

## Activity #2:

### “How Dense Can You Be?”

Matter occupies space and therefore possesses volume and mass. The relationship between a specific amount of matter and the volume it occupies is expressed as *density*. Density, then, is the relationship between the mass and volume of a substance. The unit of density is expressed as mass in grams per milliliter (g/ml). Water is unique in the way its density changes with temperature. Continued cooling of water will increase density to a certain point, then water does something quite odd compared to other liquids. It becomes less dense between 4° C and when it becomes ice!

**Objective:** Upon completion of this activity, students will demonstrate an understanding of water's density and determine the density of selected water samples.

NEVADA SCIENCE STANDARD 10:12.3

**Time:** One or two class periods

**Materials:** thermometer, hydrometer, ice (or freezer)

#### **Procedure:**

- A. Teacher: You may elect to have students make their own hydrometers (see extension activity “Won’t You BB My Hydrometer?”). Additionally, you may wish to extend the activity to include a comparison of the densities of fresh and salt water (see extension activity part 2, “An Egg In Water”).
- B. Students:
1. Using a hydrometer, measure the density of a tap water sample. Measure the tap water’s temperature and record both in the Data Table.
  2. Use ice (or a freezer) to chill the water sample. As the water is chilled, select at least three other temperatures between the initial tap water temperature and 4° C. Record density for these three points.
  3. Continue to chill the water until a temperature of 4° C is reached. Measure the density at 4° C and record in the Data Table.
  4. Continue to chill the sample and record both temperature and density in the Data Table.

## **Terms to Know:**

**Acid:** having a pH less than 7.0; liquids are sour and corrosive.

**Alkaline:** having a pH greater than 7.0; liquids are caustic and bitter.

**Density:** the ratio of an object's mass to its volume.

**pH:** a measure of the concentration of hydrogen ions ( $H^+$ ) in solution. The pH scale ranges from 0 to 14, where 7 is neutral, values less than 7 are acidic and values greater than 7 are alkaline or basic. Every unit decrease in pH means a 10-fold increase in  $H^+$  concentration. Thus, a pH of 3.0 is 10 times as acidic as a pH of 4.0 and 100 times as acidic as a pH of 5.

**Polar molecule:** a covalent molecule having a partial (+) and a partial (-) end.

**Surface tension:** a property of liquids in which the exposed surface tends to contract to the smallest possible area, caused by unequal molecular cohesive forces.