# Physical and Chemical Properties of Water

## Summary

Experiments with water as a component of suspensions, solutions, and heat conduction contributing to the use of food and the health and wellness of human beings.

Main Core Tie Food And Nutrition Strand 5 Standard 3

## **Background for Teachers**

Chemically, water consists of two atoms of hydrogen and one atom of oxygen. Due to the molecular structure of the oxygen and the hydrogen atoms, they are able to share two pairs of elections covalently.

The two hydrogen atoms are connected to the oxygen at 105 degree angles which make one end of the water molecule slightly more negatively charged or positively charged than the other. This is an important property of water which makes it attract other substances carrying either a positive or negative charge. The attraction is effective with other water molecules as it is with other substances. This attraction between a negative pole of one water molecule and a positive pole of another is due to a connection called HYDROGEN BONDING. (See <u>overhead transparency</u>.)

This type of bond is not as strong as the COVALENT BOND which keeps the oxygen connected to the hydrogen within a single water molecule.

The hydrogen (H) bonds formed between the positive and negative poles on water molecules cause surface tension and increases the bonds that must be broken before water can escape as steam when boiling.

SURFACE TENSION - Hydrogen bonds on the surface aren't equally surrounded as in the middle of a glass of water. So, the molecules are pulled into the middle and a rounded, skin-like effect is formed on the surface. The relationship between hydrogen bonding (polarity) and surface tension is illustrated by the transparency SURFACE TENSION found in the Resource section. The phenomenon of rain drops falling on a leaf or painted surface also illustrates surface tension. This characteristic of water allows of emulsions and foams to take place in food preparation.

HIGH BOILING AND FREEZING POINT - Water has a high freezing and boiling point because the molecules must break the H-bond and the atmospheric pressure before they can change from a liquid state to ice or steam.

Matter is composed of small particles called atoms, ions, and molecules. These particles are in constant motion and, therefore, the matter possesses a kind of energy called kinetic. In other words, the average kinetic energy of a group of particles determines the group's temperature. If heat is added to an object, the kinetic energy of its particles increase. The greater the average kinetic energy, the higher the temperature of the material.

## Intended Learning Outcomes

Unique physical and chemical characteristics of water enable it to function in ways essential to human and other life processes.

#### Instructional Procedures

## See attachments below:

The students will participate in a PREASSESSMENT to access their knowledge of water by experimenting with surface tension, cohesion/adhesion, and temperature properties of water.

As the teacher discusses the PROPERTIES OF WATER, the students will complete the wroksheet. To help students understand the properties of a water with gases, such as a carbon dioxide mixture, the teacher will review the information on THE MAKING OF CARBONATED DRINKS. (See overhead transparency SODA POP).

The students will perform an experiment to discover the amount of carbon dioxide in a bottle of carbonated beverage using the directions given in CARBON DIOXIDE IN SOFT DRINKS. They will record their observations on the worksheet CARBON DIOXIDE IN SOFT DRINKS - RECORD. The teacher will do a simple demonstration showing WHAT HAPPENS WHEN WATER IS HEATED? The students may perform this activity as an experiment, however, the teacher should be aware that there is some danger here. The possibility exists that the flask will implode so be careful and place a safety shield between the flask and the students. Be sure to wear goggles and gloves. Observe all safety precautions involving boiling water.

The students will prepare a gas with a liquid solution by using recipes of choice. The teacher and students will agree on recipes used. These recipes may be of any fruit drink into which a carbonated solution such as Sprite, 7-UP, Ginger Ale, soda, water, or other such solutions help to enhance the punch. This drink may be served alone or with a refreshment of some kind, or combined with other labs as a beverage. The students will participate in experiments which will show the POLARITY OF WATER and the SURFACE TENSION of water.

The teacher will discuss the phenomenon of osmosis using the transparency OSMOSIS. To illustrate osmosis, the teacher will perform three OSMOSIS DEMONSTRATION.

The teacher or the students will use a pressure pan to prepare a vegetable beef stew as an illustration of PRESSURE AND THE BOILING POINT OF WATER used in food preparation. The students will perform HARD AND SOFT WATER EXPERIMENTS that reveal physical and chemical properties of hard and soft water.

The students will complete a SUMMATIVE EVALUATION on the PROPERTIES OF WATER.

## Authors

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