

# Water Molecules in Action



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**AQUARIUM**  
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*Learn about the how water behaves as a liquid.*

## Duration

Preparation: 15 minutes (Frozen materials will take overnight)

Activity: 45 minutes (Will vary depending on which activities are completed)

## Supplies

- One small empty plastic container
- One small container filled with colored water (\*\*one frozen overnight; mark water level on container BEFORE freezing\*\*)
- Tray of frozen ice cubes of colored water
- Photos of icebergs that show above and below water
- Large (1-quart) measuring cup
- Several 1-quart containers
- Clear plastic cup
- Spoon or straw

## Background

Water in solid form is less dense than when a liquid so it will float on top of liquid water. This is important to nature.

Water in a liquid form will fill all of its containers space if the volume of liquid is the same as the container. (A gas will fill all of any size container).

When light waves go through substances it changes the wavelengths so objects in water appear to bend.

## Activity 1: Ice Floats in water (because water expands when it is frozen)

### Materials:

- Container of frozen colored water (where water level was marked BEFORE freezing)
- Tray of colored ice cubes
- Photos of icebergs (above and below the water)
- Container of tap water

**Pre-lesson:** Have students explain what happens to water when you put it in the freezer

### Activity Preparation:

1. Fill a container with tap water
2. Pull container of frozen colored water and ice cubes from the freezer just prior.
3. Put cubes into an empty container

### Activity Steps:

1. Show students container with frozen colored water and point out the original fill line mark
2. Ask: What happened to the water when it froze? (It *expanded*)
3. Show students the container of colored ice cubes and ask what will happen if the cubes are placed in water.
4. Show that the ice cubes will float in the container of tap water
5. Explain that when water freezes the water ( $H_2O$ ) *molecules* become a little farther apart, decreasing the *density* of the water and that this is unusual because most other substances become denser as they freeze.

**Follow-up discussion:** Ask the students to think of areas where water freezes in nature and why it is important for the ice to be able to float. (\*\*when lakes freeze the ice floats, making a barrier and the water below can stay close to freezing without actually freezing. Underwater animals, like fish and tadpoles, can continue to live there in the winter. Also, icebergs near the north or south pole provide habitats for all kinds of organisms, large and small\*\*)

## Activity 2: Water Molecules in Action (Density at different phases and temperatures)

### Materials:

- None

### Activity Preparation:

1. Remind students what a *molecule* is
2. Use three volunteers to demonstrate a Water molecule but having two act as hydrogen atoms and 1 as the oxygen and have them all link arms. Explain that this is how a water molecule acts.

### Steps for Activity

1. Have students stand in a group, no special order and explain that they are each going to be a water molecule.
2. Have the students link elbows and all connect tightly (it will form a circle but encourage them not to all face the same way and try to be a messy grouping)
3. Explain that with their tight bonds connecting them to each other that this is how frozen water (in its *solid phase*) behaves.
4. Next tell the students that they are going to get placed in an imaginary pot and heated up. They will start to melt. As they heat up ask students pair by pair to hold hands instead of linking arms until everyone is loosely holding hands.

5. Explain that they are now in the *liquid phase* and that while still bonded they can flow around more.
6. Have them flow like water
7. Finally tell them that you are going to increase the temperature so that they start to boil. Have the students continue to flow like liquid water but gradually separate the hands until each water molecule is flowing freely and spreading out.
8. Explain that when the liquid is heated it changes to a *gas phase* and evaporates into the air.

**Follow-up discussion:** Ask the students to teach you what happened as each phase of water was heated. Did the molecules move more or less with more heat? (\*\*more because heat energy was added\*\*)

If time allows ask the students to see if they can (in small groups of 4-6) reverse the process from gas to liquid to solid. Ask students to explain what needs to happen to water in gas (steam or vapor) form to become liquid)

### Activity #3: Demonstration – Shape of Water

#### Materials:

- 1-quart measuring cup
- Several other 1-quart containers that are different shapes
- water

**Pre-lesson discussion:** Fill the measuring cup to the 1-quart line and show kids.

#### Activity Steps:

1. Have kids look at the containers and discuss how they are different from each other.
2. Have them guess which containers will hold the amount of water in the cup.
3. Test each container by showing that it doesn't matter what shape the container is but only matters if the space inside is the same.
4. Explain that this is *volume* and that a liquid will fill all the space regardless of the shape.
5. Take one container and ask what would happen if you put a piece of ice in it. Would the ice fill all the empty space?

### Activity #4: Demonstration – “Magic trick” with *Refraction*

#### Materials:

- Clear plastic cup
- spoon or straw

#### Steps for demonstration:

1. Teacher fills the plastic cup about  $\frac{3}{4}$  full
2. Place the spoon or straw in the water and show the students that it “breaks”
3. Explain that it isn't really breaking or bending and pull it out of the cup to show the students. Explain that the light waves “bend” when they move from the side of the container and through the water and that this is called “refractions”.

**Follow-up discussion:** Have the kids try with other objects, like a pen or their finger.

## Vocabulary

Gas

Liquid

Solid

Phase

Energy

Volume

Refraction