

# The Properties of Water

Background: Water covers about three fourths of the surface of the earth? It is ubiquitous. It is also one of the simplest yet most important molecules in living systems. It makes up from 50 to 95 percent of the weight of living organisms. The cytoplasm of a cell is a water-based solution that contains a variety of ions, salts, and molecules which make life 'happen.' Water is literally involved in every facet of life.

The simplicity of the water molecule belies the complexity of its properties. Based on its small size and light weight, one can predict how it *should* behave, yet it remains liquid at a much higher temperatures than expected. It also boils and freezes at much too high, or low, of a temperature for a molecule of its size. Many of these unexpected properties of water are due to the fact that water molecules are attracted to each other like small magnets (cohesion). This attraction results in turn from the structure of the water molecule and the characteristics of the atoms it contains. Each molecule of water is made up of two atoms of hydrogen connected to one atom of oxygen. This is summarized in the familiar formula,  $H_2O$ .

## Procedures:

- Form groups of 2 students each
- Obtain one penny, a small medicine dropper and 50 ml beaker filled with water per group
- Complete Diagram #1 with your predictions on how many drops you can place on the surface of a penny. Draw your prediction showing the shape of the water on the penny after one drop, what you think it will look like when it is about half full, and just before it overflows.
- Next, begin to add drops of water to the surface of the penny, counting the number of drops in holds before it begins to overflow.
- Complete Diagram #2 with actual results by drawing a diagram of the shape of water on the penny after one drop, when the penny is about half full, and just before it overflows.
- Answer questions on the following page

Diagram #1

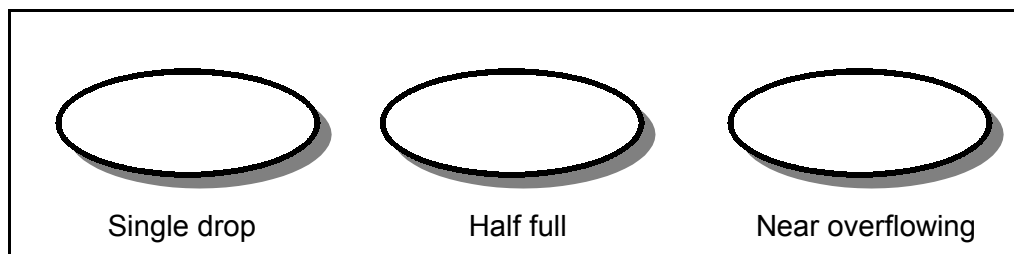
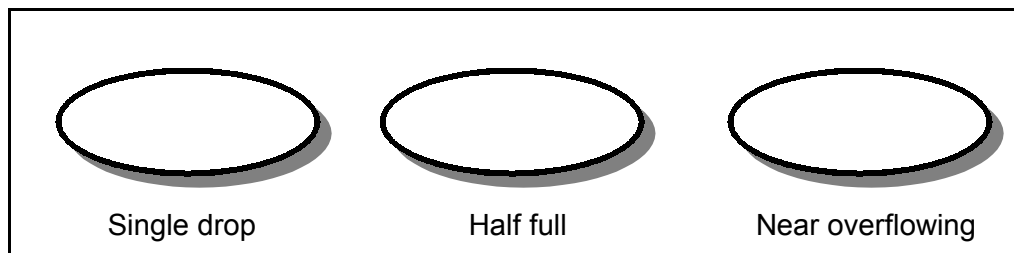


Diagram #2



Questions:

1. How many drops were you able to place on the penny before it overflowed?
2. If the number of drops is very different from your prediction, explain what accounts for the difference?
3. Explain your results in terms of cohesion. (a picture may be helpful in your explanation)
4. Using what you learned about cohesion of water molecules, try and explain how the water surface of a pond is firm enough to allow insects to walk on its surface.
5. You have just investigated the effect of cohesion of water molecules. What is adhesion, how does it differ from cohesion, and give an example of adhesion with water that exists in nature.