



WHAT'S SO SPECIAL ABOUT WATER: IT'S ICE, WATER, STEAM

Project Skills:

- Discovery of chemical and physical properties of water.

Life Skills:

- Communication – verbalizes freely, especially in small and familiar groups

Science Skills:

- Making observations

Academic Standard:

The activity complements this academic standard:

- Science D. 4.3. Understands that substances can exist in different states – solid, liquid, gas.

Grade Levels: 3-5

Time: 10-15 minutes

Supplies Needed:

- 2 clear glasses
- Kool-Aid
- Ice cubes
- Pan for boiling water
- Measuring cup
- Stove or hot plate
- 2 plastic glasses
- Paper towels

Do Ahead:

- Read through this entire activity plan and perform the experiments.
- For definitions of words and for an explanation of water properties, review the “Background,” “Helpful Hints” and “Additional Web Links” sections.

BACKGROUND

This is about water and its different forms, along with its very bizarre behavior where its solid form floats in its liquid. Usually it's the other way around! Water is one of the few substances on earth that can be easily found in all three states – solid, liquid and gas.

The temperature at which water freezes and boils are not extreme. As water heats to the boiling point, the water molecules move further apart and form bubbles of gas.

These bubbles rise to the top because they are less dense and escape as water vapor (steam). Water molecules in ice are further apart from each other than in liquid water. Ice is less dense than liquid water, so it floats in liquid water. The difference between solids, liquids and gasses lies in the arrangement of their component molecules (or atoms). The molecules of a solid are the most orderly (or least randomly arranged), while those of gasses are the least orderly (most random). The orderliness of the molecules in liquids lies in between those of solids and gases. All solid substances, when heated, melt to form a liquid and, on subsequent heating, evaporate to form a gas. The specific temperature at which these transitions occur is a property of that substance.



Key vocabulary words:

- *Condensation* is the process by which water vapor (steam) in the air is changed into liquid water by being cooled through contact with a cool surface.
- The *atom* is the smallest unit of matter that can take part in a chemical reaction. It is the building block of matter.
- A *molecule* consists of two or more atoms chemically bonded together.

WHAT TO DO

Activity: It's Ice

1. Put an ice cube in a glass of Kool-Aid.
2. See what happens when you put an ice cube in a glass of water.

TALK IT OVER

Reflect:

- Based on your observations, what happened when you put the ice cube in the glass of Kool-Aid? In the glass of water?
- Why do you think the ice cube floated?

Activity: It's a Gas

1. Measure two cups of water and pour into a small pot on a stove or hot plate.
2. Heat the water until it begins to boil and bubble up (4-6 minutes).
3. Watch the “smoke” (steam/vapor) that comes off the heated water.
4. Let it cool about 15 minutes and then re-measure the water.

TALK IT OVER

Reflect:

- What happened to the water as it heated and started to boil?
- Where do you think the water went?
- What did the water become after it boiled?

- Read “[Science with Kids, Science by Kids](#)” on how to teach science.

Sources:

- Lead author: Sally Bowers, 4-H Youth Educator, UW-Extension, Dane County.
- Contributions by: Dolly Ledin, UW Center for Biology Education and UW Adult Role Models in Science (ARMS); Tom Zinnen, UW-Extension Biotechnology Policy and Outreach Specialist; Linda Eisele, City of Madison, Office of Community Services; and Kathi Vos, Wisconsin 4-H Experiential Learning Specialist.
- Ice-in-water photo from <http://middlezonemusing.com>.

Activity: It’s a Liquid

1. Boil water in a small pot over a stove or hot plate.
2. Fill two plastic glasses with cold water.
3. Put an oven mitt on each hand. Please wear long sleeves.
4. Hold one plastic glass six inches over the boiling water pot.
5. Hold the other plastic glass in the air but *away* from the boiling pot (the other mitt is on so it is a fair comparison).
6. Dry off the two glasses with a paper towel and switch the glasses so you now hold the second glass over the boiling pot and the first glass out in the air away from the pot.

TALK IT OVER

Reflect:

- What happened to the water in the glass held over the boiling pot?
- What happened to the water in the glass held in the air away from the boiling pot?
- What differences did you observe between the two glasses?
- What happened when you switched the glass above the boiling water with the glass away from it?
- Why do you think all of this happened?

HINT: Help youth figure out how to detect something they can’t see (such as water vapor) by using one of its traits (e.g., water vapor condenses into drops when it hits a cold surface).

Apply:

- What did you learn about watching things closely?
- How did you share what you saw with words? Without words?
- How did you share what you saw with your friends? With your helpers?
- Name some other times when it’s important to share observations with others.
- When do you see things like this in everyday life?

HINT: An example may be water droplets forming on the surface of an ice cold soft drink in the summer.

ENHANCE

- Float other items on water (e.g., toothpick, paper clip or penny).
- Visit: http://www.nyu.edu/pages/mathmol/textbook/info_water.html. Have youth use balls to create the molecular structure of water and ice to show how liquid water packs more molecules into a space than solid water (ice).
- Based on what they know about the different forms of water, have youth role play ice, liquid and gas. To create a human water ball, two children who are hydrogen hold hands with the one who is oxygen. (HINT: For ice, have fewer human balls in the space than for liquid; for gas, have more disorganized movement than liquid; for water, have constant movement between positive and negative forces of hydrogen and oxygen.)

HELPFUL HINTS

Safety tips for boiling water:

- When using a stove, don’t let the handles of the pans stick out over the floor. Not only can kids bump into them, but they can snag on clothing and spill. Turn them to the side, but make sure their handles do not extend over adjacent burners. Be sure to use oven mitts.
- Vapor (steam) is quite hot so stand some distance away from pot when steam rises.
- Always have a first aid kit on hand. Keep it well stocked. For small burns, an aloe plant is good to have around. For more serious burns, your first aid kit should have professional quality burn medication on hand.

ADDITIONAL WEB LINKS

- New York University provides students, teachers and researchers the basic concepts in mathematics and their connection to molecular modeling:
http://www.nyu.edu/pages/mathmol/textbook/info_water.html.
- U.S. Geological Survey, Department of the Interior/USGS, explains the chemical nature of water with bonding of hydrogen and oxygen:
<http://ga.water.usgs.gov/edu/waterproperties.html>.
- U.S. Geological Survey, Department of the Interior/USGS, explains ice density compared to density in liquid water:
http://www.ec.gc.ca/water/en/nature/prop/e_magic.htm.

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