

A PENNY FOR YOUR DROPS



Background Information for Activity Leaders

Overview

Children will explore physical properties of water, and how adding soap can change one of these properties. Children will also investigate the consequences of adding pollutants to water in the environment.

Key Concepts

- Water, like everything else that is classified as matter, is made up of tiny particles that are too small to see even with a microscope. These particles are called molecules.
- Water molecules are attracted to other water molecules. This is called **cohesion**. Water can also be attracted to other materials, like glass. This is called **adhesion**.
- Water molecules act like magnets. Opposite sides like the North and South pole of a magnet allow them to hang on to neighboring water molecules. This causes water to appear to stay together, even when it is not in a container. For example, if you observe water that has spilled from a cup, you will see that it tends to form beads of water instead of forming one thin layer of liquid on a surface.
- Water molecules that are found on the surface are attracted and hang on tighter to the water molecules below and around the sides because they have nothing to hang on to above them. This makes the water molecules in the surface layer more difficult to separate. Scientists call this **surface tension**.
- Surface tension is the reason why small insects such as the water striders can walk on water. Their weight is not enough to break surface tension of water.
- In this lesson, soap is used to break the surface tension of water. When the water molecules can't hold onto each other anymore, the water molecules let go and the surface tension is released. When this happens, the pepper on the surface moves away from the soap as water molecules separate.
- Soaps and detergents help clean clothes by lowering the surface tension of the water so that it more readily soaks into pores and soiled areas. The soap actually breaks the attraction between water molecules.



Drop of Water



**Water Strider
on water surface**

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What to Expect

- Children will think that using a different side of the penny makes a difference. They should be encouraged to try out their hypotheses.
- By becoming familiar with observing, describing, and measuring the properties of water, and the changes that occur when water interacts with soap, children develop skills to fully understanding more advanced concepts like the surface tension of water.

Common Misconceptions

- *Children may think: "Water is afraid of soap."*
Make certain to clarify that the demonstration personifies water to add drama to the demonstration. Water is not alive; therefore, it cannot be afraid.
- *Children may think: "Raindrops have a sharp upper point."*
The surface tension of water acts like a flexible plastic bag around the water, and pulls the rain drop into a spherical shape. The attraction of water molecules to each other, cohesion, causes almost a perfect sphere to form. Raindrops are nearly spherical, and look more like a hamburger bun than their traditional pointy symbol.

A PENNY FOR YOUR DROPS

Data Collection Sheet

Name: _____

Date: _____

WONDER How many drops of each type of water will a penny hold?

RECORD

Data Table

type of water	number of drops	observations
regular water		
soapy water		

Draw how each penny looked before you added the last drop that caused the water to spill:

regular water	soapy water
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CONCLUDE How did adding soap to water affect how water behaved?

Set Up the Expedition

Materials:

For the activity leader:

- (1) large plastic pan
- (1) craft stick
- (1) teaspoon ground pepper
- (1) drop of liquid soap
- tap water

For each child:

- (1) **A Penny for Your Drops** Data Collection Sheet
- (2) pennies
- (2) droppers, one labeled "soapy water," one labeled "regular water"

For each group:

- **A Penny for Your Drops** Learning Cards
- (1) small container labeled "regular water"
- (1) small container labeled "soapy water"
- crayons and drawing paper

Prepare the demonstration:

1. Fill the large plastic pan half-way with tap water for the demonstration.
2. Place the large plastic pan of water where children can gather around and see.
3. Prepare one teaspoon of pepper.

Prepare the exploration:

1. Fill an empty 1.5 liter soft drink container with tap water. Add 20 drops of liquid soap to the tap water. Close the container and mix well.
2. Prepare one bowl with soapy water and one with regular water for each group.
3. Provide each child with a dropper labeled "soapy water", a dropper labeled "regular water," two pennies and a paper towel. Have each child place their paper towel on the table and place the pennies heads up in front of them. Everything about the two pennies must be the same, except the type of water. (It will not matter that the pennies have different dates.)
4. Distribute drawing paper and crayons.

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Activity Leader's Guide

Group Size: 4-6 children

Time: 45 minutes

Engage

- 1 Gather the children together.

Ask:

"I am going to play a trick on some pepper. Do you want to help me?"

Say:

"I am going to sprinkle this pepper all over the top of the water in this dish, and then we are going to scare it. When we scare it, you are going to see it run away!" Sprinkle the surface of the water with approximately one teaspoon of pepper.

- 2 **Whisper:**

"I heard that pepper is afraid of soap. Let's find out if this is true." Dab the tip of the craft stick with liquid soap.

Say:

"At the count of three, everybody say 'Boo!' Are you ready? 1, 2, 3, boo!" Say "Boo!" as you gently touch the center of the dish where all the pepper is. The pepper will appear to run away from the soap. If you want to repeat the demonstration, all traces of the soap must be washed out of the tray, and you must replace the water.

Explain:

"That was a great trick, but you know pepper, soap and water are not alive. Pepper can't really be afraid of the soap. Why did adding the soap cause the pepper to move?"

Allow the children to contribute their ideas. Children should suspect that soap changes something in the water, which causes the pepper to move from the soap.

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Activity Leader's Guide

Explore

- 3** If you are working with more than 4-6 children, divide the children into groups. Distribute the Data Collection Sheets and the Learning Cards.

Say:

“Follow the directions on the Learning Card to investigate how soap affects water.”

You may need to demonstrate how to fill an eye dropper, and talk about the difference between “one drop at a time” and a “squirt” of water. If they squirt the water, the activity will not work well. Ask children to add water to the penny one drop at a time.

- 4** Allow children enough time to complete the WONDER, EXPLORE, RECORD and CONCLUDE sections of their Learning Card.

Conclude

- 5** Gather the children together and ask the following questions:

“How many drops of regular water fit on your penny?”

“How many drops of soapy water fit on your penny?” The penny with regular water will hold a lot more drops than the one with soapy water.

- 6** ***“What differences did you notice about the shape formed by the regular water and the soapy water?”*** Children may describe the regular water as bubble-like, round, or taller than the penny. They may describe the soapy water as flat or spread out.

“Considering what you noticed, does adding soap to water change some of its physical properties?” Once children have shared their ideas, explain that soapy water does not form a “dome” because soap does not allow water molecules pull together. Soap and certain other substances can change how water interacts with other objects or even with living things.

Expand

- 7** Ask the children to follow the EXPAND instructions on their Learning Card.

Ask:

“What happens when runoff water containing soap finds its way into the environment? What other pollutants get into runoff water?”

Encourage children to use online or print resources to gather information. Then, they can brainstorm about what can happen to the environment when it is contaminated with polluted runoff water.


- 8** **Say:**
“Congratulations! You have earned your ‘Ask Me About Water’ stamp. You are ready to tell people about properties of water.”

A PENNY FOR YOUR DROPS

Expedition Learning Card

? How do soaps affect water?

 **property runoff pollution**

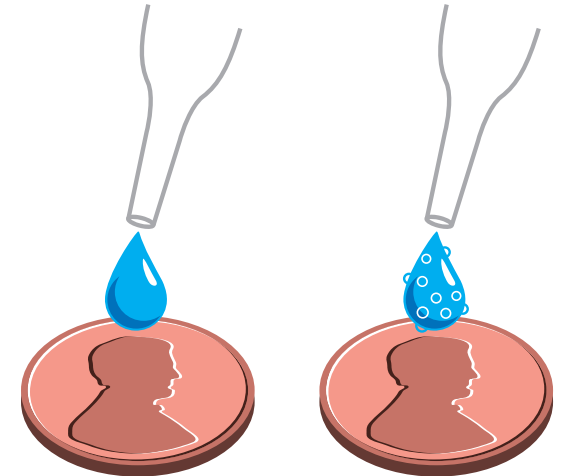
 Explore how soap can affect the way water behaves and its effects on the environment.

1 WONDER How many drops of regular water and how many drops of soapy water do you think a penny will hold?


 Write or draw your ideas on your Data Collection Sheet.

2 EXPLORE Using the eyedropper labeled regular water, carefully place one drop at a time of regular water on a penny. Count the drops.

Using the eyedropper labeled soapy water, repeat the same procedure using the soapy water on the second penny.



3 RECORD Notice everything you can about the regular water and the soapy water as each drop is placed on the pennies.

 Write down how many drops of regular water and soapy water each penny can hold. Draw the shape formed on top of the pennies by each type of water.


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Expedition Learning Card

4 CONCLUDE How did adding soap to water affect how water behaved?

5 EXPAND Did you know that washing your car with soap, and pouring motor oil or any other chemical into the ground can harm the environment?

- Soaps and other chemicals are harmful to fish and other wildlife that in or near water habitats.
- Runoff water, and everything that goes in the storm drains, ends up in water habitats without being treated to remove harmful chemicals.

 Use online and print resources to collect information. The U.S. Environmental Protection Agency is a good place to start: www.epa.gov/students
Write or draw about runoff water pollution in your area. How can runoff water pollution affect you?



Discovery

Why did we do that?

- Forming a “dome” is a property of water.
- That property can be changed when soap is added.
- Soaps in runoff water can find their way into the environment, causing harm to wildlife and plants.

Congratulations!

You have earned your “Ask Me About Water” stamp! Now you are ready to tell people about water!

