

US EPA ARCHIVE DOCUMENT



THE CASE OF THE DISAPPEARING WATER

Grades
4 - 6

► OBJECTIVES

- Demonstrate knowledge of the concepts of “evaporation.”
- Explain evaporation in the context of the water cycle.

► ESTIMATED TIME

- 45 minutes to read and start the experiment
- 15 minutes to reach conclusions at the end of the experiment.



► MATERIALS

- ☐ Clear measuring cups
- ☐ Water
- ☐ Copies of activity handouts

BACKGROUND INFORMATION

The states in which water exists—**solid**, **liquid**, and **gas**—are often referred to as **phases**. As heat is added or removed, water goes through a phase change. In its solid phase, water molecules are structured and orderly, in its gaseous phase water molecules lack structure and order.

In nature, the energy, or heat of the sun causes water to evaporate into its gaseous, or vapor, phase. Likewise, when we boil water over a burner we are causing it to change from a liquid to a gas. The process by which a substance changes from a liquid to a gas is called **evaporation**.

Water is continuously being heated and cooled—evaporating, condensing, freezing—depending on its environmental circumstances. As water travels its never-ending cycle between earth and sky, it encounters and mixes with a variety of substances. Some of these substances are **pollutants** in the sense that they are harmful to living things. Pollution can result both from natural sources and human activities.

Fortunately, through the water cycle, nature provides a variety of mechanisms for cleaning water. For example, evaporation is a natural water cleanser. When water evaporates, it leaves most dissolved substances and waste materials behind. Pollutants can also be filtered out when water moves through soil. Some pollutants settle out in slow-moving water bodies. Nature even employs a host of microscopic organisms to help keep water clean. Unfortunately, however, if pollutants remain in the environment, clean water can easily become polluted all over again as it moves through its cycle.

TEACHING STRATEGY

1. Tell the students that they are going to be water detectives who are being asked to solve the case of the disappearing water.
2. Allow students to read the activity handouts.
3. Coach students as necessary, but encourage independent thinking as much as possible.



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NOTES

4. Make sure students develop a hypothesis before beginning the experiment.
5. Make sure students remember to check the water level each day.
6. When the experiment is over, be sure the students record their results and conclusions.
7. Allow the students to work in small groups.

Follow-up Questions

1. For what reasons might the results of each group's experiment differ? *Environmental variables, e.g., one group's measuring cup may be exposed to more or less sun than the other's.*
2. Suppose that during the days Mrs. Flowers was gone the weather was sunny and hot; however, when the water detectives conducted their experiment, the weather was cloudy and cool. How would this variable affect the experiment?
3. What is a variable? *Something that is subject to change or variation; not constant.*

Alternate Strategy

- See “The Easy Evaporation Experiment” in this unit if you wish to perform this experiment without the story.



STORY: THE CASE OF THE DISAPPEARING WATER

THE CASE OF THE DISAPPEARING WATER

by Susan M. McMaster

The Water Detectives Anonymous were called to the home of Mrs. Flowers. When they arrived on the scene, Mrs. Flowers' grown son, Frank Flowers, was frantic. His mother was missing! The detectives asked Frank how long his mother had been missing.

"That's just it," Frank said. "I've been traveling a lot and kept forgetting to phone her. Now I feel terrible. I have no idea where she is or how long she's been missing."

"Do you know of some places where she might have gone?" asked one water detective.

Frank wrinkled his brow and thought hard. "Well," he said, "her habits are very predictable. If she has been gone less than a day, she probably just went shopping. If she's been gone for less than 3 days, she may be visiting one of her sisters. She always says 'Guests are like fish, they start to stink in 3 days!' She would never visit anyone for more than 3 days."

"If she's been gone more than 3 days, but less than 7," continued Frank, "she's probably taking a vacation on a cruise ship. I'm sure she can't afford more than a 7-day cruise. If she's been gone more than 7 days but less than 6 weeks, she's probably received the grant that she applied for—she wants to study art in Europe. If she's been gone more than 6 weeks, she is probably at her mountain cabin. However, she never stays there more than 2 months. If she's been gone longer than 2 months, aliens must have captured her and taken her to another galaxy. She loves her plants and her home. She would never stay away longer than 2 months for any reason.

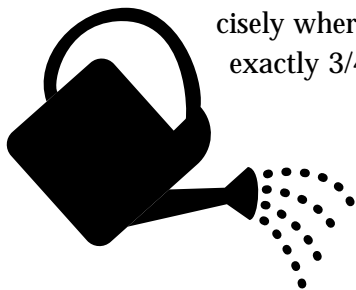
"I think we can help you solve this mystery," said another water detective who had been looking around the house.

"Did you find a note?" asked Frank hopefully.

"No," said the detective, "but I did find this glass measuring cup in the window."

"Oh," said Frank, "that's nothing. Mother is very particular. Every morning she fills the measuring cup to exactly one cup. Then she puts it in the window sill to warm in the sun for a little while before she waters her African Violets. She is very careful about how much water she uses because she doesn't want to over-water or under-water the plants."

STORY: THE CASE OF THE DISAPPEARING WATER



“Aha!” said the water detective, “Just as I suspected, this is precisely where we must begin our search. The measuring cup now has exactly $\frac{3}{4}$ of a cup of water.”

“Are you saying someone stole $\frac{1}{4}$ of a cup of water?” asked Frank.

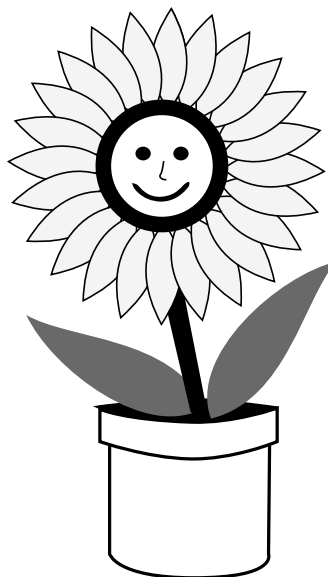
“No wonder his mother didn’t bother to tell him where she was going!” muttered one of the detectives.

“No, sir,” said another water detective, trying to keep a straight face. “It’s a matter of evaporation. Ya’ see, water evaporates into the atmosphere. The warmth of the sun changes the liquid into water vapor that we can’t see. After awhile the water vapor condenses and forms into clouds. Eventually, the water comes back to the ground as rain or snow or hail. Over time, the water evaporates again. It’s part of the water cycle.”

“To make a long story short,” said another detective. “We’re going to conduct an experiment. We’ll put a cup of water in a sunny place and keep track of how long it takes to evaporate. Based on that experiment, we will estimate how long ago Mrs. Flowers left the measuring cup in the window sill.”

“What a relief!” said Frank. “What should we do now?”

“I suggest you water the plants,” replied yet another detective.





ACTIVITY: THE CASE OF THE DISAPPEARING WATER

THE CASE OF THE
DISAPPEARING WATER

Step 1: Read "The Case of the Disappearing Water."

Step 2: Write down the facts of the case:

1. Original amount of water in the measuring cup _____.
2. Amount of water in the measuring cup now _____.

Step 3: Write down where Frank Flowers said his mother might be.

- If Mrs. Flowers has been gone for less than a day, she probably
_____.
- If she's been gone for less than 3 days, she may be
_____.
- If she's been gone more than 3 days but less than 7, she's probably
_____.
- If she's been gone more than 7 days but less than 6 weeks, she's probably
_____.
- If she's been gone more than six weeks but less than two months, she is
_____.
- If she's been gone longer than two months,
_____.

Step 4: Develop a hypothesis: (Tell what you think will happen before you do the experiment.)

1. How long do you think the water was left on the window sill? _____.
2. Where do you think Mrs. Flowers went? _____.

ACTIVITY: THE CASE OF THE DISAPPEARING WATER

Step 5: Perform an experiment to establish approximately how long it took for the water to evaporate.

Supplies:

- ☐ Clear measuring cup
- ☐ Water

Directions:

1. Write down today's date. _____
2. Fill a measuring cup to the 1-cup line.
3. Put the cup in a sunny window.
4. Record how many days it takes for the water in the measuring cup to be at the three-fourths cup line.

Step 6: Write your conclusions.

1. It took approximately ____ days for the water to evaporate.
2. Where should Frank begin looking for Mrs. Flowers? _____

Step 7: Make notes about your observations in your water detective's notebook:

Supplementary Activities:

- Have students fill cups half full with water and then add other substances (e.g., food coloring, salt, mud). Set the cups in locations that are sunny and shady. Have students observe what happens to water in sunny versus shady locations and what happens to the substances in the water as the water evaporates.