

WHAT IS WATER?

Lesson Objective:

1. Investigate and graph the freezing points of different solutions.
2. Make flat models of water **molecules**.

Teacher background:

Water equals life. Where there is no water at all, there is no life and therefore water may be the most important substance of earth. Each water **molecule** consists of one oxygen and two hydrogen atoms. In shape, a water molecule resembles a "Mickey Mouse" head. In its pure form, water is a good solvent, i.e., it can **dissolve** or mix with many substances. In fact, water has been called the "universal solvent" because of its ability to dissolve other substances. It is found everywhere and covers three-quarters of the planet. Water is found in our **atmosphere**, in our soil, and underneath the ground. The human body is about 65 percent water.

The total amount of water on earth stays the same, and the same water that exists now has always existed. Water can be found in all three states of matter (liquid, solid, and gas) on earth, most often in the liquid state. At 0 degrees Celsius (32 degrees F) and normal atmospheric pressure, water freezes.

Terms:

Freezing point: the temperature at which a substance begins to change from a liquid to a solid

Gas: a state of matter; a gas expands to take the shape of the container it fills

Liquid: a state of matter; a liquid takes the same shape as its container but maintains a definite volume.

Solid: a state of matter; a solid generally has a shape of its own

Materials:

3 clear plastic milk jugs	measuring spoons	hole punch
pitcher	measuring cup	glue sticks
cup of ice	blue construction paper	scissors
water	red construction paper	paper
salt	clear plastic cups (3 per team)	pencils
vinegar	thermometer (1 per team)	graph paper
masking tape		

Preparation:

Prepare "mystery liquids" ahead of time so they are ready for the activity. Use plastic milk jugs to prepare and store liquids.

1. Liquid A is tap water
2. Liquid B is a 50/50 mixture of vinegar and water
3. Liquid C is salt water. Use 1 teaspoon (5 ml) of salt per cup (240 ml) of water.

Have on hand a pitcher of water and a cup of ice.

Cut a large number of circles from blue construction paper. Cut twice as many smaller circles from the red construction paper. (NOTE: You may use a hole punch to cut the red circles and make the blue circles about the size of a dime - or, if you think it would be easier for students to work with larger pieces, use dimes to cut out the red pieces and quarters for the blue ones.)

Procedure:

1. Show the students a cup of ice and ask them to describe it.
2. Fill the cup of ice with water from the pitcher. Discuss the fact that liquid water and ice are both water though they look and feel different.
3. Take a sip of the ice water and discuss with students that water is essential to life. Ask students to list ways water can be used.

Activities:**A. Water Properties**

1. Show students the three liquids you have prepared.
 - a. Ask them to compare them. Can they guess what they are?
 - b. Tell the students what they are; explain that water can mix with many substances as well as dissolve many substances.
 - c. Have students suggest other things that are soluble or mixable with water.
 - d. (extension) Allow students to test various substances' solubility or ability to mix with water.

B. Water Investigation

2. Divide the students into teams and have each team complete the following investigations:
 - a. Give each team three cups and have them label the cups A, B and C. Fill up "A" one-third full with liquid A, cup "B" one-third full with liquid B, and cup "C" one-third full with liquid C. Give each team a thermometer.
 - b. Have the teams record temperature of each liquid.
 - c. Choose one cup of each liquid (A,B,C) and put them (with thermometers in them) in the freezer. Have students record every 15 minutes until all three are frozen. (Liquid "A" tap water will freeze first. The salt water in cup "C" will freeze next and the 50/50 mixture of vinegar and water in cup "B" will freeze last. This 50/50 mixture works like the antifreeze solutions we use in automobiles.)
Have students make a graph showing temperature change over time and freezing point.

Ask the students the following questions:

1. How did the temperatures change? (gradually lowered until freezing took place)
2. At what temperature did each liquid freeze? (Results will vary somewhat, but the tap water will freeze at 0 degrees C.)
3. Liquid A is water; B is water and vinegar; and C is salt water. How do vinegar and salt affect the freezing temperature of water? (They lower it.)
4. Antifreeze lowers the freezing temperature of water. Why is it added to a car radiator in winter? (Hopefully this will be low enough to keep the liquid in the radiator from freezing and cracking it.)

C. Water Molecules

1. Introduce the students to water's chemical formula H₂O. Explain that a glass of water has millions and millions of tiny water particles---called molecules.
 - a. Draw a large water molecule outline ("Mickey Mouse head") on the board. The "ears" are the two hydrogen atoms and the "face" is the oxygen atom. Relate this to the formula H₂O.

D. Additional Activities

1. Read pages 1, 2, and 5 and complete pages 1 and 2 of this lesson plan.
2. Play and complete the Water Carnival activities on pages 6- 11, and Checkpoint 1 quiz on pages 12. (Answer key on page 93-94.)

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Resources: Mississippi Department of Environmental Quality, Environmental Protection Agency, USDA Soil Conservation Service