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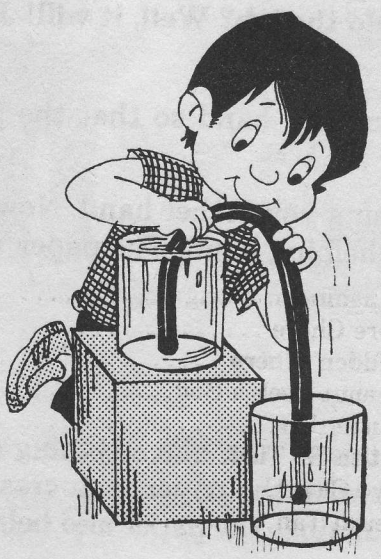
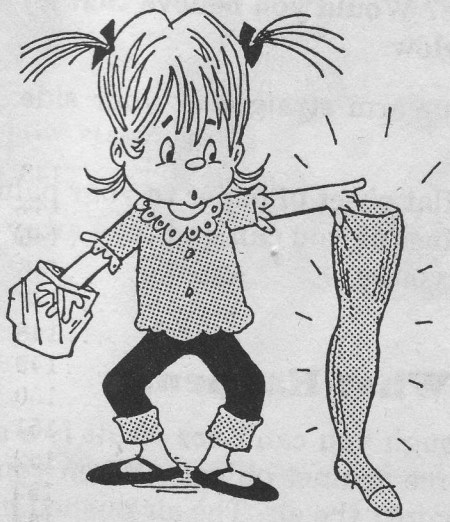




Magic Paper

You Will Need:

Sheet of paper

Instructions:

Do you know a fast way to stick a piece of paper to your hand without using any glue or tape? Would you believe that air will do the job? Well, it will! Just follow the steps below.

1. Hold your arm straight at your side. Turn your hand so that the palm faces forward.
2. Press a flat sheet of paper to your palm, using your other hand. Now start running as fast as you can and take away the helping hand. The paper will stay in place as you run.

This Is What Happens:

Even though you can't see air, it is a substance, just like anything else, and it exerts a force against objects. When you ran with the paper, you created a force pushing against the air. The air pushed back against the paper and held it in place against your hand.

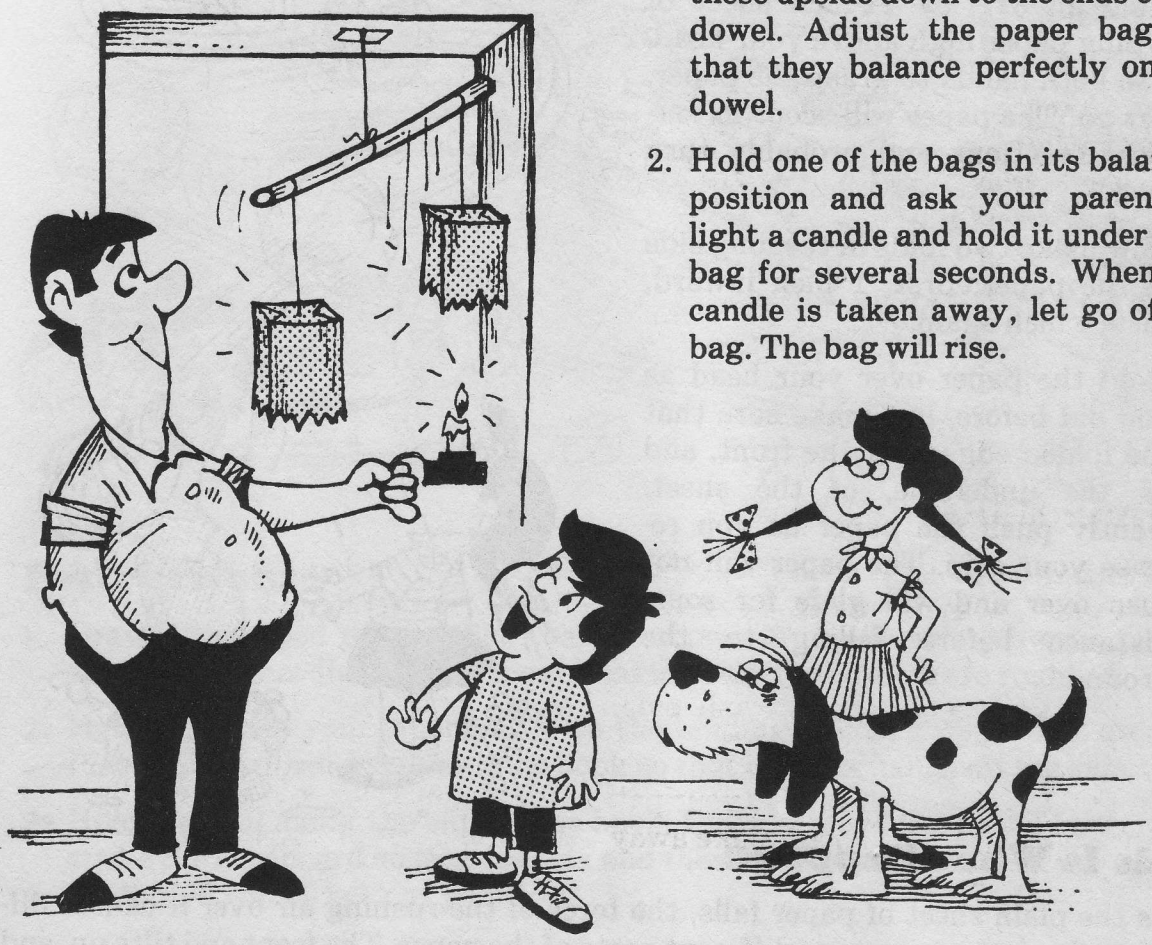
You Will Need:

String
Wooden dowel
Tape
2 paper lunch bags
Candle
Matches
THE HELP OF ONE OF YOUR PARENTS

Instructions:

What is lighter than air? Do this experiment to find the answer.

1. Tie a piece of string to the center of a wooden dowel and attach the free end of the string to a support, such as the center of a doorway. Tape equal lengths of string to the bottom of 2 paper lunch bags and tie these upside down to the ends of the dowel. Adjust the paper bags so that they balance perfectly on the dowel.
2. Hold one of the bags in its balanced position and ask your parent to light a candle and hold it under that bag for several seconds. When the candle is taken away, let go of the bag. The bag will rise.



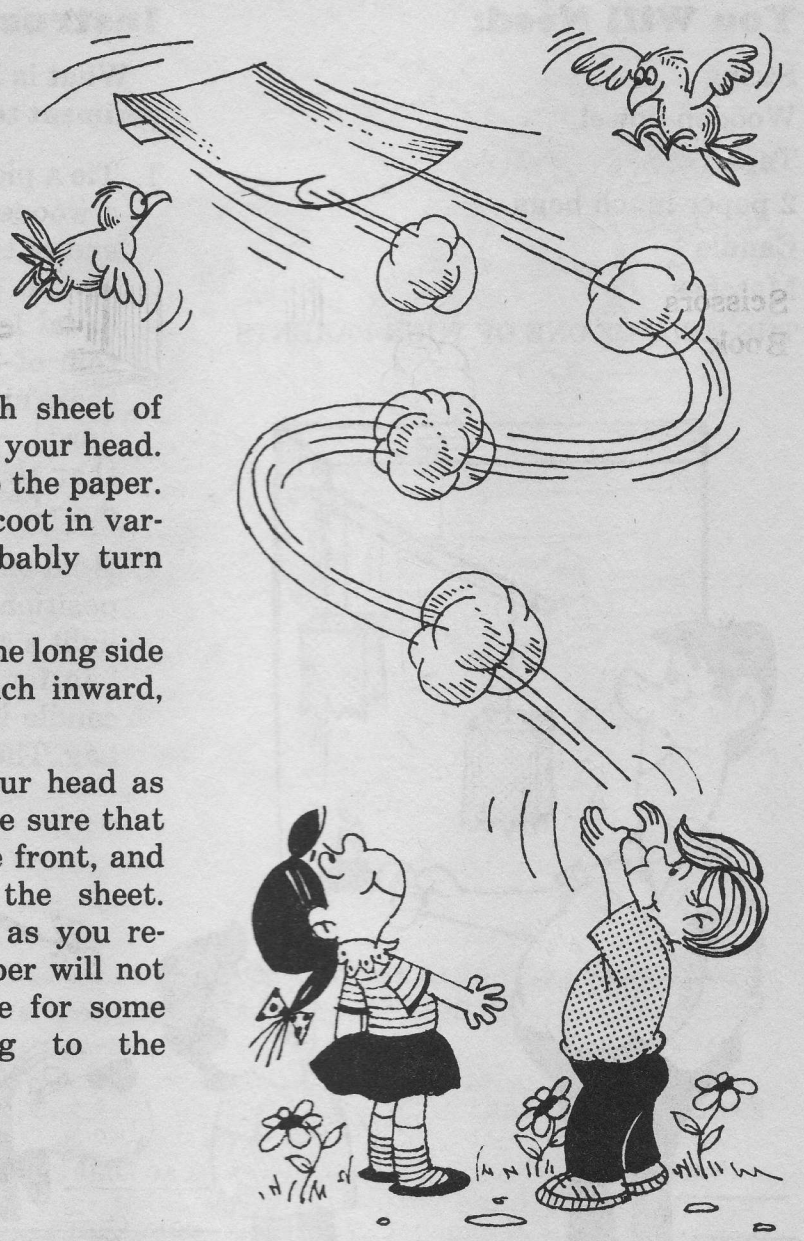
This Is What Happens:

The candle flame heats the air *inside* the bag. This hot air is surrounded outside by cooler air. The cooler air is heavier than the hot air and lifts the bag of hot air upwards. What is lighter than air? Air, of course!

Come Glide with Me

You Will Need:

Sheet of typing paper



Instructions:

1. Hold an 8½- by 11-inch sheet of typing paper high above your head. Use both hands to grasp the paper. Let go. The paper will scoot in various directions and probably turn over.
2. Now make two folds in the long side of the paper, first, 1 inch inward, then, 1 inch again.
3. Hold the paper over your head as you did before, but make sure that the folded edge is at the front, and on the underside, of the sheet. Gently push the paper as you release your grip. The paper will not turn over and will glide for some distance before falling to the ground.

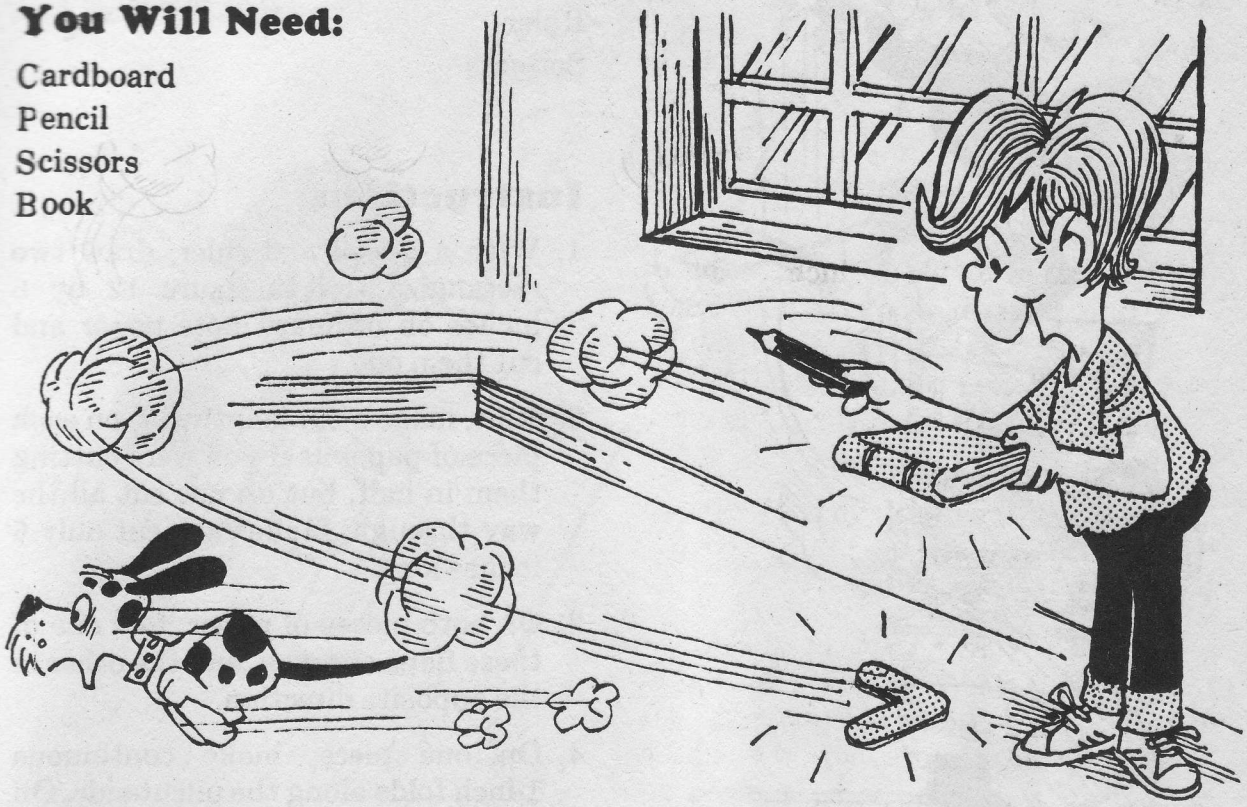
This Is What Happens:

As the plain sheet of paper falls, the force of the rushing air over it causes differences in air pressure over different parts of the paper. The front end tilts up, and the paper may move in a topsy-turvy fashion. However, by folding the edge, you increase the weight that is at the front, and this weight balances the upward force of air, causing the paper to glide smoothly without flipping over. Airplane wings are shaped like this also—they are a little bit heavier in front than they are in the rear—which helps make the ride a smooth one.

Please Step Aside

You Will Need:

Cardboard
Pencil
Scissors
Book



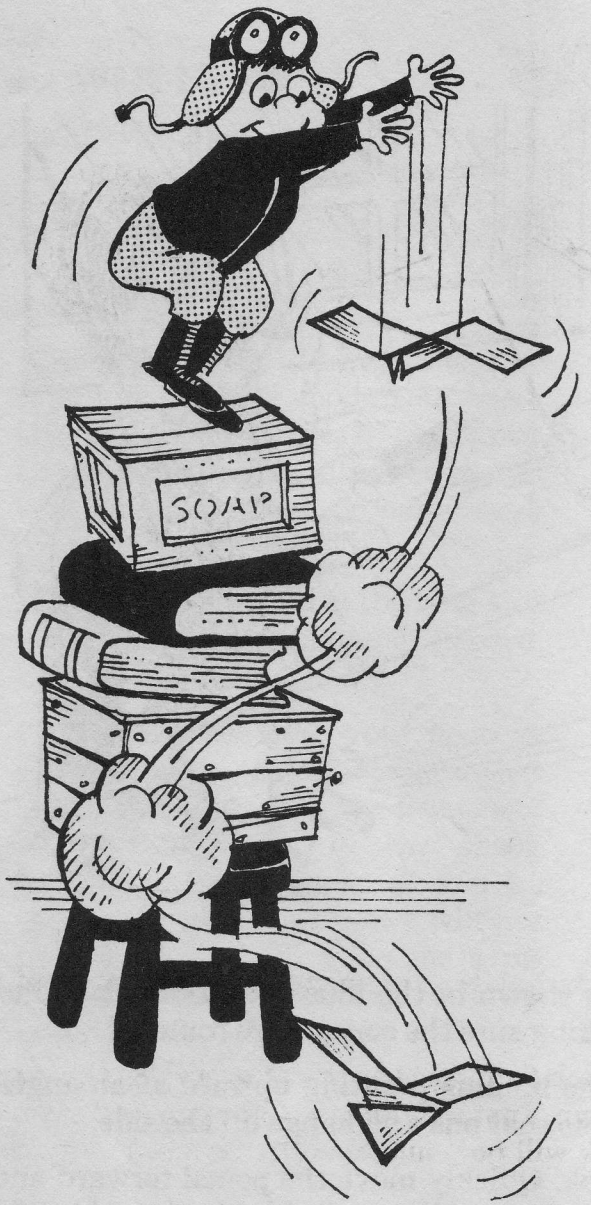
Instructions:

1. Draw a V-shaped pattern like the one shown in the illustration on a piece of smooth, stiff cardboard. Cut it out, making sure the corners are rounded.
2. Hold a book in your left hand, with the binding pointing upward at an angle. Place the cardboard shape on the book so that one arm hangs off the side.
3. Hold a pencil along the side of the book. Quickly move the pencil forward and strike the cardboard so that it spins and flies off the book. In a few seconds, the cardboard will be back at your feet!

This Is What Happens:

You have just made a *boomerang.* Because of its shape, the boomerang returns to the thrower, continuing to spin in the same path without turning over. Boomerangs, used by native Australians and usually carved from wood, can be used as weapons or for hunting or just for the fun of it.

Sister Twisters



You Will Need:

2 sheets of paper
Pencil
Ruler
Scissors

Instructions:

1. With a pencil and ruler, draw two rectangles that measure 12 by 6 inches on ordinary note paper and cut them out.
2. Now, make a cut lengthwise on each piece of paper as if you were cutting them in half, but do not cut all the way through. Make each cut only 6 inches long.
3. On both pieces of paper, fold one of these flaps one way, and the other in the opposite direction.
4. On one piece, make continuous 1-inch folds along the uncut side. On the other piece, fold the uncut side into a triangle, then fold it again into another triangle.
5. Stand on a chair or bench. Drop your two creations to the ground. They will twirl and spin gracefully like two ballerina sisters.

This Is What Happens:

You are using the same principle to operate your spinners that helicopters use to fly. The folded end of the paper is a little heavier than the rest of the piece, and this weight keeps the end always pointing down. The rotating paper wings fall against a greater amount of air than if they did not rotate. This decreases the speed at which the device drops, keeping it aloft for a longer period of time.

Tight Squeeze

You Will Need:

Cork
Glass soda bottle
Petroleum jelly
Water

Instructions:

1. Find a cork that will fit a glass soda bottle. Rub petroleum jelly around the sides of the cork.
2. Fill the bottle with water, about 1 inch from the top. Set the cork in the mouth of the bottle, but do not press it down. Instead, form a tight fist and slam the cork with one sudden blow. The cork will pop out. Now, press the cork in place slowly. It will stay there.

This Is What Happens:

Scientists say that air is *elastic.* When air is squeezed, it will press right back. This is what happened when you forced the cork down suddenly. The air left in the bottle was squeezed, so it pushed upward and sent the cork flying out. However, when you press the cork in slowly, the compressed air has time to leak through the seal between the cork and the glass.

Heavy Air

You Will Need:

Basketball
Air pump
Scientific scale (one that shows grams or fractions of ounces)

Instructions:

1. Pump up a basketball very hard. You can use a bicycle pump if you have the proper needle for inflating sports equipment.
2. Now weigh the basketball on the scientific scale. Your science classroom probably has this type of scale. Ask your teacher to show you how to use it.
3. Let all of the air out of the basketball and weigh it again. This time it weighs less. Can you explain why?

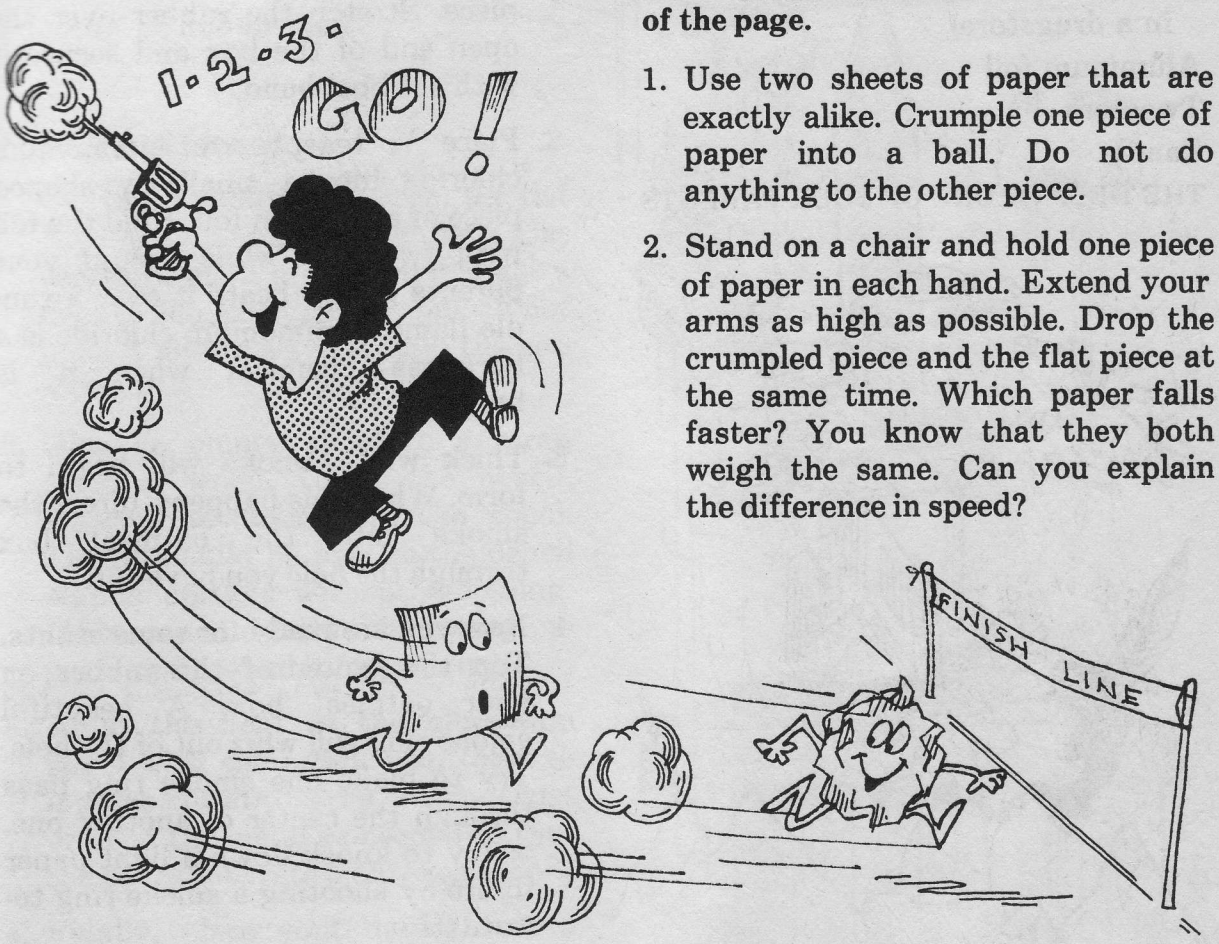
This Is What Happens:

Did you know that air has weight? Even though air does not weigh very much compared to the objects that we normally place on scales, you saw the slight difference between an empty basketball and one that was pumped up. This difference in weight was due to the amount of air inside the ball.

There is a layer of air over the entire earth, and it, too, has weight, and exerts pressure on us.

You Will Need:

2 sheets of paper
Chair



Instructions:

This experiment takes only a few seconds to perform, but you may want to repeat it a few times and think about the scientific principle before reading the explanation at the bottom of the page.

1. Use two sheets of paper that are exactly alike. Crumple one piece of paper into a ball. Do not do anything to the other piece.
2. Stand on a chair and hold one piece of paper in each hand. Extend your arms as high as possible. Drop the crumpled piece and the flat piece at the same time. Which paper falls faster? You know that they both weigh the same. Can you explain the difference in speed?

This Is What Happens:

Even though both pieces of paper weigh the same, they are shaped differently. The crumpled piece is more compact and is, therefore, able to push through the air better. The flat paper has more surface area and the air pushes against this and slows the paper down. Engineers who build airplanes and rockets know this scientific principle very well. They design their vehicles with a streamlined shape so that they can slice *through* the air instead of pushing against it.

Bring on the Rings

You Will Need:

Oatmeal box
Scissors
Balloon
Rubber band
Ammonium chloride (available in a drugstore)
Aluminum foil
Tweezers
Candle
THE HELP OF ONE OF YOUR PARENTS

Instructions:

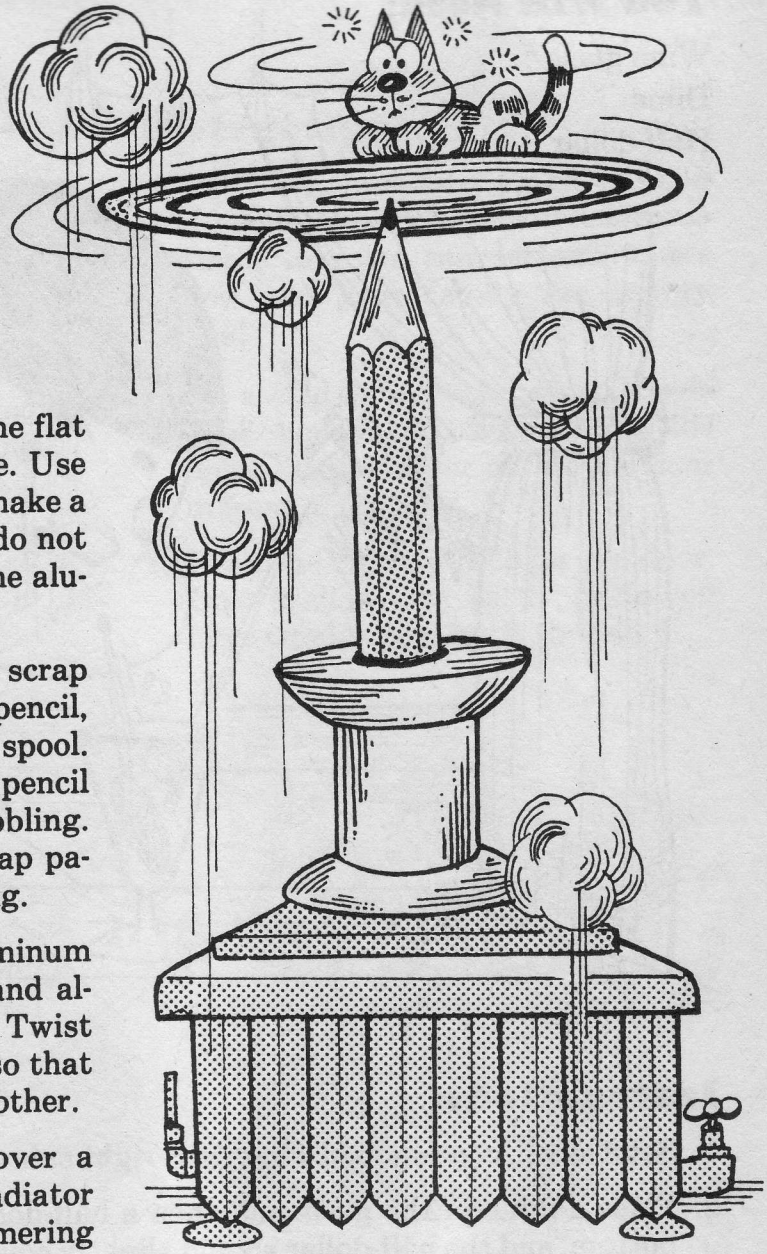
1. Cut a hole about the size of a half-dollar in the bottom of an empty oatmeal box. (The other end is completely open.) Slice open a large balloon so that you have a flat rubber piece. Stretch the rubber over the open end of the box and secure it with a rubber band.
2. Place ¼ teaspoon of ammonium chloride into a small cup-shaped piece of aluminum foil. Hold the foil with tweezers, while one of your parents gently heats it over a candle flame. (Ammonium chloride is a harmless chemical when it is burned.)
3. Thick white smoke will begin to form. When this happens, direct the smoke into the oatmeal box through the hole you have cut.
4. Now you are ready for some stunts. Tap the center of the rubber on your oatmeal box. A beautiful smoke ring will whiz out of the hole. Try to make one smoke ring pass through the center of another one, or try to knock down a light paper figure by shooting a smoke ring toward it!

This Is What Happens:

You have just produced *vortex rings,* which is simply whirling air. The smoke that you added serves to make the rings visible to your eyes. Did you notice that the smoke rings keep their shape for a long time? This happens because the only force that breaks them apart is the movement of air outside the rings.

You Will Need:

Aluminum pie plate
Pencil
Glue
Empty spool
Small block of wood
Radiator or hot-air vent



Instructions:

1. Cut out a spiral shape from the flat base of an aluminum pie plate. Use the blunt point of a pencil to make a dent in the exact center, but do not poke it all the way through the aluminum.
2. Glue an empty spool to a scrap piece of wood. Insert the pencil, eraser side down, into the spool. The fit should be firm so the pencil stands upright without wobbling. If the pencil does wobble, wrap paper strips around it for padding.
3. Align the dent in the aluminum spiral with the pencil point and allow the spiral to hang freely. Twist or bend the metal as needed so that the edges separate from each other.
4. Finally, place your device over a safe heat source, such as a radiator or hot-air vent. The shimmering spiral will spin merrily.

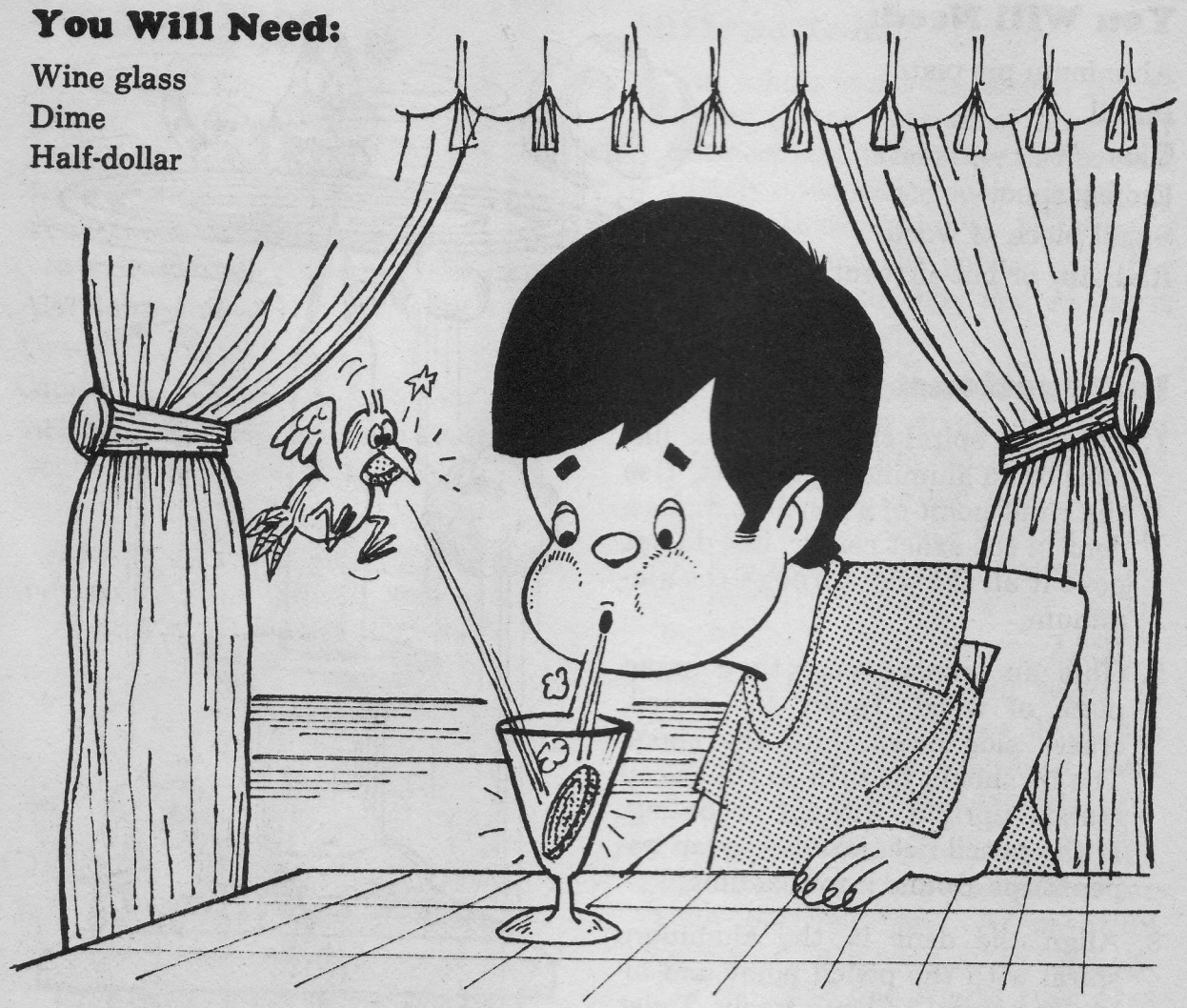
This Is What Happens:

You've just proven that hot air rises. The currents of hot air rise and push against the metal, and this continuous action causes the spiral to rotate around its pivot—the pencil point.

Loose Change

You Will Need:

Wine glass
Dime
Half-dollar



Instructions:

1. Set a small, cone-shaped wine glass right side up on a table.
2. Place a dime in the glass and then a half-dollar. The dime should rest on the bottom, and the half-dollar should slightly cover the dime.
3. Now take a deep breath and blow hard onto the inside edge of the half-dollar. The dime will jump out. Can you explain why?

This Is What Happens:

Blowing on the half-dollar tips the coin sideways, and your breath builds up underneath the dime. This increased air pressure lifts the dime from the glass.

Was Here

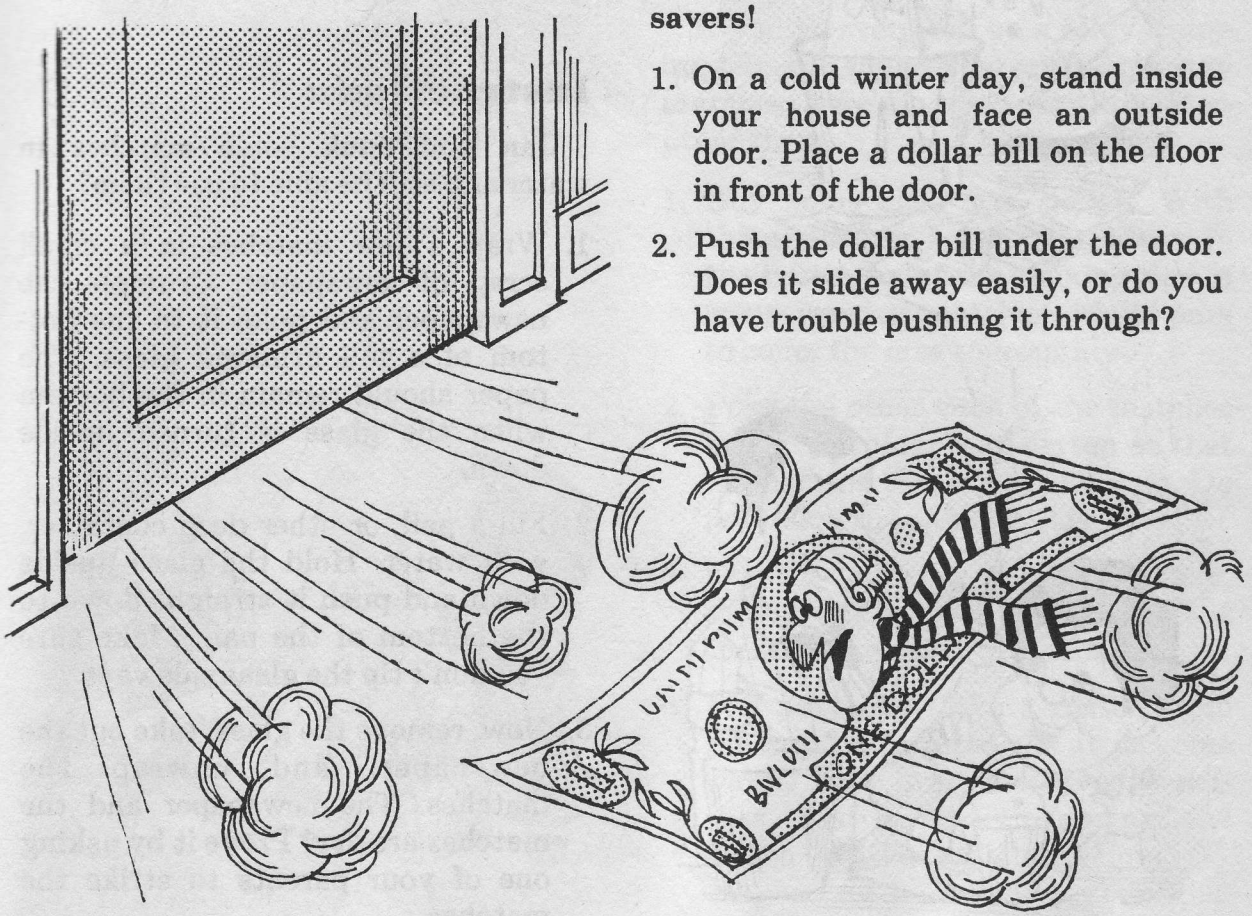
You Will Need:

A cold winter day
Door to your house
Dollar bill

Instructions:

You have probably heard a good deal about conserving energy. Here is a simple test you can perform to see if you and your family are energy savers!

1. On a cold winter day, stand inside your house and face an outside door. Place a dollar bill on the floor in front of the door.
2. Push the dollar bill under the door. Does it slide away easily, or do you have trouble pushing it through?



This Is What Happens:

The dollar bill helps you measure the air space between the bottom of the door and the floor. If you could slide the bill underneath the door easily, this means that there is not a tight seal and warm air from your house is escaping through this space. It is very expensive to heat the air in your house, and now this hot air is leaving! Hold your hand in front of the door for a few seconds. Do you feel cold air? Not only are you losing warm air, but the leak is also letting cold air in!

Dry Dunk

You Will Need:

Matches
Newspaper
Tall drinking glass
Pail
Water
THE HELP OF ONE OF YOUR PARENTS

Instructions:

Can you dunk some matches in water and still be able to use them?

1. Wrap a few matches in a small scrap of newspaper. Crumple the newspaper and poke it to the bottom of a tall drinking glass. The paper should remain in the bottom when the glass is turned upside down.
2. Fill a pail, or other deep container, with water. Hold the glass upside down and push it straight down to the bottom of the pail. Make sure you don't tip the glass sideways.
3. Now, remove the glass, take out the newspaper, and unwrap the matches. The newspaper and the matches are dry! Prove it by asking one of your parents to strike the matches.

This Is What Happens:

When you pushed the glass into the water, the glass was not really empty. It was full of air. This volume of air prevented water from entering the glass, and the paper and matches remained dry.

You Will Need:

Clear nail polish
Wooden matches
Styrofoam egg carton
THE HELP OF ONE OF YOUR PARENTS

Instructions:

If you've ever been on a rainy camping trip and found yourself with soggy matches, here's a good way to waterproof them.

1. Buy some clear nail polish. With the applicator brush that comes in the bottle, paint the striking tips of some wooden matches. Make sure to cover the area thoroughly.
2. Poke the other ends of the matches into a Styrofoam egg carton so that the painted tips are sticking up. Do not touch the painted ends.
3. Let the matches dry completely, then give them a second coat. Let them dry overnight this time.
4. The next day, take a match from the egg carton and dip it in some water. Now, ask one of your parents to strike the tip against the match box. The match will light!

This Is What Happens:

The nail polish coats the chemicals on the match tip and seals them. Since the nail polish is a hard substance, it creates a barrier to moisture. However, when the match is struck, the polish is scratched away, allowing the chemicals to ignite as they normally do.

Water Scrubber

You Will Need:

½-gallon plastic jug
Scissors
Nail
Hammer
Pebbles, gravel, and sand (coarse and fine)
Glass jar
Muddy water

THE HELP OF ONE OF YOUR PARENTS

Instructions:

1. Cut off the bottom of a ½-gallon plastic jug. Then, unscrew the cap and ask one of your parents to punch a few small holes in it with the tip of a nail and a hammer. Screw the cap back on and turn the jug upside down.
2. Fill the jug with equal layers of pebbles, gravel, coarse sand, and fine sand. The pebbles go in first, the gravel next, then the coarse sand, and, finally, the fine sand on top. Don't fill the jug completely; leave a couple of inches free.
3. Hold the jug over a clear glass jar. If possible, prop up the jug so that it rests securely over the jar.
4. Now, pour some muddy water onto the sand. In a few minutes, clean water will trickle into the jar.

This Is What Happens:

You have just performed *filtration.* Filtration is the removal of material that is suspended in a liquid. The muddy water contained many impurities, and these were trapped—filtered—by the layers in your jug. The water itself, however, was free to pass through the layers and into the jar. Of course, you *shouldn't* drink this water because it is *not* really clean enough for drinking.

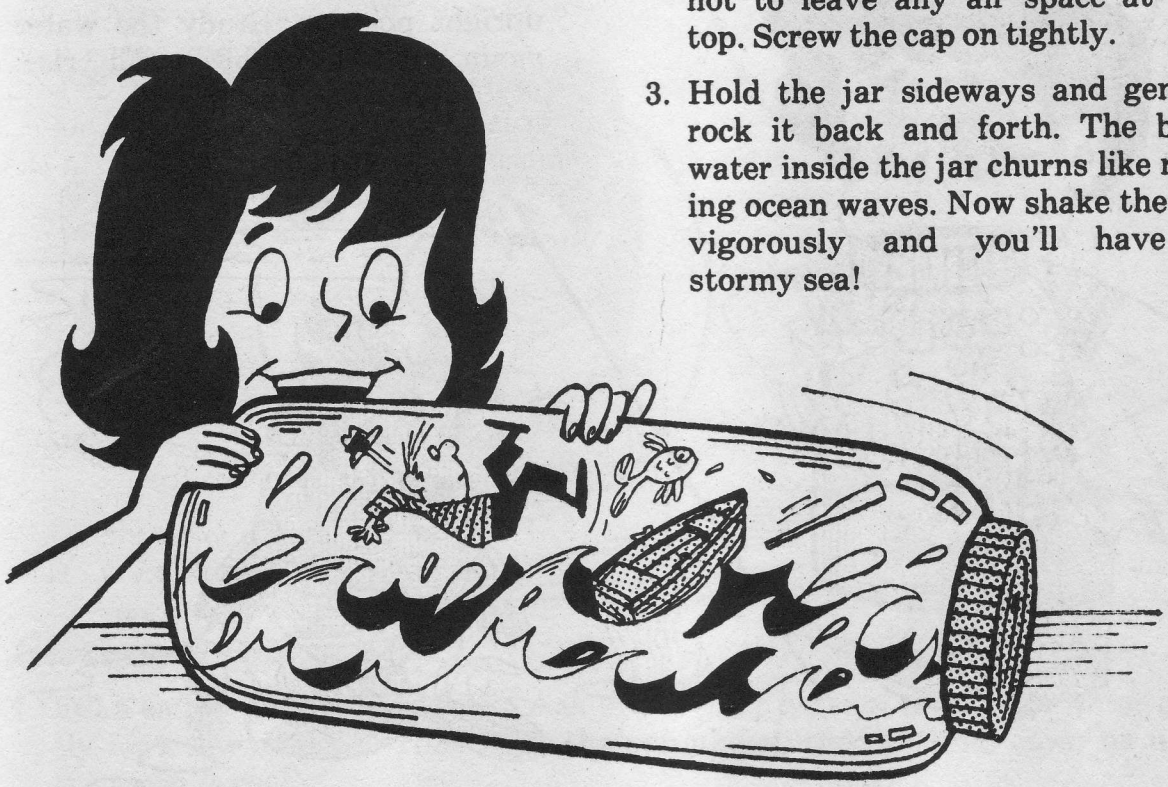
Stormy Seas Ahead

You Will Need:

Tall olive jar
Water
Blue food coloring
Cooking oil

Instructions:

1. Save one of the tall jars that olives come in. Fill it halfway with water, then add a drop of blue food coloring.
2. Fill the rest of the jar, right up to the top, with cooking oil, being sure not to leave any air space at the top. Screw the cap on tightly.
3. Hold the jar sideways and gently rock it back and forth. The blue water inside the jar churns like rolling ocean waves. Now shake the jar vigorously and you'll have a stormy sea!



This Is What Happens:

Water and oil do not mix together. Each remains separate, and since water is heavier, it stays on the bottom of the jar. When you rock the jar, the colored water moves against the surface of the oil. When you shake the jar vigorously, foamy bubbles form that look like the stormy sea, but the water and oil are still not mixed. Let the jar sit for a few minutes and you will see two separate layers again.

Mystery Bubbles

You Will Need:

Glass jar with lid
Water
1 tablespoon salt

Instructions:

1. Fill a clear glass jar—such as a mayonnaise jar—with tap water. Set the jar in front of a bright window and watch the water at the top. Air bubbles will rise to the surface.
2. After the bubbling has stopped and the water becomes clear, add a tablespoon of salt to the jar. Screw the lid on the jar and turn the jar over once. Then return it to the upright position. Study the water again. More bubbles will rise. Where did they come from?

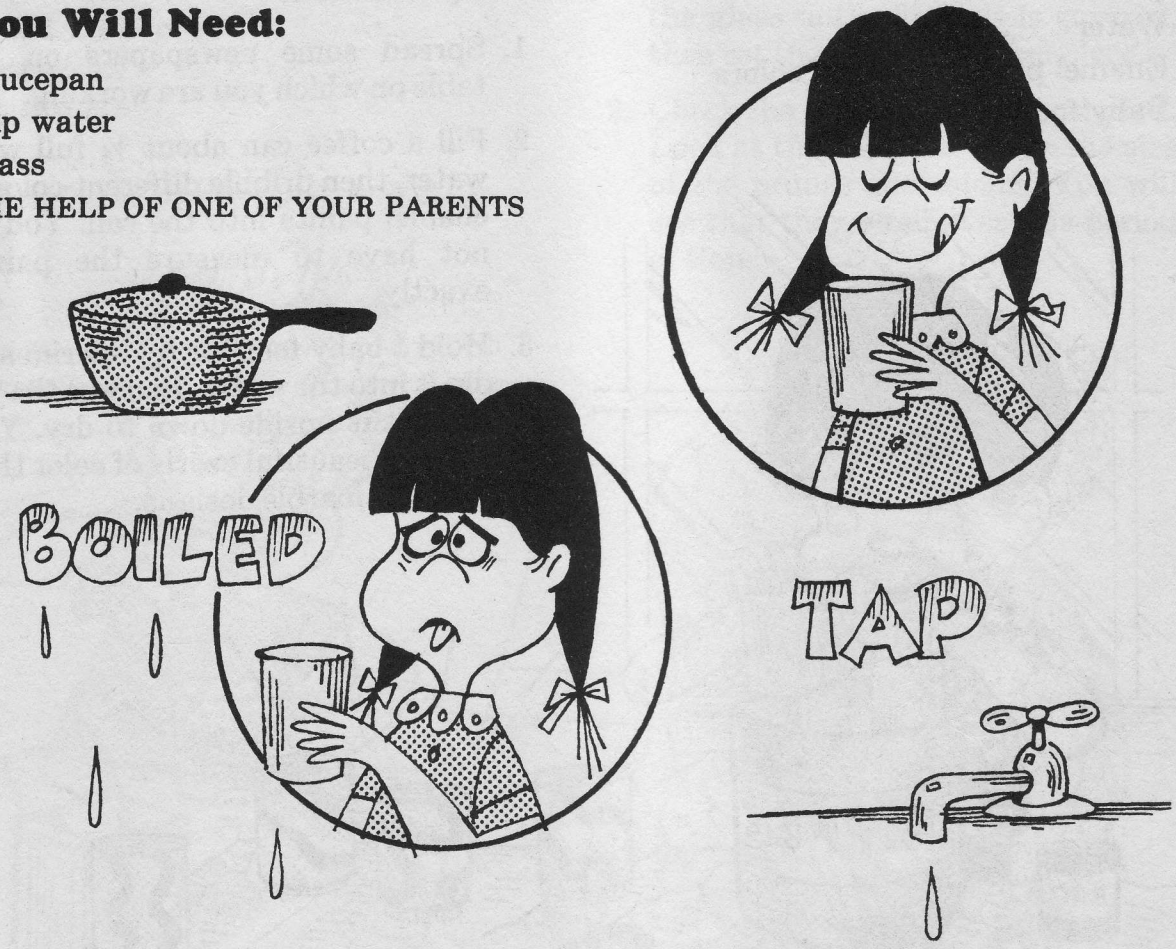
This Is What Happens:

Water contains air, even though you can't see it. This air is usually dissolved in the water. You saw some of the excess air rising as bubbles in the first part of the experiment. When you added the salt, more air was driven from the water because the salt dissolves more easily in the water than the air, and it replaces the air. Fish in lakes and streams are able to take air directly from water by passing water through their gills.

The All-American Taste Test

You Will Need:

Saucepan
Tap water
Glass
THE HELP OF ONE OF YOUR PARENTS



Instructions:

1. Fill a saucepan with tap water. Ask one of your parents to boil the water gently for a few minutes. Then leave the pan undisturbed with its cover on until the water is cool.
2. Now pour some of the water into a glass and drink it. Does it taste flat and dull? Drink some water fresh from the faucet and compare the taste.

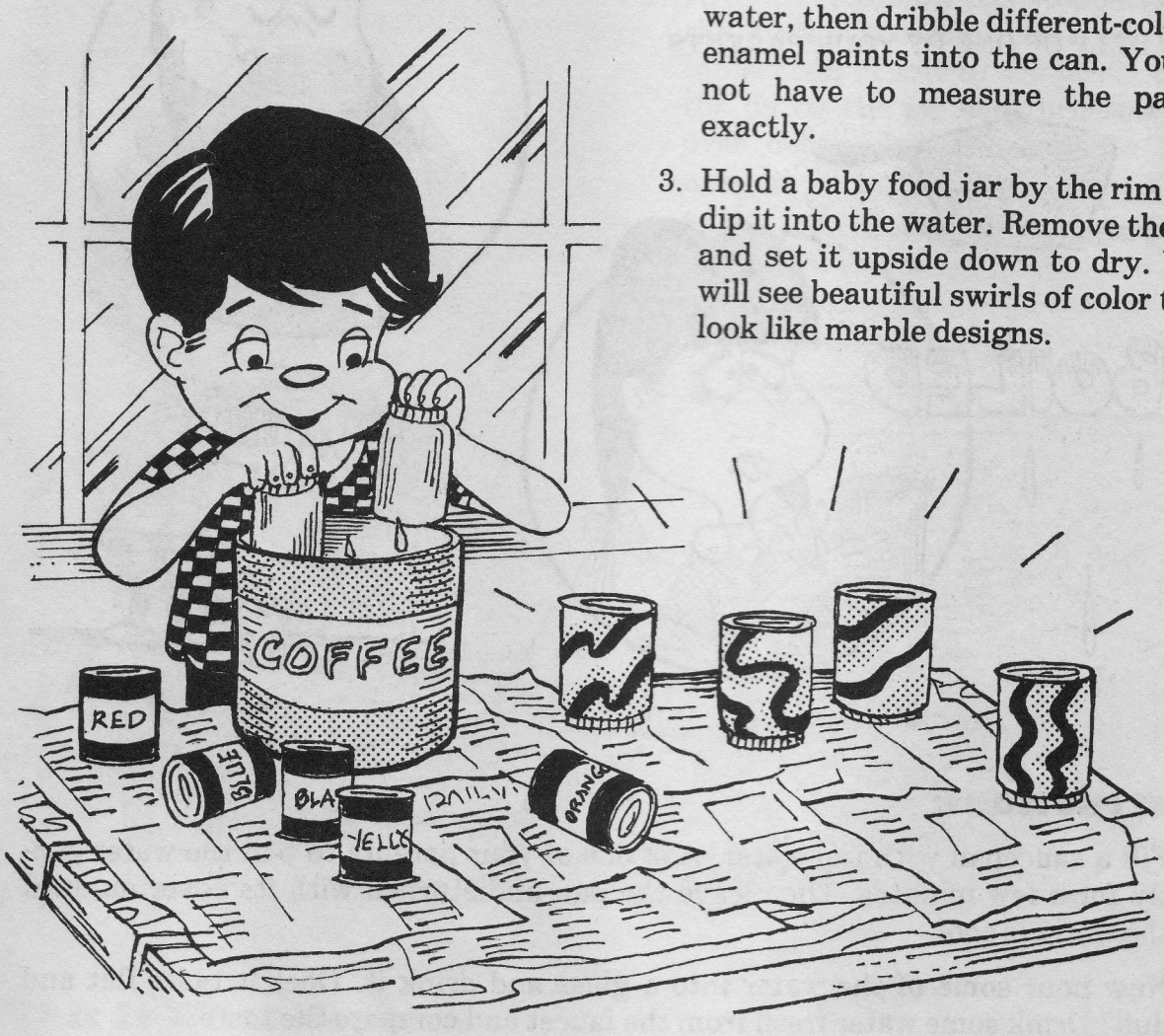
This Is What Happens:

Tap water contains air in addition to many minerals, and they all help to give water a pleasant, lively quality. But by boiling the water, you have removed most of the air, and this changes the flavor.

Marble Jars

You Will Need:

Newspapers
Coffee can
Water
Enamel paint in several colors
Baby food jars



Instructions:

This is a good project to do outdoors on a picnic table.

1. Spread some newspapers on the table on which you are working.
2. Fill a coffee can about ¾ full with water, then dribble different-colored enamel paints into the can. You do not have to measure the paints exactly.
3. Hold a baby food jar by the rim and dip it into the water. Remove the jar and set it upside down to dry. You will see beautiful swirls of color that look like marble designs.

This Is What Happens:

Enamel paints are made with oil and this causes them to float on top of the water. When you dip the jar into the water, the paint sticks to the glass and runs together to form interesting patterns. You might use your new jar to store rubber bands, seeds, paper clips, coins, or crayons.

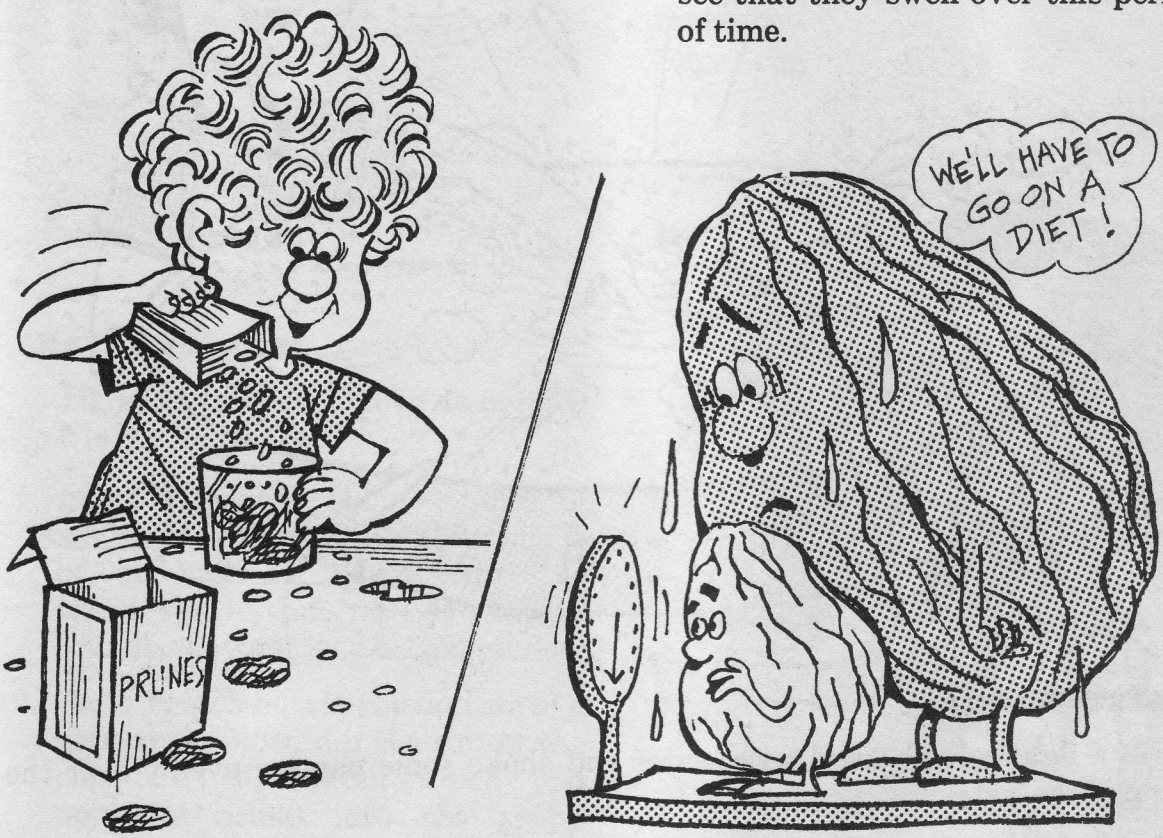
That's Swell

You Will Need:

Prunes
Raisins
Small, clear glass
Water

Instructions:

1. Place several prunes and raisins in a small, clear glass. Pour water into the glass until the fruit is covered, then set the glass in a warm place.
2. Check the glass each day for 3 days. Look at the fruit and notice the size of the prunes and raisins. You will see that they swell over this period of time.



This Is What Happens:

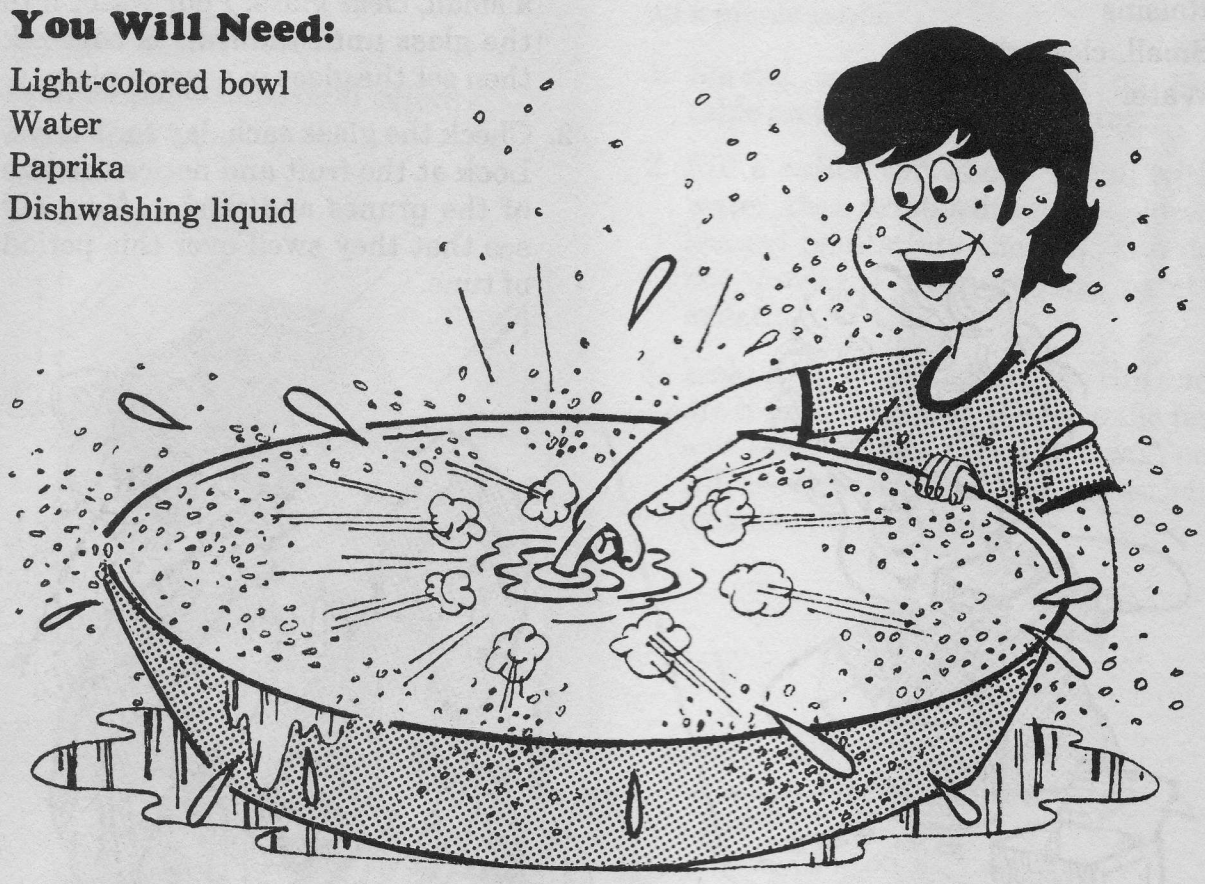
Fruit is covered with a tough skin that holds the fibers inside. However, this skin allows water to pass through it. This process is called *osmosis.* Water moves through the skin and swells the prunes and raisins.

Do you know what prunes and raisins really are? A prune is a dried plum, and a raisin is a dried grape. The water is removed—just the opposite of what you did in your experiment—to make these dried, shriveled fruits!

Little Red Scooter

You Will Need:

Light-colored bowl
Water
Paprika
Dishwashing liquid



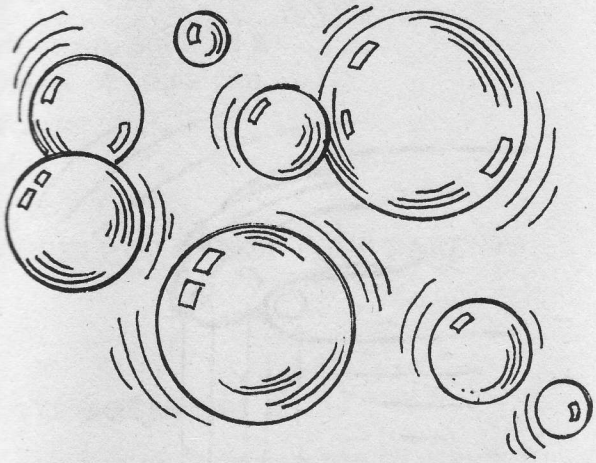
Instructions:

1. Fill a light-colored bowl with water and shake some paprika evenly over the top of the water.
2. Put a drop of dishwashing liquid on your finger, then dip your finger into the center of the bowl. The red paprika quickly scoots to the sides of the bowl.

This Is What Happens:

Dishwashing liquid is a detergent, and one of the important qualities of detergent is that it mixes easily with water. As you dipped your finger into the bowl, a small amount of dishwashing liquid from your finger readily attached itself to the water. Then it quickly spread over the entire surface and pushed all the grains of paprika to the sides.

Giant Bubble Machine



You Will Need:

Large bowl
Water
4 to 5 tablespoons dishwashing liquid
Scissors
Paper cup

Instructions:

Here's something fun to do outside on a lazy summer day.

1. Fill a bowl with about 1 quart of water, then add 4 or 5 tablespoons of dishwashing liquid. Stir the water slowly, but do not beat it. You do not want it to become sudsy.
2. Cut a ½-inch hole in the bottom of a paper cup. Now, dip the rim of the cup (the edge from which you normally drink) into the soapy water. Lift it slowly and blow through the small hole. A giant bubble will float into the air. Try to fill the air with several bubbles.

This Is What Happens:

The soap helps the water cling across the rim of the cup and when you blow, it acts like a thin skin around the bubble of air—the bubbles you are making are really puffs of air surrounded by water!

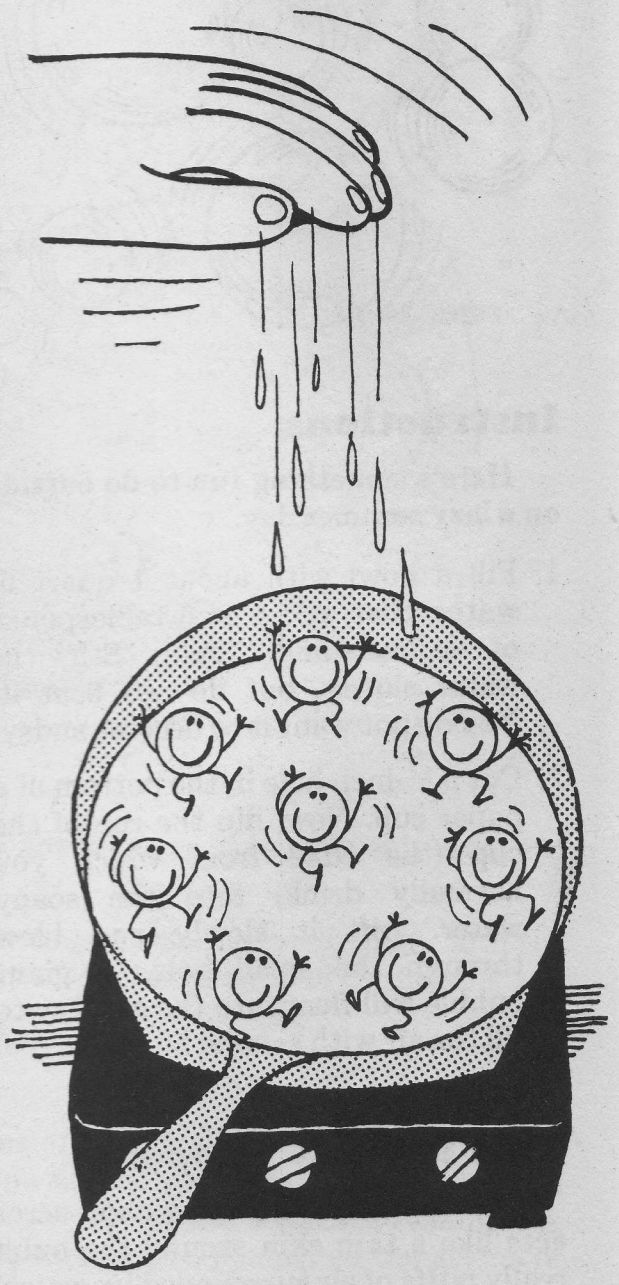
Parade of the Drops

You Will Need:

Stove or hot plate
Frying pan
Small glass
Water
THE HELP OF ONE OF YOUR PARENTS

Instructions:

1. Ask one of your parents to turn a stove burner or hot plate on high heat and to set a frying pan on the burner.
2. Fill a small glass, such as a juice glass, with water and set this down nearby.
3. After the pan has had time to heat for a few minutes, and with your parent at your side during this step, dip your fingers into the glass of water to moisten them. Shake the excess water from your fingers over the frying pan so that drops of water fall into the pan. You will see perfectly formed spheres of water bounce and parade around the pan.
4. Remind your parent to turn off the heat when you are finished.



This Is What Happens:

As soon as a drop of water hits the hot surface of the frying pan, a little layer of steam forms underneath the drop. This steam acts as a cushion and raises the drop above the metal surface. The drop of water is held together as a sphere by the surface tension of the water, but eventually the drop disappears, as all of its water is changed into steam by the heat.

Stick Together

You Will Need:

Large can, such as a coffee or juice can
Hammer
Nail
Water
THE HELP OF ONE OF YOUR PARENTS

Instructions:

1. Ask one of your parents to punch 5 holes into a large can, using a hammer and nail. The holes should be placed on the side of the can, near the bottom, and spaced ¼ inch apart.
2. Cover the holes with your hand as you fill the can to the top with water. Then set the can near the edge of the sink and remove your hand. You will see 5 streams of water spurt out.
3. Squeeze the streams together with your thumb and index finger. They will combine to form a single flow of water.

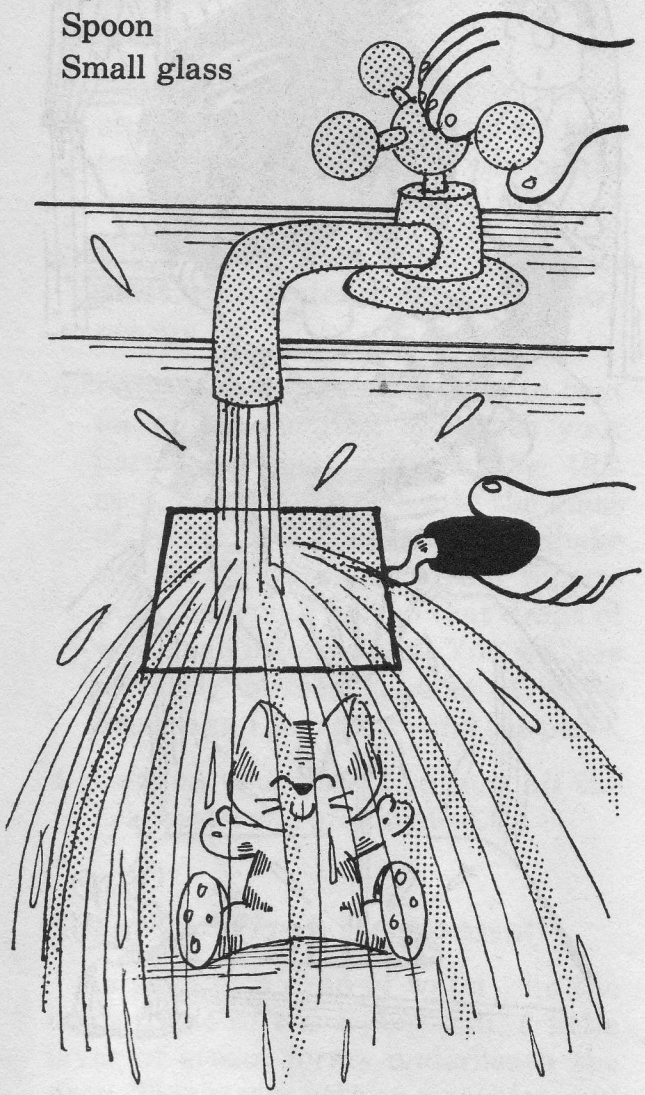
This Is What Happens:

Each of the 5 streams of water has a film around it. This film, composed of water molecules itself, encases the water, but is quite elastic and allows movement. When you pinch the streams into 1 stream, a new film is formed, which is strong enough to hold all the water together without breaking apart.

See-Through Sheets

You Will Need:

Water faucet
Spatula
Spoon
Small glass



Instructions:

1. Turn on the kitchen faucet and adjust the water to produce a smooth, continuous stream. Insert the flat portion of a spatula into the water's path. Hold the spatula horizontally and direct the water stream forward and downward until you produce a sheet of water.
2. You can make the water assume various shapes by slightly changing the angle and position of the spatula, or instead of the spatula, use a spoon to make different shapes from the water. If you hold the spoon rounded side up, you can produce a circular sheet of water!
3. Hold a small juice glass under the faucet. If you let the water strike the side of the glass at an angle, you can make a cone-shaped figure.
4. Search for other common household objects that might change the water's shape in unusual patterns. With a little practice, you can make many interesting shapes.

This Is What Happens:

As you've seen, one of the many interesting qualities of water is its surface tension. When you inserted the objects into the stream of water, you spread the water over a wide area, but the water did not disperse. Instead, it held together in thin, clear sheets—surface tension!

Berry Good Box

You Will Need:

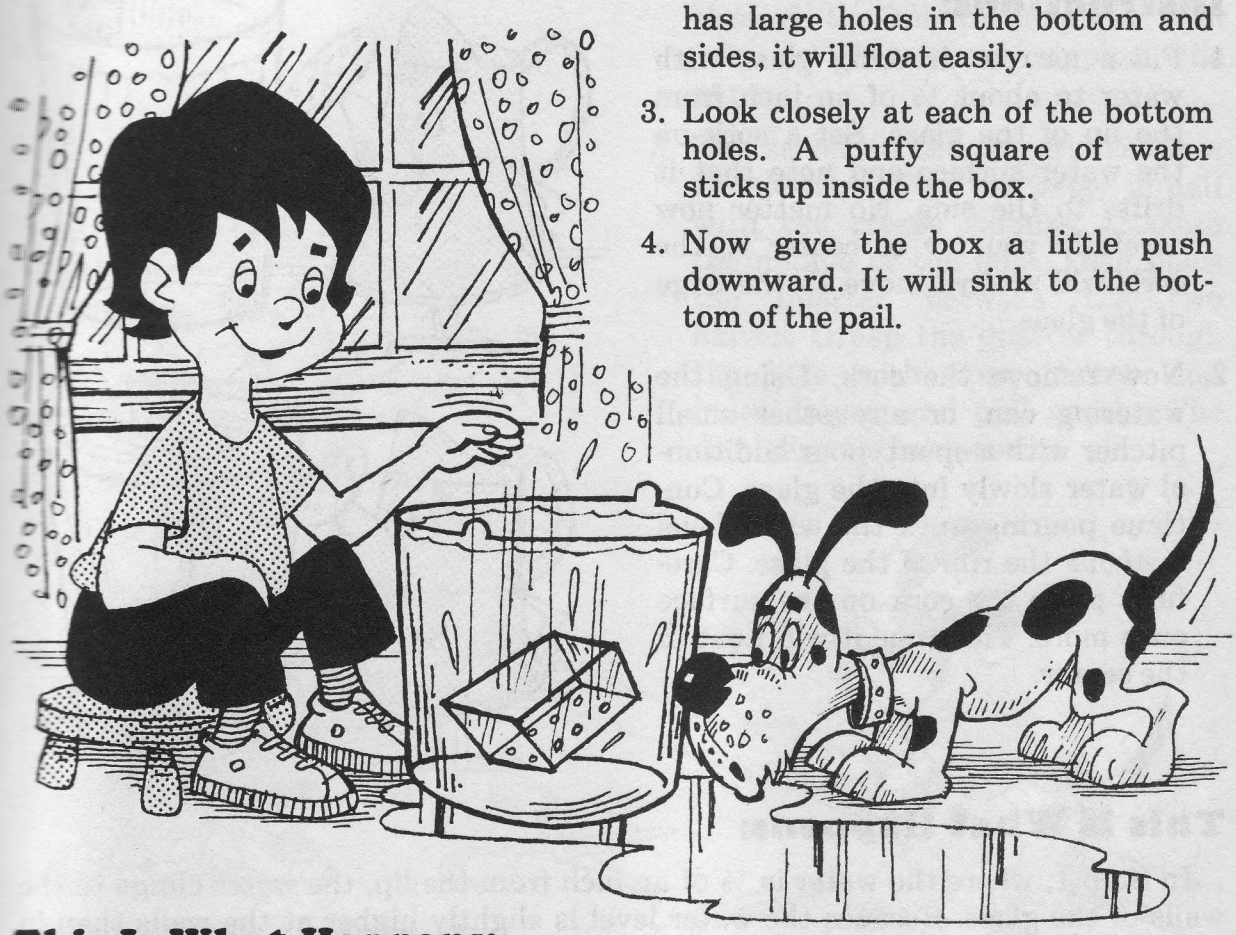
Pail

Water

Lightweight plastic box (like the kind that berries are sold in) with holes in the bottom

Instructions:

1. Fill a pail, or any deep container, with water.
2. Make sure the berry box is dry, then gently set it on top of the water surface. Even though the box has large holes in the bottom and sides, it will float easily.
3. Look closely at each of the bottom holes. A puffy square of water sticks up inside the box.
4. Now give the box a little push downward. It will sink to the bottom of the pail.



This Is What Happens:

Surface tension of water has an elastic quality that supports the weight of the berry box. You could see this stretchiness as the water protruded through the holes into the bottom of the box. But when you push the box downward, the force of that push is great enough to break the surface tension of the water, sending the water streaming through the open holes. Finally, when the box is surrounded entirely by water, it sinks.

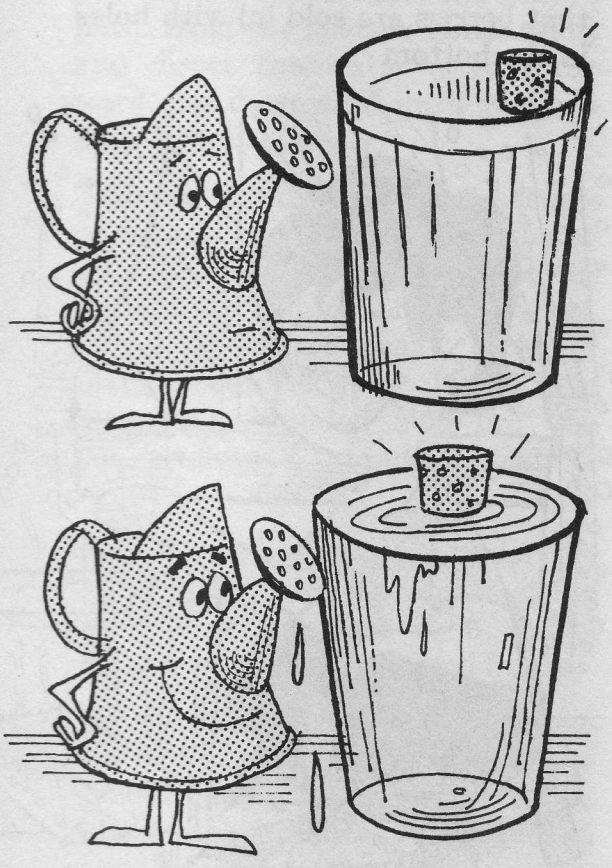
All Corks to Center Stage

You Will Need:

Narrow drinking glass
Water
Cork
Watering can (like the kind used for house plants)

Instructions:

1. Fill a narrow drinking glass with water to about ⅓ of an inch from the lip of the glass. Set a cork on the water surface and note that it drifts to the side. No matter how carefully you try to center it, the cork will always move to the edge of the glass.
2. Now remove the cork. Using the watering can, or any other small pitcher with a spout, pour additional water slowly into the glass. Continue pouring until the water level is *above* the rim of the glass. Carefully place the cork on the surface once more. This time it will float in the center.



This Is What Happens:

In Step 1, where the water is ⅓ of an inch from the lip, the water clings to the walls of the glass. Because the water level is slightly higher at the walls than in the middle of the glass, the cork floats to this higher point. However, in Step 2, where the water is above the rim, the shape of the water is just the opposite—higher in the center. So, again, the cork floats to the highest point, but this time it's the center. Do you know why you were able to "pile up" the water above the normal level in Step 2? If your answer was "surface tension," you're right! The attraction of water molecules to each other allowed you to add water to the glass slightly above the normal level.

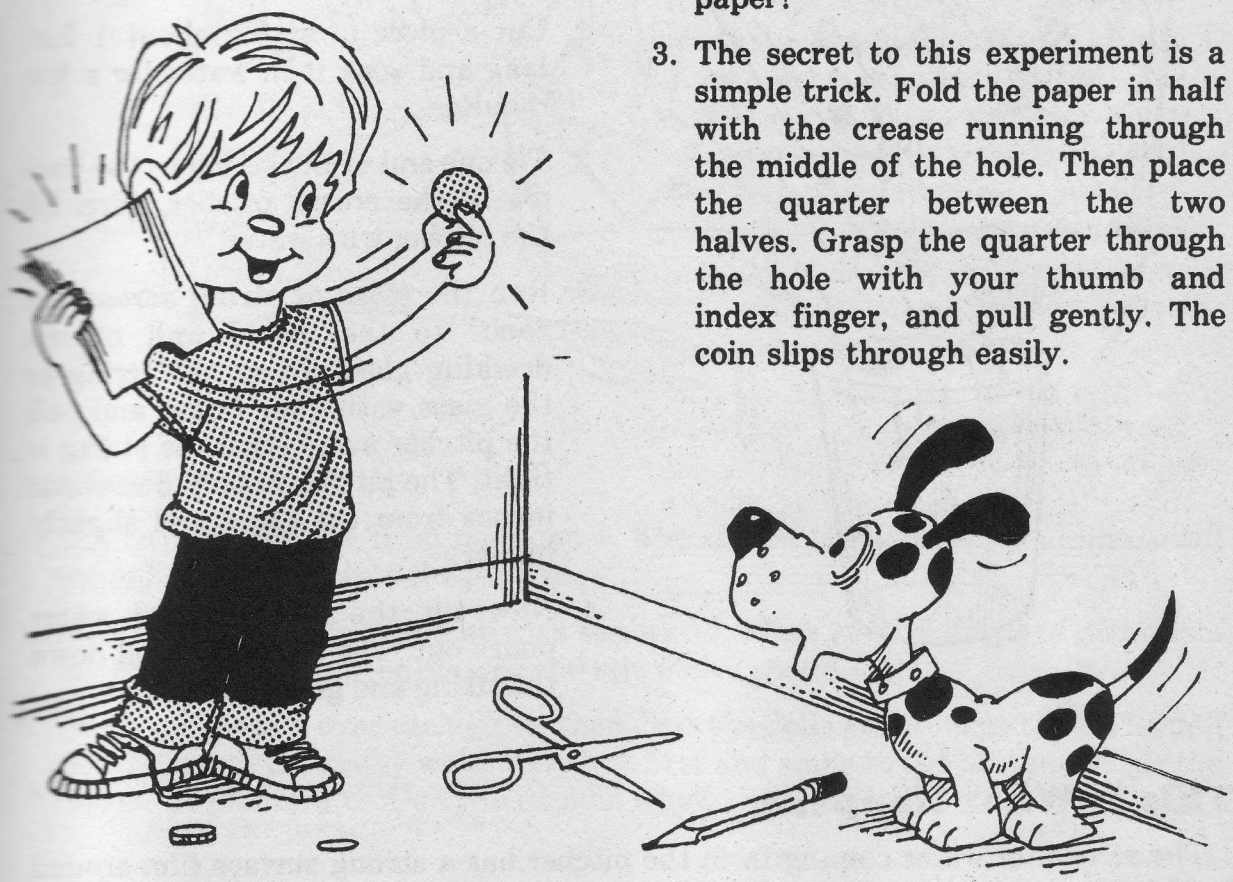
Hole Stretcher

You Will Need:

Dime
Paper
Pencil
Scissors
Quarter

Instructions:

1. Lay a dime on top of a piece of paper and trace around it with a pencil. With a pair of scissors, cut out the hole.
2. Now, try to push a quarter through the hole in the paper. Can you do it without ripping the paper?
3. The secret to this experiment is a simple trick. Fold the paper in half with the crease running through the middle of the hole. Then place the quarter between the two halves. Grasp the quarter through the hole with your thumb and index finger, and pull gently. The coin slips through easily.



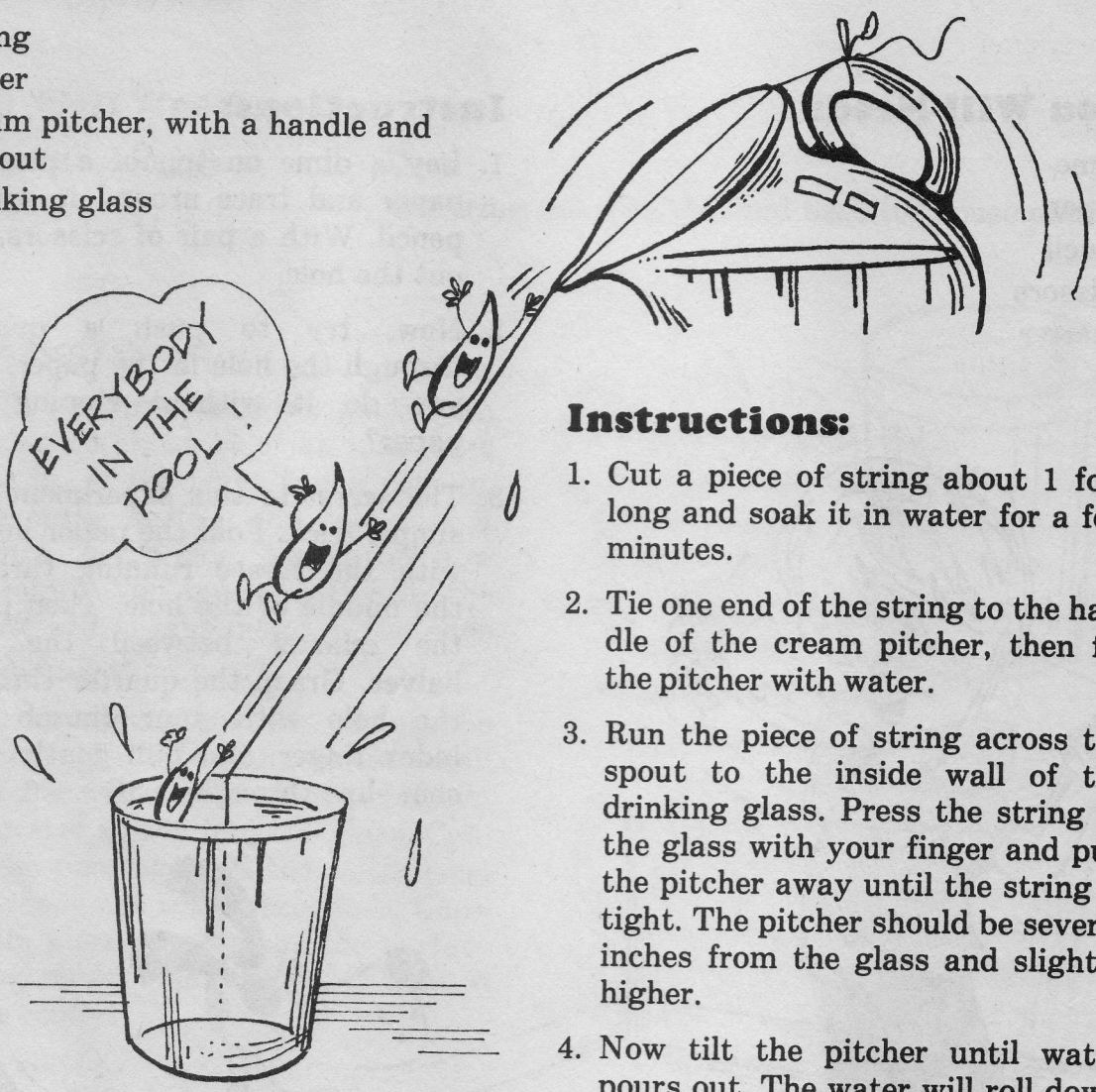
This Is What Happens:

The hole in the paper is not really getting bigger. When you fold the paper, you are flattening the hole and moving the sides apart so that the opening gets thinner, but not longer. This allows the coin, which is not very thick, to pass through.

Follow Me

You Will Need:

String
Water
Cream pitcher, with a handle and spout
Drinking glass



Instructions:

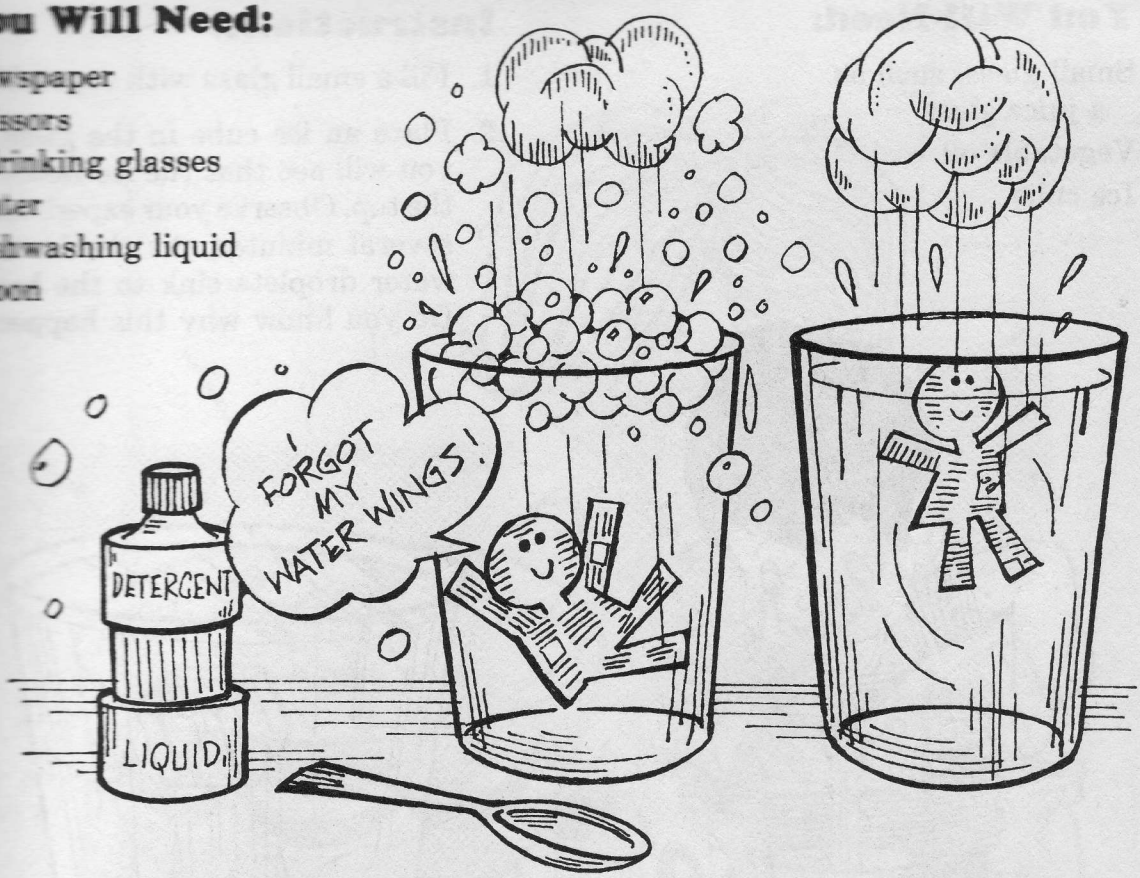
1. Cut a piece of string about 1 foot long and soak it in water for a few minutes.
2. Tie one end of the string to the handle of the cream pitcher, then fill the pitcher with water.
3. Run the piece of string across the spout to the inside wall of the drinking glass. Press the string to the glass with your finger and pull the pitcher away until the string is tight. The pitcher should be several inches from the glass and slightly higher.
4. Now tilt the pitcher until water pours out. The water will roll down the string and go into the glass.

This Is What Happens:

The stream of water coming from the pitcher has a strong surface film around it. This film holds the water to the string, preventing it from dropping straight below. The string guides the path of the water and leads it into the glass. People who work in laboratories use this principle when they pour a solution from one container to another and must not spill a single drop. They will place a glass rod across the spout of their pouring container and let the solution run along the rod into the other container.

You Will Need:

Newspaper
Scissors
2 drinking glasses
Water
Dishwashing liquid
Spoon



Instructions:

1. Cut two paper dolls from newspaper. The size of the figures should be small enough to fit easily into the glasses.
2. Now fill two drinking glasses with tap water. Place several drops of dishwashing liquid into one of the glasses and stir with a spoon.
3. Hold a paper doll over each glass, then drop the dolls at the same time. The doll that falls into the soapy water gets wet first and sinks to the bottom before the doll in the plain water. Can you explain why?

This Is What Happens:

In this experiment, the dishwashing liquid is acting as a *wetting agent.* The detergent helps to break the surface tension of the water molecules and allows them to soak into the newspaper. The water in this glass is actually "wetter" than the plain water in the other glass.

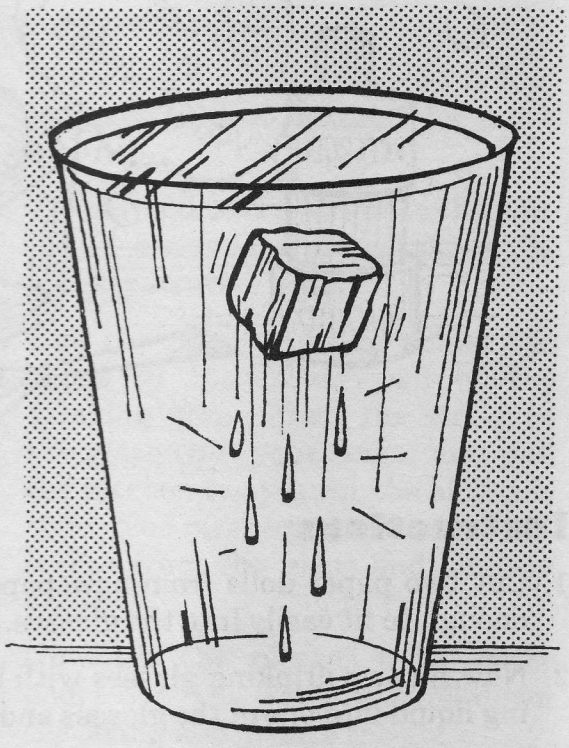
Heavy Drops

You Will Need:

Small glass, such as
a juice glass
Vegetable oil
Ice cube

Instructions:

1. Fill a small glass with vegetable oil.
2. Place an ice cube in the glass, and you will see that the ice floats near the top. Observe your experiment for several minutes. As the ice melts, water droplets sink to the bottom. Do you know why this happens?



This Is What Happens:

In "Stormy Seas Ahead" (page 21), you saw that water and oil don't mix, and that since water is heavier, it will remain underneath the oil. So, since ice and water are made from the same matter, why did the ice float *on top* of the oil in this experiment? Well, even though ice and water are made of the same matter, each behaves in a different way. As water freezes, it expands and takes up more room. This makes it less dense and it floats in the oil. But once the ice has melted, the water is heavier than the oil and it falls to the bottom.

You Will Need:

Bowl
Water
Ice cube

Instructions:

1. Fill a bowl with warm tap water and set the bowl on a firm surface, such as a counter top.
2. Gently place an ice cube in the water and let it come to rest. Do not touch the experiment now; just watch it closely. The ice cube will turn over. Soon it will turn over again. This action will be repeated many times. Do you know why?

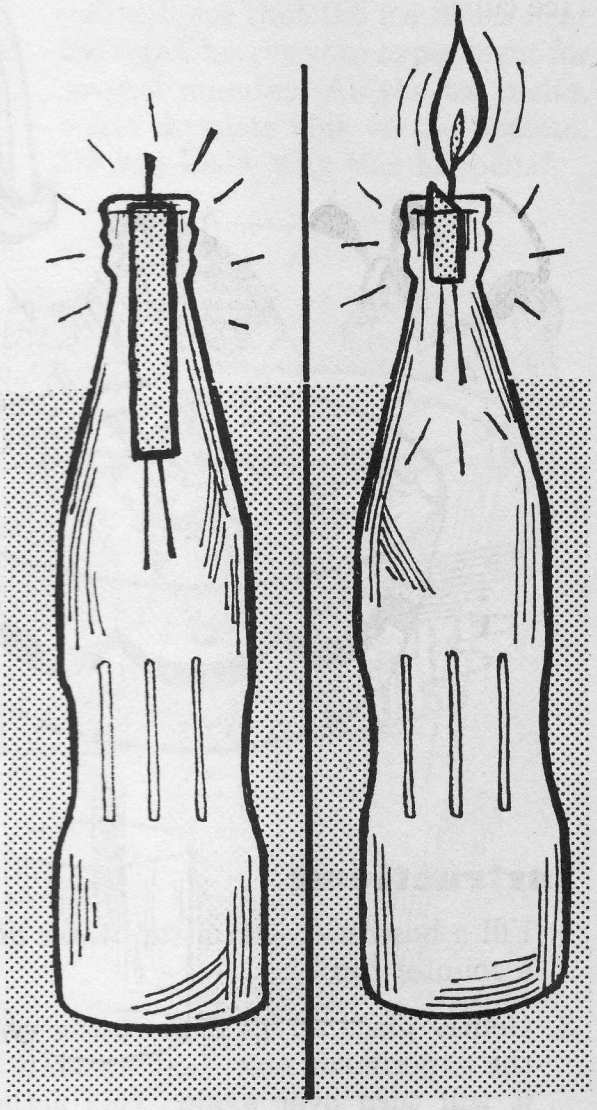
This Is What Happens:

As the ice cube floats in the warm water, the bottom side melts quickly. This makes the top half heavier, so the top falls and the cube flips over. Now the warm water melts the new bottom, and the process repeats while the cube gets smaller and smaller.

Happy Birthday to You

You Will Need:

Glass soda bottle
Water
Small candle (like the kind put on birthday cakes)
2 or 3 straight pins
Matches
THE HELP OF ONE OF YOUR PARENTS



Instructions:

1. Fill the soda bottle to the top with water.
2. Poke two straight pins into the bottom of a birthday candle and suspend the candle in the water. It should float upright. If the candle is tilted, you may need to add another pin to weight the base down a little more.
3. Now, ask one of your parents to light the candle. As you watch it burn down, stop and think: Will the flame die out when the wick burns down to the water level? Watch and see.

This Is What Happens:

At the start of the experiment, the candle floats at the surface of the water. As the top burns away, the weight of the candle is decreased bit by bit. With less weight, the entire candle rises slightly, keeping the wick above the water level at all times. So, even though the candle grows shorter, the flame is never smothered by the water, and the candle keeps burning until its wick finally burns out.

The Amazing Upside-Down "U"

You Will Need:

2 jars
Water
Box, 1 foot high
Flexible (rubber or plastic) tubing

Instructions:

1. Fill one jar completely with water and set it on top of the box. Place the empty jar on the ground beneath the full jar.
2. Cut a piece of rubber or plastic tubing long enough to reach between the two jars. Hold both ends of the tubing together under the faucet until the tubing fills entirely with water.
3. With your fingers, pinch both ends of the tubing closed. Place one end in the jar of water, pushing it beneath the water level. Release your hold, but make sure the tube rests on the bottom of the jar.
4. Place the other end of the tubing into the empty jar and release it. The water will flow from the full jar to the empty jar until all the water is completely transferred.

This Is What Happens:

You have just created a device called a *siphon.* Notice that the shape of your siphon is really an upside-down 'U', with one long side. As the water falls down this long side, a vacuum is formed at the bend in the 'U'. Air pressure against the water in the top jar pushes water into the short side of the tube where it climbs up until it reaches the bend, and then falls. The process occurs continuously until the flow of water is interrupted, such as when the jar runs dry, or when air gets into the tube, disturbing the vacuum.

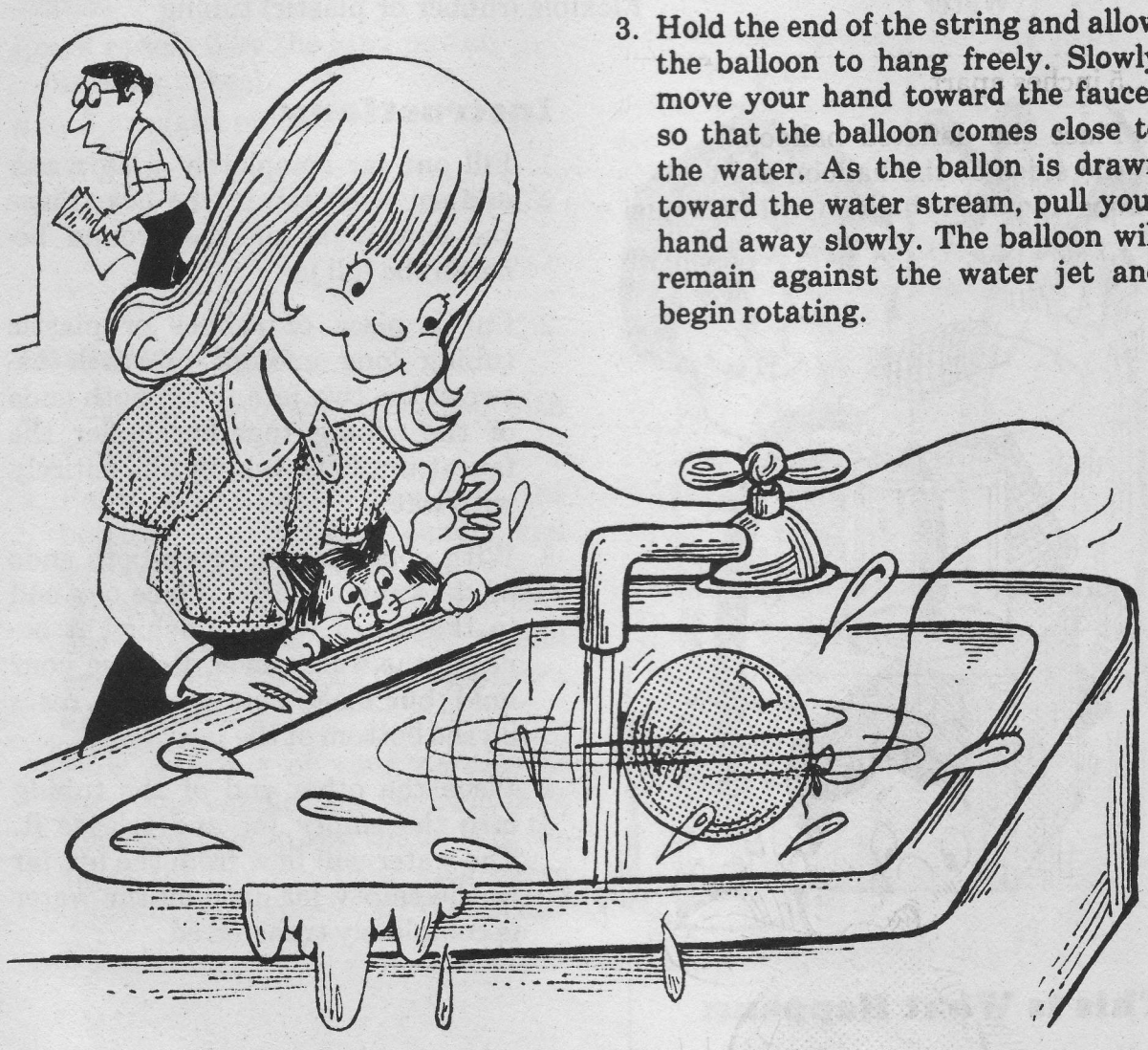
Kitchen Orbit

You Will Need:

Round balloon
String, 1 foot long
Faucet

Instructions:

1. Inflate a round balloon and tie the opening with the piece of string.
2. Turn on the faucet full force to produce a rushing stream of water.
3. Hold the end of the string and allow the balloon to hang freely. Slowly move your hand toward the faucet so that the balloon comes close to the water. As the ballon is drawn toward the water stream, pull your hand away slowly. The balloon will remain against the water jet and begin rotating.



This Is What Happens:

The force of the water stream rushing into the sink creates an area of low pressure around it. Because the balloon is very light, it is pushed into this area by the surrounding air of higher pressure. The push of air on the rounded surface causes the balloon to spin.

Stick Up

You Will Need:

2 teacups
Round balloon

Instructions:

1. Place two teacups—ask your parents which ones you can use—on a table, about 5 inches apart.
2. Place the deflated balloon between the two cups and blow air into it until the sides of the balloon are touching the sides of the teacups. Then knot the opening of the balloon, without raising it from the table.
3. Slowly raise the balloon. You will lift the two cups.

This Is What Happens:

The air that you blew into the balloon pushed the rubber against the walls of the cups. The force of the air held the balloon snugly and prevented the cups from slipping away when you lifted the balloon.

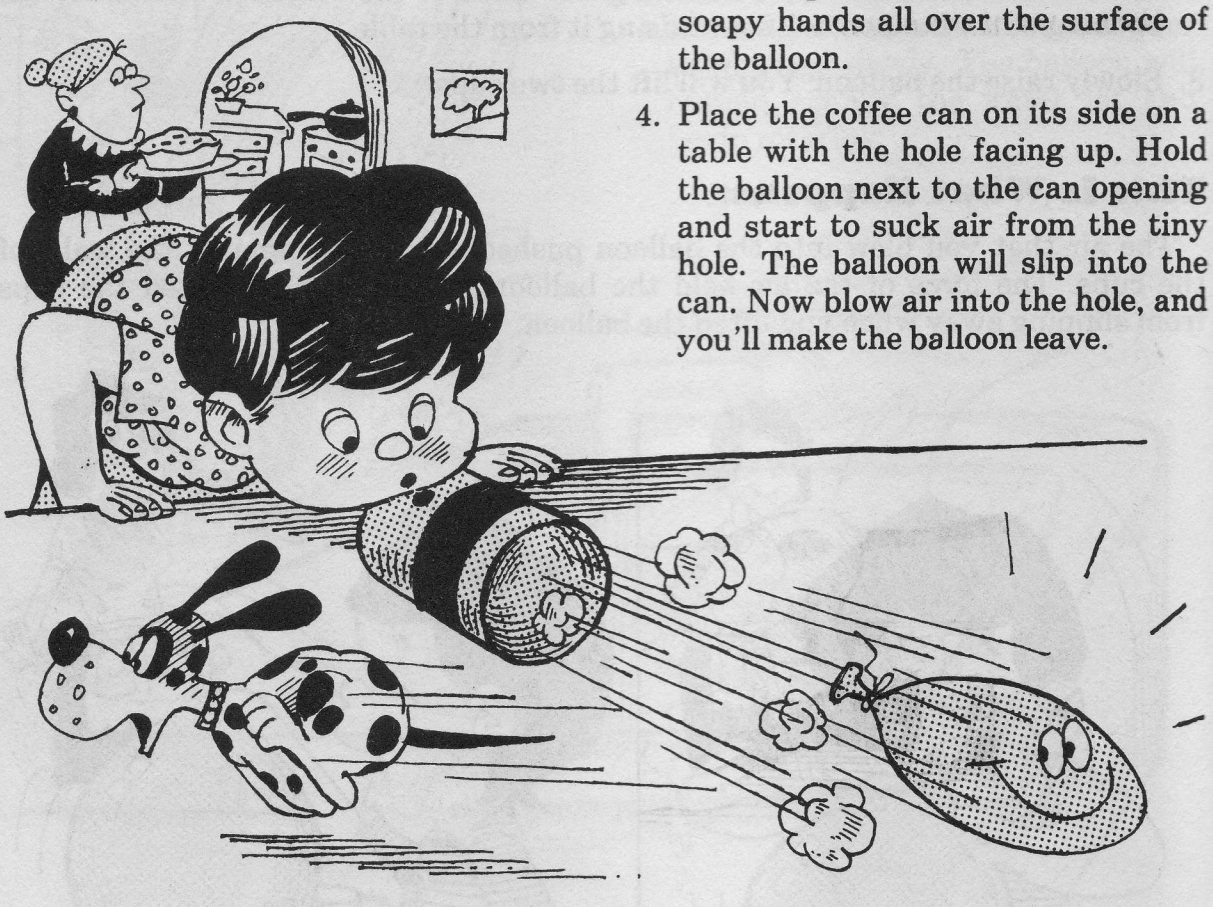
A Hole in One

You Will Need:

Coffee can
Nail
Hammer
Round balloon
Soap
THE HELP OF ONE OF YOUR PARENTS

Instructions:

1. Ask one of your parents to make a small hole near the bottom of a coffee can by tapping the tip of a nail into the metal can with a hammer.
2. Inflate a round balloon until it is slightly larger than the can opening, then tie the balloon shut.
3. Wet your hands and lather them with a piece of soap. Rub your soapy hands all over the surface of the balloon.
4. Place the coffee can on its side on a table with the hole facing up. Hold the balloon next to the can opening and start to suck air from the tiny hole. The balloon will slip into the can. Now blow air into the hole, and you'll make the balloon leave.



This Is What Happens:

By sucking air from the can, you decrease the air pressure inside. The air pressure outside the can is now greater, and this pushes against the balloon, forcing it into the can. Blowing into the can does just the opposite: The pressure builds up inside and forces the balloon out.