Properties of Water Lesson Plan

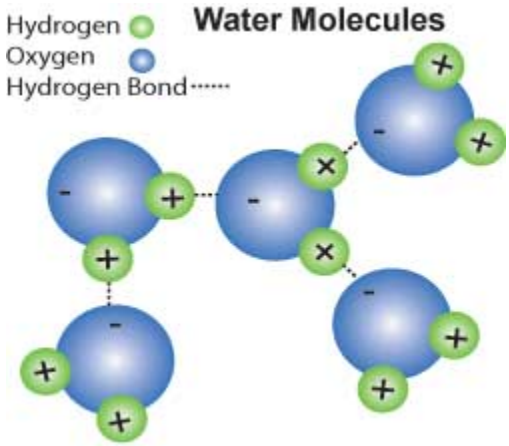
Learning Objective: The purpose of this activity is to let the students experiment with water so that they may understand the concepts of

- Polarity
- Hydrogen Bonding
- Surface tension
- Scientific method

Idaho State Science Standards Met: Kindergarten (Goals 1.2, 1.3, 1.6, 1.7, 1.8, 2.1), Grade 1 (Goals 1.2, 1.3, 1.6, 1.7, 1.8, 2.1), Grade 2 (Goals 1.2, 1.3, 1.6, 1.7, 1.8, 2.1) Grade 3 (Goals 1.2, 1.3, 1.6, 1.7, 1.8, 2.1), Grade 4 (Goals 1.2, 1.3, 1.6, 1.7, 1.8, 2.1), Grade 5 (Goals 1.2, 1.3, 1.6, 1.8, 2.1) Grade 6 (Goals 1.2, 1.3, 1.6, 1.8, 2.1), Grade 7 (Goals 1.2, 1.3, 1.6, 1.8, 2.1), Grades 8-9 (Goals 1.2, 1.3, 1.6, 1.8), Grade 10 (1.2, 1.3, 1.6)

Materials: A penny, an eyedropper or pipette, a cup of water, and paper towels for each team of students.

Background: Sometimes we call water H_2O. That's because water molecules each have two hydrogen atoms and one oxygen atom. While water molecules are neutral as a whole, one end of the water molecule tends to have a positive charge while the other has a negative charge (polarity). Each end of a water molecule is attracted to the opposite charged end of another water molecule. This is called "hydrogen bonding."



Activity:

- How many drops of water can you fit on a penny? Make a prediction.
- Clean the penny using a paper towel. Don't use soap!
- Place the penny heads-up on a flat surface.
- Fill the eyedropper and drop one drop of water on the penny at a time.
- After dropping five drops of water, take a look at your penny from the side view. What is happening?
- Continue to place drops of water on the penny. How many drops of water did your penny hold? What did the water on your penny look like? Were you surprised?
- Repeat the experiment and see if you can fit more drops of water on the penny.
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Follow up: After the activity, hold a discussion about the shape of the water on the penny and why the so many water drops fit on the head of the penny. Introduce the term "surface tension."

When you put water drops on a penny, the drops pile up into a dome because of surface tension. Surface tension is produced by the force of attraction between water molecules. Within the liquid, each water molecule is attracted to its neighboring molecules, making them "stick" together. The water molecules at the top, however, "stick" only to the water molecules next to and below them.

That's because there are none above them. This unbalanced attractive force causes the water to act as if it had a thin "skin" on the surface. As you add more drops, the force of gravity becomes stronger than the force of attraction among the water molecules at the surface. This causes the water to spill over the edge of the coin.

Extension: Students will conduct a simple test to determine how many drops of each of three liquids can be placed on a penny before spilling over. The three liquids are water, rubbing alcohol, and vegetable oil. Students will make a hypotheses based on the previous experiment. Conduct the experiment using water, rubbing alcohol and vegetable oil and ask students to report their findings.

Note: Oils have few, if any, hydrogen bonds amongst their large, organic molecules. When oil is dropped onto a flat, nonporous surface, it quickly spreads and forms a thin layer coating considerably more surface area than would a drop of water. Rubbing alcohol, on the other hand, is a mixture consisting of 70 percent isopropyl alcohol and 30 percent water. It does contain some hydrogen bonds within its structure, but not nearly as many as occur in pure water. Rubbing alcohol will form a bead when dropped onto a flat, nonporous surface, but the bead will be slightly flatter and larger in diameter than a corresponding bead of pure water.