SHOWY SCIENCE

EXCITING HANDS-ON ACTIVITIES

That Explore the World Around Us

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Good Year Books

An Introduction for Adult Helpers

As a teacher and a science education consultant, I have developed many hands-on science experiments. This book is a collection of my most successful science activities, which I have demonstrated hundreds of times, either in my classroom or at my consulting sites.

The activities in *Showy Science* are clustered around scientific concepts and principles that are closely related to elementary and junior high school science curricula. It is an excellent supplementary hands-on activity guide that can make science lessons fun and meaningful. Additionally, the principles taught have application to other common life activities. For example, simple siphon activities can lead to making a bean-sprout-growing device and self-watering devices for house plants.

Ordinary household objects are the major resource for these activities. Even a simple science apparatus costs some money, and many teachers, parents, and students are reluctant to buy an apparatus to conduct just one scientific investigation. Ordinary objects such as pop bottles and jars are economical, abundant, and easy to handle.

Even though this is an activity guide for elementary and intermediate grades, lay people will find it interesting. Various activities such as different methods of propagating house plants and building self-refilling bird baths are intriguing solutions to everyday problems. My ultimate goal was to present science in a fun and interesting way.

Hy Kim

Teachers, Parents, and Other Adult Helpers,
please take note:

Some of the activities in this book involve matches, hot plates, hot water, scissors, or other sharp tools. Below are the symbols used to alert you to any safety issues:

In the activities involving these safety issues, I've included notes to students, directing them to seek adult help. The results of these activities can be quite "showy" and safe, too, with your help and guidance.

An Introduction for Students

The activities in *Showy Science* cover a variety of science topics, allowing you to explore the air, water, earth, and animals around you, as well as forces that act upon you. You can do many of the activities alone or with adult help, but a great number of them will be more fun if you demonstrate them for your family, friends, or classmates.

Each activity includes:

- a list of things you will need to perform the activity
- illustrations to help you as you work
- the reasons behind the results of each activity
- information and terms to help you expand your scientific knowledge

Note that some experiments involve matches, hot plates, hot water, scissors, and sharp tools. Below are the symbols used in the book to alert you to any safety issues for an activity:


Flame used


Heat used


Chemicals used


Safety needed

If you conduct an activity that includes one of the above symbols, ask an adult to help you do it safely. If the experimental result doesn't turn out as described, try to find out what factors might be causing it to not work. By trying again and again until you figure it out, you can learn the science concepts better and understand how to control the variables. You may find many fascinating ideas to investigate with simple materials as well as gain excellent science fair project ideas.

Have fun with the many scientific investigations in this book.

Hy Kim

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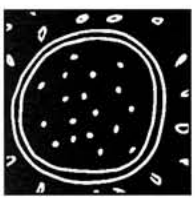

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ACTIVITIES FOR EXPLORING WATER

The Water Trick

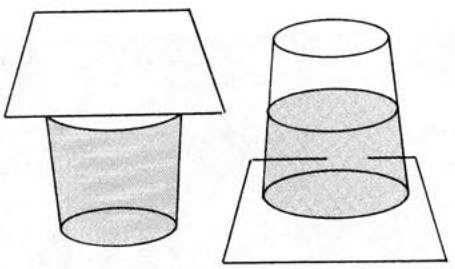
Everybody knows that water will spill out of a glass if you hold the glass upside-down. However, if you place an index card on the mouth of the glass and hold it upside-down, the water won't pour out! Try to find the minimum amount of water in the glass that you need for this activity.

For this activity, you need:

- ❍ a glass
- ❍ index cards
- ❍ water

To do this activity:

Partially fill two glasses with water and place an index card over the mouth of each, as in the illustration. Press the index card lightly to the glass with the palm of your hand, and gently flip over the glass so that the index card is positioned on the bottom.

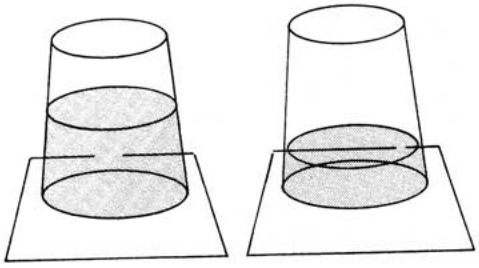


Slowly remove your hand from the card. The water will not spill! Try it again with a different amount of water.

Why does this work?

Because we live on the bottom of an "air ocean," there is a great amount of air pressure on everything on the earth's surface. A force equal to that exerted by a kilogram mass is on every square centimeter at sea level. This pressure also presses the glass from all directions. When gravity on the water pulls the water down, a partial vacuum is created inside the jar. This lowers the air pressure inside the glass. Outside air pressure presses upward against the index card, keeping the water from spilling. When this happens, it equalizes the forces inside and outside the jar.

Competition makes this activity even more fun. Give a glass and an index card to each of your friends. Ask them to do the same activity while trying to succeed with the least amount of water in the glass. The person who performs the activity with the least amount of water is the winner.



Why is it more difficult to keep a smaller amount of water in the glass? If you put only a little bit of water in the glass, the rest of the space inside is taken up by a larger amount of trapped air. Air can easily be compressed or expanded; a large amount of air can proportionally expand more than a small amount of air. The large pocket of trapped air in the glass exerts more pressure on the water. In turn, this pushes the index card away from the rim of the glass, allowing air to enter and the water to spill. This simple activity is related to the following useful device.

A Self-Refilling Water Bowl for Pets

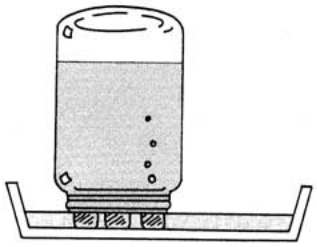
If you have a pet, you know that you must keep putting fresh water in its bowl for it to drink. You can make a device that will refill the bowl with fresh water as the pet drinks. It will even keep the water level constant! By using this device, you free yourself from the chore of filling the bowl with fresh water every day.

For this activity, you need:

- ❍ a large bottle (a gallon size is good)
- ❍ a water dish
- ❍ three small blocks that can be used to support the bottle

To do this activity:

Fill the bottle to the top with fresh water. Cover the bottle with the water dish so that the smooth bottom of the dish touches the mouth of the bottle. Carefully flip over the bottle and dish together, and place the device where your pet can find it. Lift up a corner of the bottle and insert the small blocks between the dish and the bottle. Water will flow into the water dish until the water level reaches exactly the height of the small blocks!



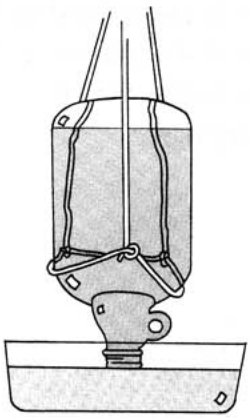
As your pet drinks, fresh water will flow into the dish, maintaining the same water level until all the water in the bottle is gone.

For a similar activity, you need:

- ❍ an adult helper
- ❍ an apple cider jug with cap
- ❍ string
- ❍ tape
- ❍ water
- ❍ a bowl
- ❍ a drill

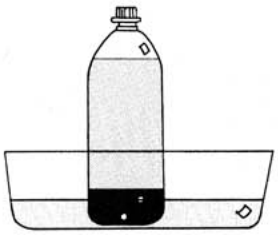
To do this activity:

With some durable string, make a harness by which you can suspend the jug as shown below.



Fill the jug with water, and cap the jug temporarily. Using the harness you have made, suspend the jug from a convenient height. Place a water bowl directly underneath the jug's mouth. Make sure the mouth of the jug is below the rim of the dish. Now remove the jug's cap. Water will fill the bowl until it reaches the mouth of the jug. Whenever the water level goes down, fresh water will fill the bowl to the same water level.

You can use a two-liter pop bottle to make the water refilling device, too. As shown in the following illustration, make two holes in the bottle about 5 millimeters in size, one at the bottom and one at the side. Ask an adult to help you use an electric drill to make the holes.



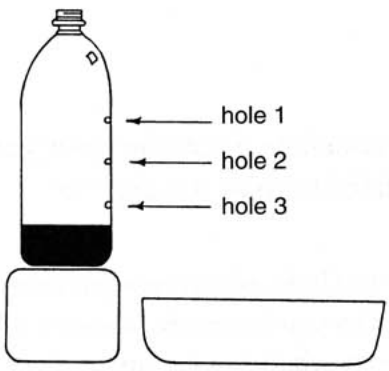
Block the holes with tape, and fill the bottle to the top with fresh water. Tighten the cap on the bottle and place it in a water dish as shown above. Remove the tape from the holes. You will see air bubbles rising in the bottle from the side hole. Water will flow through the bottom hole into the dish. When the water level reaches the side hole, both the water flow and the air bubbles will stop.

Why does this work?

If the water level goes down, a gap will form between the water level and the rim of the bottle. Through this gap, air seeps into the bottle and releases an equal volume of water into the dish. Once the water level reaches the rim of the bottle, the air passage is blocked, and the water stops flowing.

Water Jets I

Use the following illustration to set up this simple system.



One hole will always shoot a longer stream, or jet, of water. Which hole is it? Ask your friends to predict the answer!

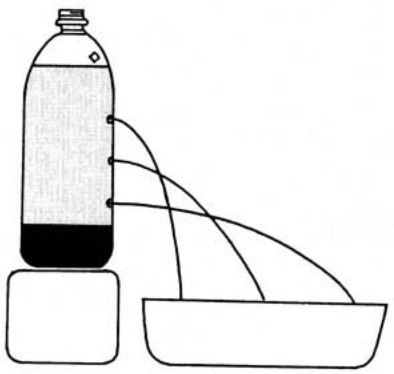
For this activity, you need:

- ❍ an adult helper
- ❍ a plastic pop bottle
- ❍ water
- ❍ a container
- ❍ a block on which the bottle can stand

To do this activity:

Make three holes on the side of the bottle, one above the other. An adult can help you make these holes more easily by heating one end of a metal wire (such as a coat hanger) and applying the heated metal to the plastic bottle.

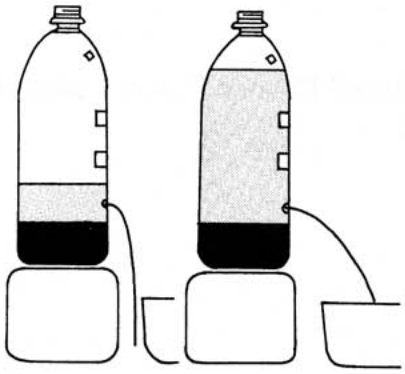
Plug the three holes with your fingers, and fill the bottle to the top with water. Place the bottle on a block. Place a container in front of the bottle to catch the water. As you prepare to demonstrate this to your friends, ask them, "Which hole will shoot a water jet the farthest?" Then release your fingers to see whose prediction is correct!



The results will be similar to the illustration. The bottom hole shoots the water jet the longest distance, the middle hole a little shorter, and the top hole the shortest distance of all.

Why is this? The bottom hole has more water above the hole, which creates more pressure on it than the other two holes. This is also why you feel more pressure when you dive to the bottom of a swimming pool compared to when you are just wading.

Cover the upper two holes with tape. Fill the bottle to the top. With the bottom hole exposed, watch how far the water jet shoots as the water level goes down.



How does this happen?

The water jet becomes shorter as the water level goes down because the water pressure above the hole is diminishing.

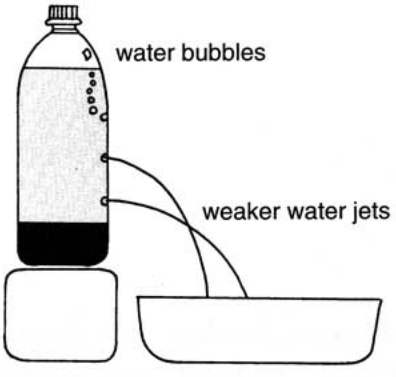
Water Jets II

For this activity, you need:

- ❍ the bottle from the last activity

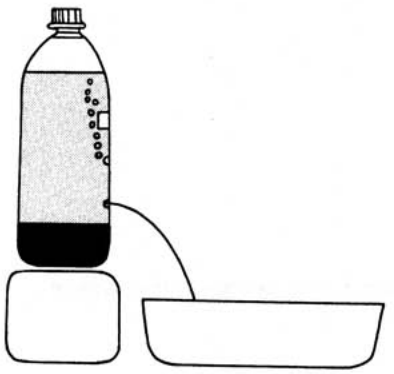
To do this activity:

Take the bottle and plug its holes with your fingers. Fill it with water and tighten the cap. Before you release your fingers, predict what will happen with the water jets.



Your results will be similar to the illustration above. The bottom two holes will produce weak water jets. The top hole will take in air, forming bubbles in the bottle. Why does the top hole make air bubbles in the water? Air pressure surrounding the bottle forces air inside through the top hole because it has the least water pressure.

Try to block the top hole with your finger. What happens? The middle hole makes air bubbles and the bottom hole makes a weak water jet.

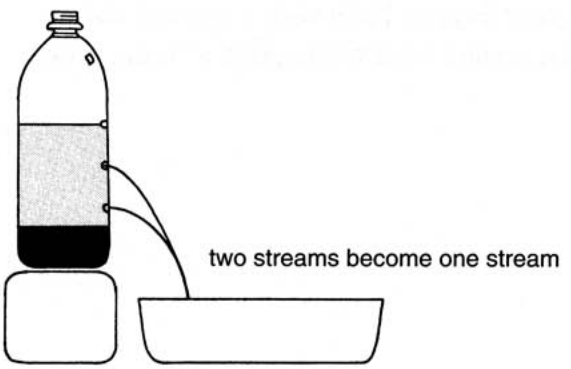


For a similar activity, you need:

❍ the bottle from the last activity

To do this activity:

As the water jets grow weaker, and only two streams are running, "pinch" the streams together. They will remain together. You may also tilt the bottle slightly so that the two water jet streams meet and become one.



Why does this happen?

Like oppositely charged particles, water molecules attract each other. This attracting force between the water molecules is called *cohesive force*. This force keeps water in a liquid state instead of a gaseous one.

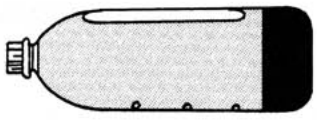
A Series of Provoking Tasks

For this activity, you need:

- ❍ the two-liter pop bottle from the previous experiment

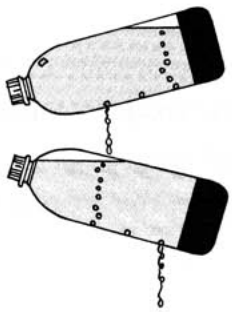
To do this activity:

Fill the pop bottle to the top with water while blocking the holes with your fingers. Put the cap on the bottle and tighten it. Hold the bottle horizontally as shown below.



If you have an audience, ask them what they think will happen if you release your fingers from the holes. Release your fingers. What happens? Does one hole shoot a stronger water jet than the others?

Water doesn't flow out of any of the holes! Now, raise the right side of the bottle a little bit and see what happens. Do the same to the left side.



If you hold the bottle horizontally, no water will run out of the bottle.

Why does this happen?

This happens because the three holes have an equal force of water pressure on them. Water pressure tries to push the water out through the holes, but there is no weak hole through which air can go into the bottle. However, if you tilt one side of the bottle, the highest hole has the least water pressure on it. This allows the air to enter the bottle. The lower holes now permit the water to flow out of the bottle.

The Obedient Diver

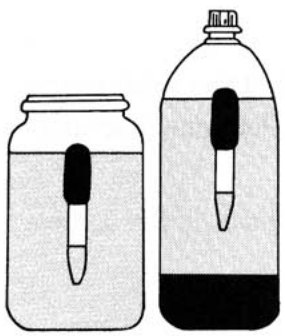
You can make an eye-dropper diver system. The diver will obey your every command. If you order the diver to dive in the bottle, it will go down. If you order it to rise, it will.

For this activity, you need:

- ❍ one two-liter pop bottle or any other kind of transparent plastic bottle
- ❍ a glass eyedropper (your diver) (A plastic eyedropper won't work, but a test tube can be used instead of an eyedropper.)
- ❍ an empty jar with a large mouth
- ❍ water

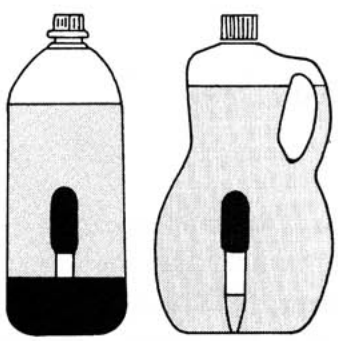
To do this activity:

Fill an empty jar with water as shown below. Notice that if you place the eyedropper in the jar, it will float.



Squeeze and release the rubber bulb on the eyedropper to draw water into it. Do this until the rubber bulb touches the surface of the water when it is floated in the water.

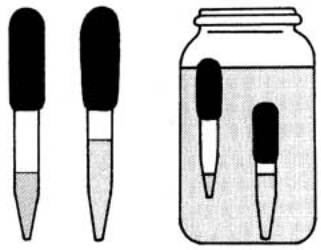
Now fill the pop bottle about 3/4 full of water. Remove the eyedropper from the jar and drop it into the filled pop bottle. Tighten the cap on the bottle. You are now ready to demonstrate how the obedient diver works.



Squeeze the bottle. What happens to the diver? The diver will sink. As you release the bottle, the diver will float. Pretend you have magical powers to make the diver float or sink. Do this while you squeeze and release the bottle without anyone noticing your actions.

Why does this work?

Watch the air column in the diver as you squeeze the bottle. What happens to the size of the air column when the diver sinks?



When you squeeze the bottle, the pressure in the bottle increases. The air column will get shorter as more water forces its way into the diver and makes it heavier. Thus, if you put too much water in the diver at the very beginning, the diver will sink and stay down.

Did you ever watch a water snail sink and float in an aquarium? For millions of years, water snails have used the same principle as our diver to sink or float. Some fish use their balloon-shaped air bladders to sink or float.

Pretend you are designing a submarine. You have attached a "float tank" to the submarine so that the volume of air can be controlled by pushing a button. Increasing the volume of air causes the submarine to rise. Decreasing the volume of air causes the submarine to sink.