy is the same kind of energy you can get from a banana, a glass of milk, and a peanut butter sandwich.

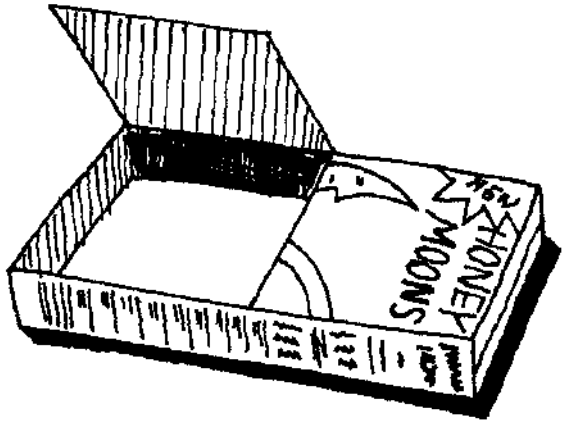
Just for Fun

You can turn a cereal box into a kind of camera. Point it out the window and you will see a miniature picture show right inside the box.

Cereal Box Camera

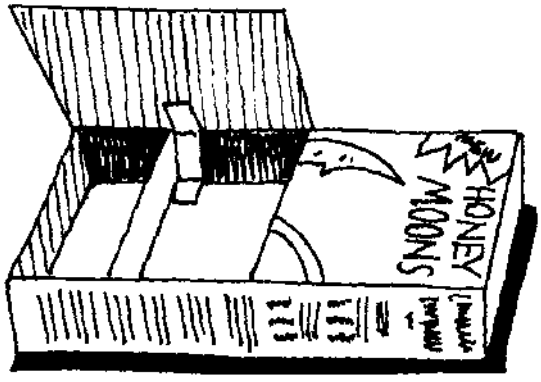
What you need:

an empty cereal box
scissors
waxed paper
a pin
tape



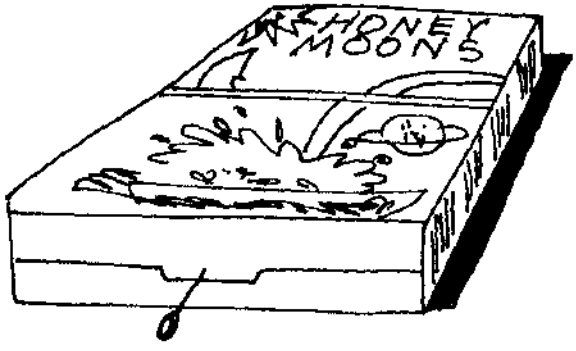
What to do:

1. Measure your cereal box to make sure it is at least 12 inches tall. Remove the waxed paper from the inside and throw it away.



2. Now make a flap in the box. It should look just like the picture. Take your scissors and cut across the middle of the box. Now cut down one side. Finally, cut across the bottom so the flap opens.

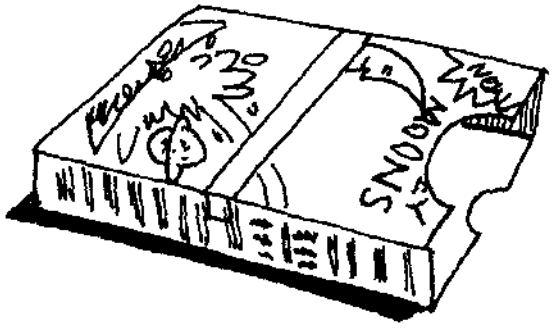
3. Take a smooth piece of waxed paper that is about two inches high. Tape both sides so the paper is standing two inches from the bottom of the box. Be sure there are no wrinkles or creases in your waxed paper. The smoother the piece, the better the camera will work.



4. Close the flap and tape it shut so that no light can get inside.

5. Using a pin, carefully poke a tiny hole in the middle of the bottom of your box.

6. Cut off the top flaps of the box. Shape the top of the box so your face will fit snugly against it. It is a good idea to cut a space for your nose.



7. Hold the box up to your eyes and point the pinhole out the window on a sunny day. Cup your hands so that as little light gets inside as possible. Light must enter only through the pinhole you made! If light leaks through the cracks in your box, cut up a brown paper bag and wrap it around the outside of your camera.

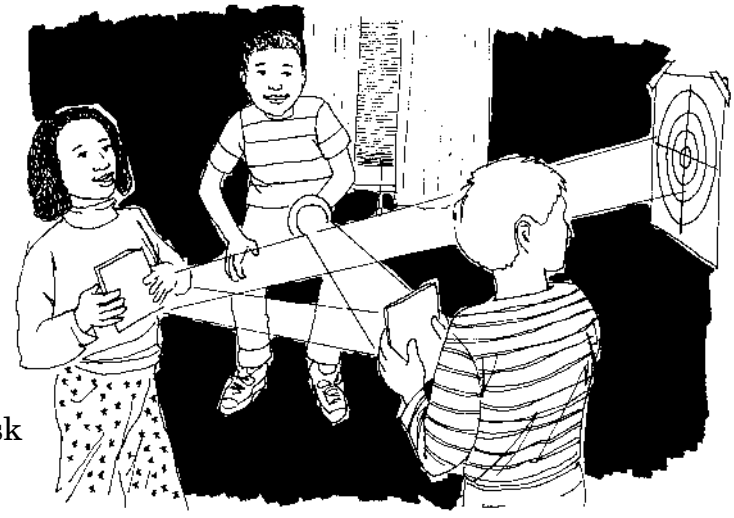
You should see a miniature upside-down picture inside the box. Light rays enter your box only through the pinhole. They fall on the waxed paper to make a little picture or image of what's outside. Light rays travel in straight lines. Those that come from low objects outside hit near the top of the waxed paper. Those from high objects outside hit near the bottom of the waxed paper, so the image is upside down.

You have built a device called a camera obscura. It has been used for centuries by artists and astronomers to project images of things they wish to see.

A real camera works on the same principle. Instead of a pinhole, it uses a lens, which can collect a lot more light rays.

Mirror Darts

You can play darts at light-speed if the darts are rays of light. You and your friends can hit a target with light rays again and again, using only mirrors.



What you need:

two partners
two mirrors
a small flashlight
a piece of paper
a pencil or pen
a dark room

What to do:

1. Draw a target on the piece of paper and ask an adult to hang it on a wall.
2. Give each of your partners a mirror.
3. Turn off the lights and turn on the flashlight.
4. Shine the flashlight at the first mirror and watch the light bounce off. Have your partners try to bounce the light reflection off their mirrors onto the target.
5. Keep shifting position until you find your target. Practice until the three of you hit the target.
6. Change positions and try again.

