

This guide accompanies
[*Science Sustainability Sleuths Day 1*](#)

PRIOR TO TEACHING



Subject

Los Angeles' Environment



Program Length

45 minutes – 1 hour



Program Objective

It can take thousands of years for one water molecule to move its way through the entire water cycle. By watching a special kid-friendly documentary and doing several hands-on activities, students will learn about and create their own mini-water cycle models.



Next Generation Science Standards

3-PS2-2: Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

5-LS1-1: Support an argument that plants get the materials they need for growth chiefly from air and water.

5-LS2-1: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

5-PS1-1: Develop a model to describe that matter is made of particles too small to be seen.

5-PS2-1: Support an argument that the gravitational force exerted by Earth on objects is directed down.



What I Need Today

zipper lock sandwich bag

tape

water

permanent marker

clear plastic bottle with screw cap (optional for students – can be teacher led)

matches and help from an adult (optional for students – can be teacher led)

shaving cream foam

liquid food coloring

clear cup



Vocabulary

Sustainability – Using resources (such as water and energy) wisely so we can continue using them in the future. Some natural resources can be reused over and over again (like energy generated from the sun), but some have a limited supply (such as clean fresh water or fossil fuels like gasoline).

Sleuth – A detective, or someone who looks for clues or information.

Water Cycle – The movement of water around the Earth from liquid to vapor (gas) to ice (solid) and back again. The Water Cycle has several stages: evaporation, condensation, and precipitation.

Evaporation – When liquids (such as water) change into a gas (vapor).

Condensation – When gases (such as water vapor) change into a liquid.

Water Vapor – Water in its gas form (above its boiling point of 100 degrees Celsius/212 degrees Fahrenheit). Steam is a form of water vapor.

Atmosphere – The layer of several different gases that surrounds the Earth; often called air.

Precipitation – When water falls from the sky as rain (liquid), snow (solid), sleet (solid), or hail (solid).



Instructor Prep

In advance, send students a list of the materials needed for today's lesson.

******To make a cloud in a bottle, you need matches, so feel free to do this as a demonstration instead of having your students each make their own cloud.



PROCEDURE



What We'll Learn

A science sustainability sleuth is a detective who learns all about the science of using water and energy in ways that help, instead of hurt, our environment. We only have one planet Earth, so it's important to keep her healthy and clean. This 10-session program will immerse you into a world of hands-on science, high quality (and kid friendly) video content, and get you excited to become a conservation expert!



The Water Cycle has three basic parts: evaporation (when water turns from a liquid into a gas), condensation (when water vapor turns from a gas into a liquid), and precipitation (when liquid or solid water falls down onto the surface of the Earth).



What Will Happen?

Scientists ask questions and make predictions before they start investigating. Have your students hypothesize: how long will it take their miniature water cycle models to rain down water?

- ☐ 1 hour or less
- ☐ 2 hours
- ☐ 3-5 hours
- ☐ 6-10 hours
- ☐ 1 day or longer

What to Do

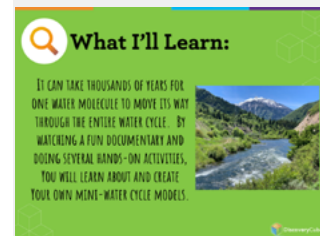


VIDEO - THE WATER CYCLE

To start learning about the importance of water conservation, first watch [The Water Cycle](https://vimeo.com/496452851/b3217dd63e) documentary:

<https://vimeo.com/496452851/b3217dd63e>

To review the stages of the water cycle and see them in action, complete the following three activities. Start by experimenting with precipitation when you make a water cycle in a bag.





EXPERIMENT - WATER CYCLE IN A BAG

1) Grab a zipper lock sandwich bag and a permanent marker. Then use the marker to draw the sun and some clouds on the bag.



Tips & Tricks: You can still do this activity if you don't have a zipper lock sandwich bag – just make sure you have a small water-tight clear bag and a way to seal it. If you don't have a permanent marker, you can use washable markers (just be careful not to touch the wet marker as it won't dry on the plastic).

2) Pour a little water into the bag. To help you see the water better, you can add a couple drops of blue food coloring (if you have some) to your water. Seal the bag and gently shake it to mix the water and food coloring together.



Tips & Tricks: You don't need much water or food coloring for this to work well. One or two drops of food coloring mixed with about an inch of water is perfect.

3) Tape the sealed bag to a window that gets lots of natural light.

4) While you wait for the energy from the heat of the sun to turn the liquid water into a gas (through a process called "evaporation"), try the next activity to learn how clouds form through condensation.



Tips & Tricks: Check on your bag throughout the week. It may take several hours for the water vapor to begin forming droplets of water that stick to the side of the bag.



EXPERIMENT - CLOUD IN A BOTTLE*

1) Water vapor (the gaseous form of water) is found all over our atmosphere, but water vapor on its own cannot form clouds. So how do clouds form? Grab a clear plastic bottle with a screw cap (such as a two-liter bottle or a disposable

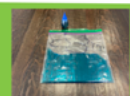
WATER CYCLE IN A BAG



1. USE THE MARKER TO DRAW THE SUN AND SOME CLOUDS ON THE BAG.

YOU CAN TELL BY THE ACTIVITY IF YOU DON'T HAVE A ZIPPER LOCK SANDWICH BAG – THIS PROJECT WORKS BEST WITH A ZIPPER LOCK SANDWICH BAG AND A WAY TO SEAL IT. YOU CAN USE WASHABLE MARKERS (JUST BE CAREFUL NOT TO TOUCH THE WET MARKER AS IT WON'T DRY ON THE PLASTIC).

WATER CYCLE IN A BAG



2. POUR A LITTLE WATER INTO THE BAG. TO HELP YOU SEE THE WATER BETTER, YOU CAN ADD A COUPLE DROPS OF BLUE FOOD COLORING. SEAL THE BAG AND GENTLY SHAKE IT TO MIX.

ONE OR TWO DROPS OF FOOD COLORING MIXED WITH ABOUT AN INCH OF WATER IS PERFECT.

WATER CYCLE IN A BAG



3. TAPE THE SEALED BAG TO A WINDOW THAT GETS LOTS OF NATURAL LIGHT.

IT MAY TAKE SEVERAL HOURS FOR THE WATER VAPOR TO BEGIN FORMING DROPLETS OF WATER THAT STICK TO THE SIDE OF THE BAG.

CLOUD IN A BOTTLE



HYPOTHESIZE:
HOW ARE CLOUDS MADE?

CLOUD IN A BOTTLE



1. WATER VAPOR (THE GASEOUS FORM OF WATER) IS FOUND ALL OVER OUR ATMOSPHERE, BUT WATER VAPOR ON ITS OWN CANNOT FORM CLOUDS.

2. WATER VAPOR (THE GASEOUS FORM OF WATER) IS FOUND ALL OVER OUR ATMOSPHERE, BUT WATER VAPOR ON ITS OWN CANNOT FORM CLOUDS.



water bottle), some water, a match, and help from an adult so you can find out!



*Tips & Tricks: Since this activity involves a match, it may be better for you to conduct it as a demonstration for your students.

2) Pour a small amount of water into the bottom of your bottle – you don't need much to make this work!

3) Swish the water around the bottle to move more of the liquid water into water vapor. Continue swishing the water around for about 1 minute.

4) With the help of an adult, strike a match and blow it out. Then quickly place it into the bottle and screw on the lid. This adds ash and smoke particles into your environment.



Tips & Tricks: You don't need the match to burn very long for this to work.

5) Squeeze the bottle to increase the pressure inside the bottle.



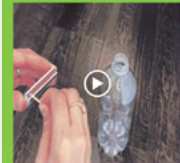
Fun Facts: Greater air pressure causes the air temperature to rise (get hotter), which moves more of the liquid water into the vapor form.

6) Stop squeezing the bottle. A cloud will form! (If you can't see a cloud, try adding a bit more ash or try squeezing a little harder.)



Fun Facts: When you stopped squeezing the bottle, the air pressure inside dropped, causing the temperature to drop (get cooler). As air temperature cools, water vapor clings to ash, smoke, or dirt particles and moves into the liquid form of water, creating a cloud (this process is called "condensation"). If you didn't have the ash and smoke inside the bottle, the cloud wouldn't be able to form.

CLOUD IN A BOTTLE



1. Pour a small amount of water into the bottle.
2. Swish the water around the bottle for about 1 minute.
3. Strike a match, blow it out, and quickly place it into the bottle and screw on the lid.
4. Squeeze the bottle to increase the pressure inside the bottle.
5. Stop squeezing the bottle and a cloud will form.

CLOUD IN A BOTTLE



1. Squeeze and release the bottle. The air temperature inside the bottle will increase, which moves more of the liquid water into the vapor form.
2. When you stop squeezing the bottle, the air pressure inside drops, causing the temperature to drop (get cooler). As air temperature cools, water vapor clings to ash, smoke, or dirt particles and moves into the liquid form of water, creating a cloud (this process is called "condensation"). If you didn't have the ash and smoke inside the bottle, the cloud wouldn't be able to form.



EXPERIMENT - SHAVING CREAM RAIN

1) Water needs smoke, ash, dirt, or some other microscopic particle to form a cloud, but all clouds do not create rain or snow. To learn about precipitation and how clouds release rain, gather your final materials: a clear cup, some water, shaving cream, and liquid food coloring.

2) Pour water into the clear cup until it is about $\frac{3}{4}$ full.

3) Spray a layer of shaving cream foam on top of the water, until the cup is filled.



Tips & Tricks: Make sure the shaving cream covers the entire surface of water, but the less shaving cream you use, the faster this will work.

4) Add several drops of food coloring on top of the shaving cream.



Tips & Tricks: If your students don't have food coloring, have them try out some other watery, colored liquids found in their kitchen, such as soy sauce or orange juice.

5) It may take a couple of minutes for the weight from the liquid food coloring to make its way through the shaving cream, but when it does you will see the colored water "rain" down. This part of the water cycle is called "precipitation". (If you need to speed it up, try adding a few drops of water on top of the food coloring.)



Fun Facts: When enough water molecules cling together (either in their liquid or solid forms), their weight becomes so great that the gravitational pull of the Earth pulls these water droplets down toward the Earth – in the form of rain or snow!

6) Remember to go back and check on your water cycle in a bag. Do you see any evaporation?

SHAVING CREAM RAIN



1. WATER NEEDS SMOKE, ASH, DIRT, OR SOME OTHER MICROSCOPIC PARTICLE TO FORM A CLOUD. SPRAY THESE MATERIALS TO CLOUD ABOUT PRECIPITATION.

SHAVING CREAM RAIN



2. POUR WATER INTO THE CLEAR CUP UNTIL IT IS ABOUT $\frac{3}{4}$ FULL.
3. SPRAY A LAYER OF SHAVING CREAM FOAM ON TOP OF THE WATER, UNTIL THE CUP IS FILLED.
4. ADD SEVERAL DROPS OF FOOD COLORING ON TOP OF THE SHAVING CREAM.

SHAVING CREAM RAIN

4. ADD SEVERAL DROPS OF FOOD COLORING ON TOP OF THE SHAVING CREAM.

5. IT MAY TAKE A COUPLE OF MINUTES FOR THE WEIGHT FROM THE LIQUID FOOD COLORING TO MAKE ITS WAY THROUGH THE SHAVING CREAM, BUT WHEN IT DOES YOU WILL SEE THE COLORED WATER "RAIN" DOWN. THIS PART OF THE WATER CYCLE IS CALLED "PRECIPITATION".

6. REMEMBER TO GO BACK AND CHECK ON YOUR WATER CYCLE IN A BAG. DO YOU SEE ANY EVAPORATION?





CONCLUSION



What I Discovered

To earn a portion of the H2O Now You Know badge, have your students reflect on what they discovered. We would love to see pictures of their water cycle models. Please email pictures to educationemail@discoverycube.org.



For Next Week

Have your students gather these supplies:

- clear plastic or glass bowl
- small clear cup that can easily fit inside the bowl
- mixing spoon
- plastic wrap
- warm tap water
- measuring cup
- measuring spoon
- salt
- paper
- pencil
- tape
- small weights, such as small rocks, marbles, or coins
- heat lamp (optional)
- crayons, markers, or colored pencils (optional)
- *empty toilet paper tubes, paper towel tubes, and/or wrapping paper tubes (as many as possible). Note: these will not be needed until week 4.

