

Unit 2: What Is Water?

TABLE OF CONTENTS

Page	2-3	Objectives
	2-3	Words to Remember
	2-3	Background Information
	2-6	Questions for Review
	2-6	Questions for Thought
	2-7	Figure 2.1: Hard and Soft Water in Alabama
	2-8	Fact Sheet: What is Water?
	2-9	Glossary: What is Water?
	2-11	Worksheet 2.1: Definitions
	2-13	Worksheet 2.2: Vocabulary (Word Puzzle)
	2-14	Worksheet 2.3: Facts About Water (Word Puzzle)
	2-15	Activity 2.1: Properties of Water: Surface Tension
	2-17	Activity 2.2: Capillarity of Water
	2-18	Activity 2.3: Hard and Soft Water
	2-20	Activity 2.4: Fun Experiments With Water
	2-24	Answer Key: Worksheet 2.1: Definitions
	2-26	Answer Key: Worksheet 2.2: Vocabulary (Word Puzzle)
	2-27	Answer Key: Worksheet 2.3: Facts About Water
	2-28	How Am I Doing?

Unit 2: What Is Water?

Objectives: Each student will be able to:

- Name the three forms of water.
- Discuss why water is such a remarkable substance.
- Name some of water's special properties.

Words to Remember:

- | | | | |
|---------------|--------------------|------------------|---------------------|
| • atoms | • gravity | • metric system | • soft water |
| • capillarity | • H ₂ O | • microorganisms | • surface tension |
| • Celsius | • hard water | • molecule | • universal solvent |
| • dissolve | • humidity | • oxygen (O) | • water vapor |
| • distilled | • hydrogen (H) | • pollutants | |
| • Fahrenheit | • hydrogen bond | • precipitation | |

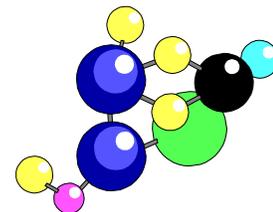
Background Information

Water may not seem very interesting: it is a colorless, tasteless and odorless liquid. However, it is one of the most precious and unusual substances found on the earth. Water is unusual because it exists in three different forms: gas (**water vapor**), liquid, and solid (ice) under normal atmospheric conditions. Some substances need very cold or very hot temperatures to be able to change into different forms. Ice can float on top of liquid water. Other substances would not be in frozen and liquid forms at the same temperature. Earth is the only planet where water is found in all three of its forms.

In the unit *The Water Cycle*, we learn how most of Earth's water is always moving and continually changing from one form to another. Rain falls from the sky as a liquid. (Water may fall from the sky as frozen material (such as snow or sleet), but in

Alabama we receive most of our **precipitation** as rain). Ice is found at the North and South Poles. And water vapor is found in clouds and in the air. By the way, the air in our state contains more water vapor than is found in some other areas. When the air contains a lot of water vapor, it has high **humidity**. In Alabama, especially in the summer, when the air feels wet and heavy, it is because the air is very humid.

The Water Molecule. The water **molecule** is very simple. A molecule is a piece of matter that contains two or more **atoms**. Atoms are the tiniest pieces of matter. The scientific name for water is **H₂O**. It is called H₂O because it has two atoms of hydrogen (**H**) and one atom of oxygen (**O**). There are millions of these molecules in one drop of water.



The form water takes depends on the movement of the water molecules. In liquid form, water molecules are constantly moving and rolling over themselves. You can pour liquid water into a container and it will move around to take the shape of that container. When water is frozen (ice) water molecules are locked into position and stay in that shape. When water boils, water molecules move very fast. Water molecules move so fast that they actually break apart from each other and escape into the air as water vapor or steam.

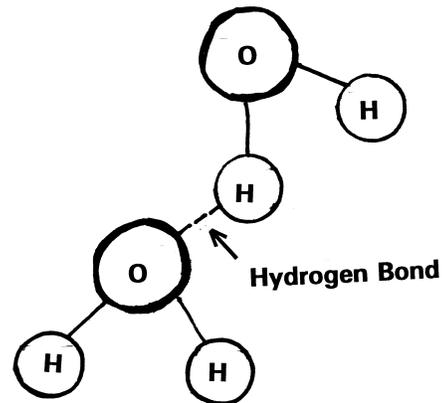
You may be familiar with the two most common temperature scales. These are called the **Fahrenheit** and the **Celsius** scales. The Fahrenheit scale is the one mostly used in the United States. The Celsius scale is based on the **metric** system and is the one used in most other countries. However, the metric system is becoming more common in the USA. If you look at water temperatures, you can see how much easier the Celsius scale is to remember. Look at the following chart of water temperatures in the two different scales:

Water temperature	Fahrenheit (° F)	Celsius (° C)
Boiling	212° F	100° C
Freezing	32° F	0° C

The Hydrogen Bond. Water has several special properties. We already mentioned that it is unusual because it can exist in its three different forms at the same temperature. The reason for many of water's special properties, which we will discuss below, is the type of bond (or attachment) that is formed between the atoms of the water molecule.

The hydrogen and oxygen atoms in water attract other molecules that contain

oxygen and hydrogen atoms and form a bond with them. This bond is called the **hydrogen bond**. The two hydrogen atoms in the water molecule are attached at wide angles to the oxygen atom. This wide angle creates a lot of space in the molecule and



makes it easy for other substances (or other water molecules) to fill in this space.

Water: The Universal Solvent. Another of water's special properties is its ability to **dissolve** many other substances. Because of this property, water is called the **universal solvent**. Many materials are able to dissolve in water more easily than in other liquids because of the hydrogen bond. One reason dissolving is an important property is the fact that water makes up about 70% of the fluids in our bodies. The water in our bodies can dissolve substances from food we eat and transport these necessary chemicals to other parts of our bodies. Therefore, water is absolutely necessary for life to exist.

Water's ability to dissolve other materials can sometimes be undesirable. Harmful substances, or **pollutants**, can dissolve in water. These substances harm the quality of water. In the unit "*How Our Water Becomes Polluted*" we will learn about water pollution.

Even though water is clear and relatively tasteless, water is never

completely pure. Many substances, including salts, minerals and **microorganisms** can be found in water that looks absolutely clear. But these substances are not necessarily harmful. In fact, some minerals in water actually improve its taste. Minerals usually come from soils and rocks and dissolve in rainwater when it soaks into the ground. Where you get your water usually determines its mineral content.

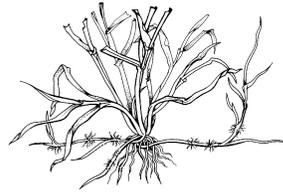
Hard and Soft Water. If water has a high mineral content, it is called "**hard**" water. "**Soft**" water is water which has a very low mineral content. If water is too hard, it is hard to make soap suds in it (that's why we call it "hard water"). Some people attach artificial water softeners to their water supply to make it softer and easier to use for washing. In Alabama, the water varies between soft and very hard, depending on the area (Figure 2.1). Water can be **distilled** to make it free of minerals. Distilled water has no taste.

Surface Tension. Another property of water has to do with something called **surface tension**. We discussed water's ability to bond with other molecules and how this makes other things dissolve in it. Besides bonding with other substances, water molecules also form very strong bonds with themselves (other water molecules). Because of these strong bonds, the outside surface of water forms a barrier like a "skin" between the air and water. This is the reason that small objects heavier than water are able to float on top of water. If they break the surface tension, they will sink.

The surface tension of water molecules and attraction of water to other substances also affects water movement. When water is flowing, water molecules actually "pull" each other along. Water molecules are so strongly attracted to each other and to other substances that they can move against

gravity. This is why water can hang around in small pore spaces in the soil for weeks and months after a rain. If this did not happen there would not be a supply of water available for most plants and animals. Gravity would cause most rain water to drain out and soil would dry out very rapidly after each rain.

Water's ability to move upward in small openings or cavities, against the force of gravity, is one of its most essential properties in supporting life. When water flows up from the ground through plant roots, it is the **capillarity** of molecules that helps water to flow. This property of water is another example of the very special hydrogen bonding of the water molecule.



Water is an amazing substance. It is absolutely necessary for all forms of life. Even though the water molecule seems very simple, its ability to bond with itself and other molecules is the reason water is so unusual. This bonding is responsible for its ability to dissolve substances, its ability to exist in three forms at similar temperatures, its surface tension and the movement known as capillarity. These different properties are necessary for life to exist.

In the following chapters we will learn about water and its importance. Most importantly, we should learn to have an appreciation for water and the need to keep it plentiful and clean for everyone to use.

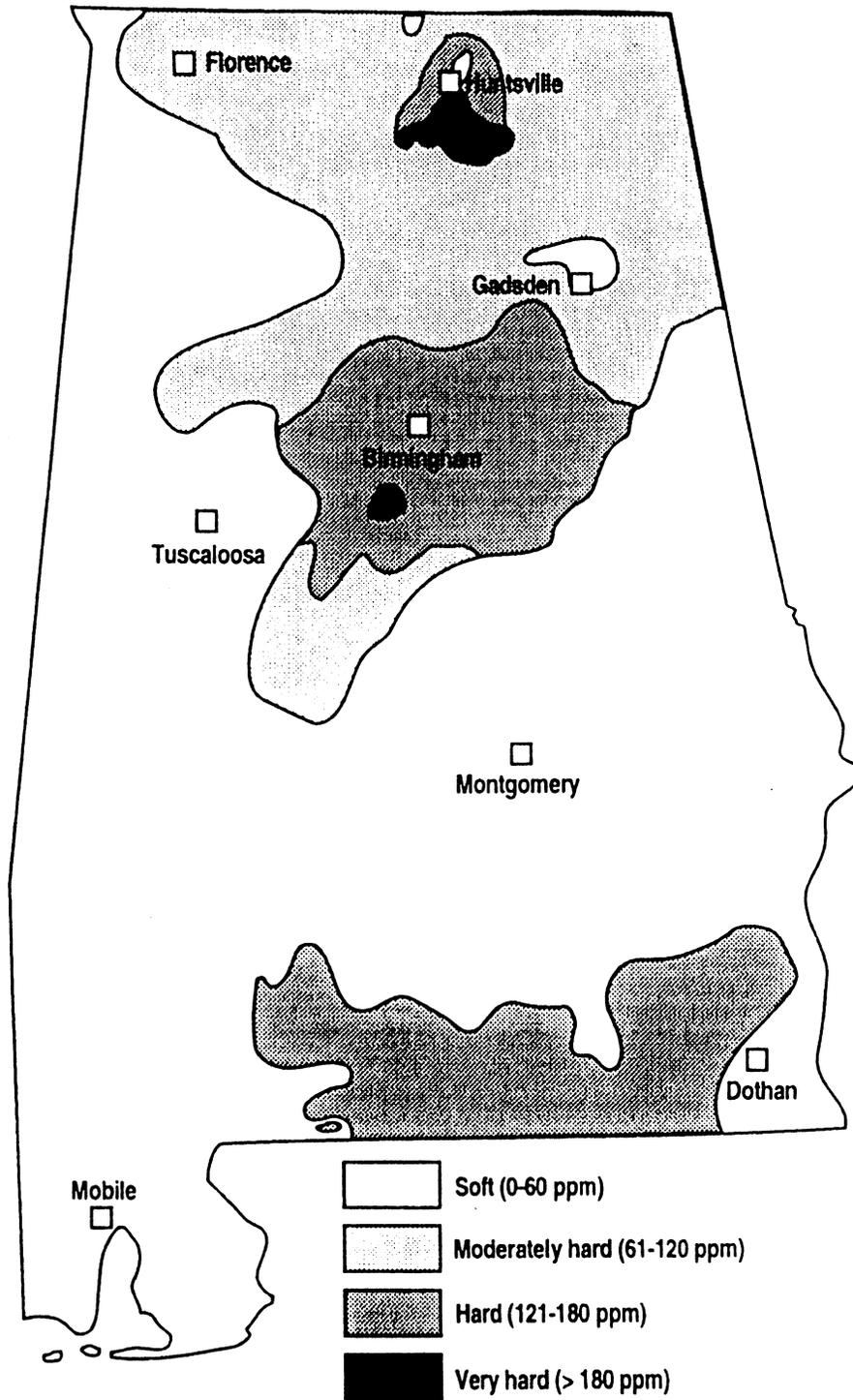
Questions for Review

1. What is unusual about the three forms of water?
2. What is **humidity**?
3. Which **atoms** make up the water **molecule**?
4. What are the two most common temperature scales? Which scale makes it easier to remember the freezing and boiling temperatures of water?
5. What is the name of the bond which is responsible for many special properties of water?
6. In which type of water is it easier to make soap suds?
7. What is the property of water that makes the surface of water act like a "skin"?
8. What is **capillarity** and why is it important?

Questions for Thought

1. If water is completely clear, does that mean it is safe to drink and is free of pollutants?
2. Ice can float on top of liquid water because the molecules in frozen water spread out and take up more space, making ice less dense (solid or thick) than liquid. In a pond or other body of water, water will freeze at the top first. Can you think of why this would be important?
3. Why are water's dissolving properties so important for life?
4. Describe the process of **gravity** and why the property of surface tension is important to soils and plant life.

FIGURE 2.1: Hard And Soft Water In Alabama



Source: Powell and Duncan, 1965.

FACT SHEET: What Is Water?

Interesting facts about water:

1. Water is unusual because it can exist at in all three forms (gas, liquid and ice) under normal atmospheric conditions.
2. Water is found in all three forms only on the planet Earth.
3. In Alabama, the air often has high **humidity**; this means there is a lot of water vapor in the air.
4. The water **molecule** is made up of two **atoms** of **hydrogen (H)** and one **atom** of **oxygen (O)**; therefore, the scientific name for water is **H₂O**.
5. The form that water takes (solid, liquid or gas) depends upon the movement of water molecules; in ice, the molecules are locked into place and in gas, water molecules are moving around very fast.
6. The **Fahrenheit** and **Celsius** scales are two types of temperature scales.
7. The **hydrogen bond** is a bond between a hydrogen atom of one molecule and an oxygen atom in another molecule.
8. One special property of water is its ability to **dissolve** many other substances; this is why it is called the **universal solvent**.
9. The mineral content of water determines whether it is **hard water** or **soft water**; if it has a high mineral content it is difficult to make soap suds in water.
10. Water molecules form strong bonds between themselves and this accounts for the special property called **surface tension** in which the outside surface of water is fairly strong and behaves like a "skin."
11. Water's ability to move upward in roots of plants is called **capillarity**.
12. The reason for many of water's special properties is because of its ability to bond both with itself and with other molecules.

GLOSSARY: What Is Water?

atom	The smallest unit of an element that can exist by itself or in combination with other units.
capillarity	Water's ability to move upward in small pores or cavities through the soil against the force of gravity supporting life for plants and animals.
Celsius	Relating to a temperature scale divided into 100 degrees, where 0 degrees is the freezing point of water and 100 degrees is the boiling point of water. Based on the metric system, it is most commonly used in other countries other than the United States.
dissolve	A condition where solid particles mix with a liquid and appear to become part of the liquid.
distilled	Water that has been purified of minerals and has no taste.
Fahrenheit	Temperature scale most commonly used in the United States that indicates the freezing point of water as 32 degrees and the boiling point of water as 212 degrees.
gravity	A force that causes smaller objects to move toward the center of the earth.
H₂O	An abbreviation for "water," a compound composed of 2 atoms of hydrogen (H) and 1 atom of oxygen (O).
hard water	Water which has a high mineral content. It is difficult to make soap suds because of this high mineral content.
humidity	When air contains a lot of moisture. It makes the air feel wet and heavy.
hydrogen (H)	A chemical element that mixes with oxygen (O) to make water.
hydrogen bond	Bond that holds water molecules together.
metric system	A system of weights and measures in which the meter is the basic unit of length, the kilogram is the basic unit of mass or weight, and the liter is the basic unit of liquid volume.

microorganism	An organism that can only be seen by a microscope, such as a bacteria; bacteria aid in wastewater treatment.
molecule	The smallest part of a substance that retains the properties of the substance and is composed of one or more atoms.
oxygen (O)	A chemical element that is present in air.
pollutants	Substances which harm the quality of the air, land, or water.
precipitation	The water which falls to earth after condensing into either rain or snow.
soft water	Water which has a very low mineral content.
surface tension	A condition that exists at the free surface of a body (as a liquid) by reason of intermolecular forces about the individual surface molecules and which is manifested by properties resembling those of an elastic skin under tension.
universal solvent	Water.
water vapor	Water that is in the gaseous state which is produced by evaporation or transpiration.

WORKSHEET 2.1: Definitions

Directions: In the left column are definitions to the *Words to Remember* and in the right column are the words. Match the words with the correct definitions. Place the letter of the correct definition in the blank to the left of the word.

- | | |
|--|----------------------|
| _____ 1. Water which has a high mineral content. It is difficult to make soap suds because of this high mineral content. | A. atom |
| _____ 2. A chemical element that is present in air. | B. capillarity |
| _____ 3. The water which falls to earth after condensing into either rain or snow. | C. Celsius |
| _____ 4. When air contains a lot of moisture. It makes the air feel wet and heavy. | D. dissolve |
| _____ 5. Relating to a temperature scale divided into 100 degrees, where 0 degrees is the freezing point of water and 100 degrees is the boiling point of water. Based on the metric system, it is most commonly used in other countries other than the United States. | E. distilled |
| _____ 6. An abbreviation for "water," a compound composed of 2 atoms of hydrogen (H) and 1 atom of oxygen (O). | F. Fahrenheit |
| _____ 7. Water's ability to move upward in small pores or cavities through the soil against the force of gravity supporting life for plants and animals. | G. gravity |
| _____ 8. A condition where solid particles mix with a liquid and appear to become part of the liquid. | H. H ₂ O |
| _____ 9. A force that causes smaller objects to move toward the center of the earth. | I. hard water |
| _____ 10. Substances which harm the quality of air, land or water. | J. humidity |
| | K. hydrogen |
| | L. hydrogen bond |
| | M. metric system |
| | N. microorganism |
| | O. molecule |
| | P. oxygen |
| | Q. pollutants |
| | R. precipitation |
| | S. soft water |
| | T. surface water |
| | U. universal solvent |
| | V. water vapor |

- _____ 11. Water that has been purified of minerals and has no taste.
- _____ 12. Water which has a very low mineral content.
- _____ 13. Water.
- _____ 14. A chemical element that mixes with **oxygen** to make water.
- _____ 15. Water that is in the gaseous state which is produced by evaporation or transpiration.
- _____ 16. Water which is found on the exterior surface of the earth, such as in rivers and lakes.
- _____ 17. A bond that holds water **molecules** together.
- _____ 18. The smallest part of a substance that retains the properties of the substance and is composed of one or more **atoms**.
- _____ 19. Temperature scale most commonly used in the United States that indicates the freezing point of water as 32 degrees and the boiling point of water as 212 degrees.
- _____ 20. A system of weights and measures in which the meter is the basic unit of length, the kilogram is the basic unit of mass or weight, and the liter is the basic unit of liquid volume.
- _____ 21. The smallest unit of an element that can exist by itself or in combination with other units.
- _____ 22. An organism that can only be seen by a microscope, such as a bacteria; bacteria aid in wastewater treatment.

WORKSHEET 2.2: Vocabulary (Word Puzzle)

Unscramble the following letters to make the correct words:

Water is a special substance because it can exist in three different _____.
orsfm

The water _____ has two atoms of _____ and one atom
of _____. The atoms of the water molecule form a unique bond called the
lemeculo **eyrnhdog**
gonyxe

_____ Water is called the _____.
eyrnhdog **nobd** **ravilunes**
_____ because of its ability to _____ many substances.
sletvon **ledvisso**

Water with a high mineral content is _____ water. Water's ability to form a
radh

"skin" on its outside surface is an example of the property called _____.
acesfur

_____. This is the reason water molecules can move upward in plant roots,
notesin

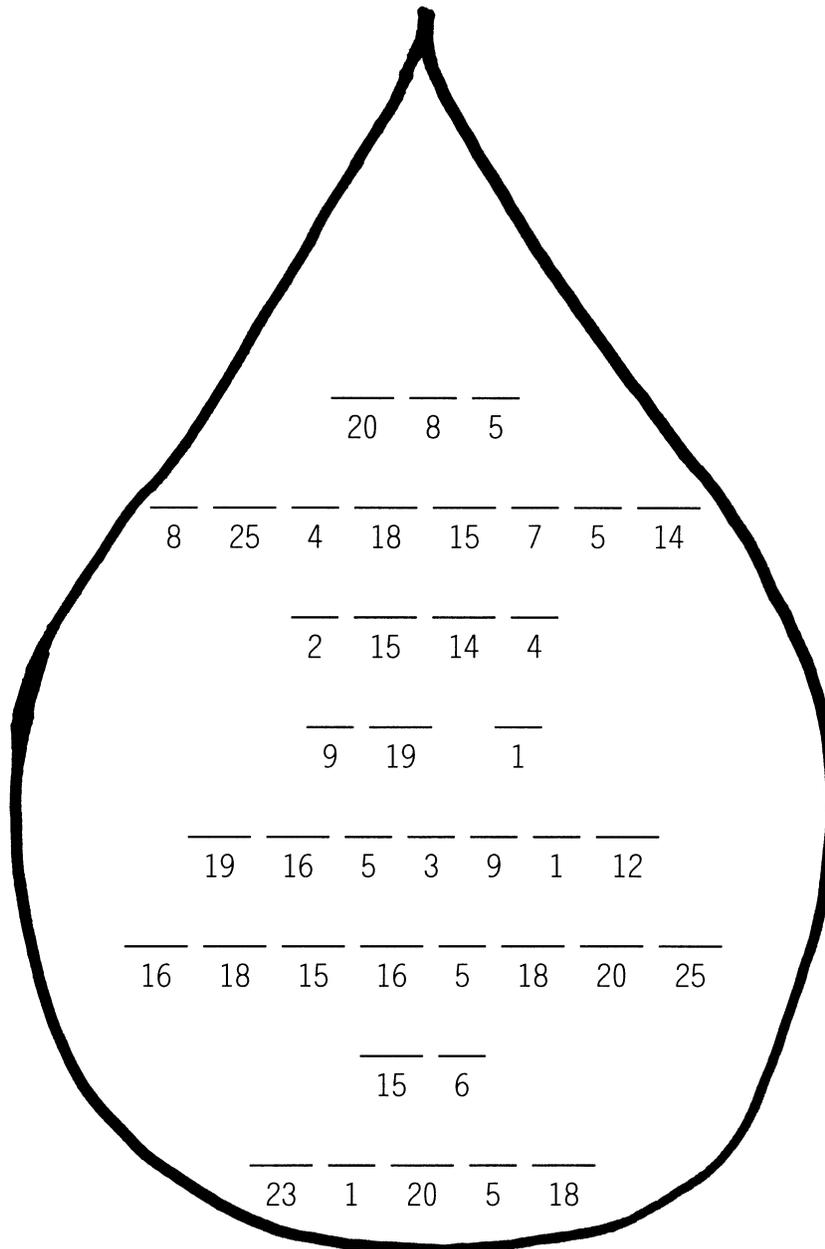
against the force of gravity, is because of _____.
raliticplay



WORKSHEET 2.3: Facts About Water (Word Puzzle)

Directions: Use the secret code to find a water fact

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
14	15	16	17	18	19	20	21	22	23	24	25	26



ACTIVITY 2.1: Properties of Water: Surface Tension

Goal:

To gain an awareness of the phenomenon of **surface tension**.

Objective:

P To demonstrate the effects of an important property of water, **surface tension**, by performing two activities.

Materials:

- " large bowl or other wide-mouth container
- " water
- " fork
- " sewing needle
- " small paper clip
- " staples
- " small plastic berry box (one with square holes rather than diamonds works best)
- " water strider (or similar aquatic insect--look at local stream to see if you can find insects on top of water)
- " wax paper
- " toothpick
- " detergent (such as Joy or Dawn)

Procedure:

Activity 1

1. Fill the large bowl or other container with water.
2. Using the fork, carefully lower the sewing needle onto the water surface.
3. Take out the needle and repeat the experiment using other objects: a small paper clip, staples bent into squares and the plastic berry box (be careful to use these only if they're dry).
4. If available, put a water strider or similar water insect on top of the water.

5. When one of the above objects is still on top of the water, add a small amount of detergent to the water. What happens?

Activity 2

6. Take a piece of wax paper and place a drop of water on it.
7. With a toothpick, pull the water drop along the paper.
8. Describe what happens to the water drop.
9. Now dip the toothpick into some detergent and touch the drop. What happens?

Discussion:

These two activities demonstrate the phenomenon of **surface tension**. Because of strong **hydrogen bonds**, water molecules stick to themselves. These bonds cause the outside surface of water to act like a "skin" enabling objects heavier than water to lie on top of the water. Hydrogen bonding is more effective when water is pure and clean. Adding detergent breaks the hydrogen bonds and weakens surface tension; therefore, objects are no longer able to float.

Discussion Questions:

1. What happens when detergent is added in the activities? Why does this happen?
2. Why is surface tension important to life?
3. Insects such as the water strider depend upon the surface tension of water to survive. What would the effect of an oil spill into a waterway have on different organisms?

Extension:

Repeat the activities with dirty pond water and distilled water and observe any differences.

Desired Outcome:

1. Objects such as the needle, paper clip, staples, etc., should lie on top of the water.

2. If the object gets wet, it will sink.
3. When detergent is added, the object will sink.
4. In Activity 2, the drop of water seems to stretch, but stays together when pushed by the toothpick.
5. When detergent is added, the surface tension is destroyed.

Evaluation:

Students will be able to:

1. Observe the phenomenon of **surface tension**, a concept that may otherwise be difficult to understand.
2. Test the effect of another substance (detergent) on water and discuss possible harmful results of a contaminant (such as an oil spill) on a waterway.

References:

Instructors Guide to Water Education Activities. Activity 1.1. Harrisburg, PA: Commonwealth of Pennsylvania Department of Environmental Resources, 1986.

What Is Water? Virginia Cooperative Extension Service. 390-051. December, 1987.

ACTIVITY 2.2: Capillarity of Water

Goal:

To demonstrate an important property of water: **capillarity**.

Objective:

Students will observe the process of capillarity, a means of water transport.

Materials:

- " glass of water
- " food dye
- " celery stick (with leaves attached) or white carnation flower

Procedure:

1. Cut off the bottom of the flower stem or celery stalk.
2. Add about 10 drops of dye to the water (use color other than green if using celery). Let the food dye spread until the water is all the same color.
3. Put the flower or celery into the water.
4. Let sit a few hours and then observe.

Discussion:

This experiment demonstrates **capillarity**, an important property of water. Capillarity is the result of two properties of water: its ability to stick to other water molecules and its ability to stick to other substances. These properties help water molecules move upward, against the forces of gravity. Plants are able to take up water by their roots and transport nutrients to other parts of the plant by this mechanism.

Discussion Questions:

1. What happens to the food dye in the flower or celery?
2. Suppose the food dye in the water represents a pollutant or contaminant. Sometimes we dump poisonous substances into our streams or on the ground. Can you see how these could

affect plants or other living things that depend upon this water?

Desired Outcome:

The colored water will spread up the stem of the flower or celery. The tips of the flower petals will be colored. This may take a few hours to happen.

Extension:

Since the temperature of water affects the rate something dissolves in it, try another experiment with water and food dye. Have two glasses of water available: one hot and one cold. Add a drop of food coloring to each and see how the one in hot water dissolves much more quickly. This happens because the water molecules in hot water move faster and something will dissolve more readily.

Evaluation:

Students will be able to visualize the phenomenon of capillarity. They may be able to hypothesize what would happen to a water source if the dye represented a pollutant.

Service Idea:

Students may wish to make bouquets of mixed colors of dyed white carnations. They could be used for decorations for the school or as gifts for Mother's Day or other holidays. A variety of colors could be used for different seasons.

ACTIVITY 2.3: Hard and Soft Water

Goal:

To understand that water, even though it is clean, has different amounts of minerals dissolved in it; this depends largely upon the source of the water and affects its taste.

Objective:

To test the effects of minerals and salt in water.

Materials:

- " cold tap water
- " distilled water
- " 3 jars with lids
- " measuring cup
- " 1 teaspoon
- " Epsom salt (available at a drugstore)
- " soap flakes (not detergent) or Calgon (a water softener)
- " labels or tape
- " marking pen
- " 4 jars filled with 4 different water samples for tasting and enough paper cups for each student (optional)
- " petri dish or small clear drinking glass (optional)

Procedure:

1. Label each of the three jars: 1, 2 and 3.
2. Into jars 1 and 2 put 1/2 cup of tap water.
3. Into jar 3 put 1/2 cup of distilled water. (Distilled water is **soft water**).
4. Add 1 teaspoon of Epsom salt to jar 1 and replace lid. Shake well to mix. (This makes **hard water**).
5. Add 1 teaspoon soap flakes or Calgon to each of the 3 jars and replace lid. Shake each jar 5 times.¹

Discussion:

Certain minerals and salt (which

occur naturally) in water, have an effect on the **hardness** of water. Distilled water is water that has been treated to remove minerals, therefore it is **soft water**. Look at Figure 1 in this unit and find which part of Alabama you live in. Use this information to evaluate the results of the tap water you used.

Discussion Questions:

1. How were the three jars different? Which one had the most suds?
2. Is your tap water more similar to the distilled water or the hard water you made? What does this tell you about your water?
3. Why is hardness important? What are the benefits and disadvantages

of hard or soft water?

Teacher Note:

¹Make sure to shake each jar only 5 times each so that each jar will have an equal mixture.

Desired Outcome:

The distilled water is the softest water because it is free of minerals that make water hard; therefore, jar 3 will have the most suds. Jar 1 is the hardest water in this experiment and it will have the least amount of suds. The plain tap water (jar 2) will have some amount of suds between jars 1 and 3 depending upon the hardness of your tap water.

Extended Activity 1:

"Water Taste Test"

Try having students evaluate several different samples of water and vote on the one they think tastes best. Take 4 different samples and put them in 4 different bottles labeled 1, 2, 3 and 4. Use the following:

bottle 1	tap water from school
bottle 2	tap water from home
bottle 3	plain bottled water from a store (not carbonated)
bottle 4	distilled water

Assure the students that each sample of water is clean and drinkable. Have several small paper cups so that each student can sample each water. To save on cups, only pour enough water into each cup to allow enough to taste and reuse the cup for the other samples. On small pieces of paper, have the students select which one of the water samples tastes best and guess its source. They could use a rating scale of 1 to 5 with 5 being the best and 1 being the worst. Have them turn in the pieces of paper with the water sample number and their score written on it. Tabulate the results and compare the evaluations.

Extended Activity 2:

Take 2 petri dishes or small clear glasses. Into one, place a small amount of tap water. Put the same amount of distilled

water into the other one. Let both dry overnight. Compare the two dishes the next day. The one with hard water (tap water) will leave a small residue of minerals. These minerals are usually dissolved in water. When water evaporates, minerals are left behind. If the water in your area is not very hard, use tap water (1/2 cup) with 1 teaspoon Epsom salt added and add this to the dish instead of plain tap water. (You may wish to do this anyway to have more of an effect). There should be no residue left from the distilled water. In this way, students can visualize minerals that are normally present in water.

Evaluation:

Students will be able to experience the effects of hardness in water by examining the amount of soap suds produced by hard or soft water. If the extended activities are used, this will further demonstrate hardness of water on taste and/or mineral residue left behind after evaporation. Have students review Figure 1: Hard and Soft Water in Alabama. You may wish to check the unit: *The Water Cycle* to review the process of evaporation and the fact that when water evaporates, salt and other minerals are left behind.

References:

Cobb, V. The Trip of a Drip. Boston: Little, Brown and Co., 1986.

Water: The Liquid of Life. Springfield, IL: Illinois Environmental Protection Agency, 1991.

Internet: www.gene.com/ae/ (Access Excellence/Genentech Activities Exchange).

ACTIVITY 2.4: Fun Experiments With Water

Goal:

To use water in producing a melody, making rock candy, blowing bubbles, recycling newspaper and making rain paintings.

Objective:

To demonstrate different ways in which water can be utilized by performing five varied activities.

Materials:

- | | |
|------------------------------|--|
| " jar | " a big spoon |
| " hot water | " an old newspaper |
| " 1 cup of sugar | " water |
| " clean string | " a screen about 3" square or bigger |
| " pencil | " a flat pan a little larger than the screen |
| " paper clip | " starch |
| " 1 gallon water | " 8 same-size drinking glasses |
| " 40 drops of glycerine | " spoon |
| " 1/2 cup dishwashing liquid | " white drawing paper |
| " a large mixing bowl | " poster paints |
| " an eggbeater | " paintbrushes |
| " a cup | |

Melody Glasses

Drinking glasses filled with different amounts of water can become a musical instrument. You will need:

- \$ 8 same-size drinking glasses
- \$ water
- \$ spoon

1. Number the glasses from one through eight.
2. Fill each glass with different amounts of water (#1 being almost full gradually decreasing the amount of water until #8--just a little water).
3. Play "Twinkle, Twinkle, Little Star" on your melody glasses. The numbers tell which glasses to tap. (It would help to label the glasses). If a note doesn't

sound just right, try adding or taking away a little water. Tap fast or slow in different places to follow the rhythm.

Twinkle, twinkle little star,
1 1 5 5 6 6 5

How I wonder what you are.
4 4 3 3 2 2 1

Up above the world so high
5 5 4 4 3 3 2

Like a diamond in the sky.
5 5 4 4 3 3 2

Twinkle, twinkle little star
1 1 5 5 6 6 5

How I wonder what you are.
4 4 3 3 2 2 1

- *4. Optional: Have the students create their own tune with the water glasses. Make sure they write down their creation.

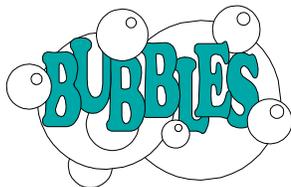
Home-Grown Crystals

Crystals are minerals that are clear and sparkly. Some crystals have colors, too! Ice, salt, and diamonds are all crystals. So is rock candy! Try growing some of your own crystals with this experiment.

You will need:

- Jar
 - Hot water
 - 1 cup of sugar
 - Clean string
 - Pencil
 - Paper clip
1. Fill the jar with one-half cup of hot water.
 2. Add the cup of sugar.
 3. Wrap one end of a piece of string around the pencil. Knot it.
 4. Put the pencil across the top of the jar and let the other end of the string hang almost to the bottom. Use the paper clip to keep it down.
 5. Let it sit for a few days. Then you can eat your experiment!

Bubbles



You can make some special bubbles.

Try this mix.

- 1 gallon water
 - 40 drops of glycerine
 - 1/2 cup dishwashing liquid
1. Mix together in a large flat pan. Stir slowly. If you can, let it set for at least one day. The glycerine can make stronger bubbles.
 2. For your bubble maker, have an adult help you shape a metal hanger. Dip your bubble maker into the pan and then gently wave it in the air. Try other shapes for your bubble makers.

Homemade Recycled Paper

A fun recycling activity is making your own paper. You can make paper for books, posters, newsletters, paintings, and many other things.

You will need:

- A large mixing bowl
 - An eggbeater
 - A cup
 - A big spoon
 - An old newspaper
 - Water
 - A screen about 3" square or bigger
 - A flat pan a little larger than the screen
 - Starch
1. Tear a half-page of newspaper into very small pieces. Put the paper in a large mixing bowl full of water.
 2. Let the paper soak for one hour.
 3. Beat the paper with an eggbeater for ten minutes. The paper should be soft and mushy. It is now called "pulp."

-
- Mix two tablespoons of starch in one cup of water. Add this to the pulp. Stir well. The starch makes the paper pulp strong.
 - Pour the pulp into the flat pan.
 - Place the screen in the bottom of the pan. It will become evenly covered with pulp.
 - Put the rest of the newspaper on a table. Pick up the screen covered with pulp and put it on one half of the newspaper.
 - Fold the other half of the newspaper over the top of the screen. Press down very hard.
 - Fold back the newspaper so you can see the pulp. Let it dry overnight.
 - When it is dry, peel your recycled paper from the screen.
- Carefully, bring your papers inside, holding them flatly so as not to disturb the rain drops.
 - Let the papers dry and observe the different patterns created by the raindrops.
 - Optional: If it is not raining, try using a fine spray from a hose or sprinkler to create the same effect as raindrops.

The above activities are reprinted by permission from Brownie Girl Scout Handbook, copyright 1993, Girl Scouts of the United States of America.

Making Rain Paintings

- Just before it begins to rain, take some white drawing paper and poster paints.
- With the poster paints, paint various shapes in desired colors on the paper using the paintbrushes or by fingerpainting.
- Put the papers outside in the rain for a little while (a light shower would be best--heavy thundershowers would be too strong a rainfall).

Discussion:

These activities demonstrate the variety of ways in which water can be used for fun and experiments. Not only is water a major part of all living matter, but it plays a big role in our everyday lives. In our experiments we have shown that water can be used to recycle goods, make edible treats, make fun bubbles, create music and make paintings.

Discussion Questions:

- Which of these activities was the easiest to do? The most fun? Why?
- What are some activities in which you use water everyday?
- What are some ways you can conserve water every day?
- Discuss why water is such an important part of all of our lives.

Desired Outcome:

Students will follow the directions for the fun water activities, and through their application they will understand that water is an important ingredient in many processes. They will be able to produce a melody by tapping glasses filled with different amounts of water. They will create a mineral (rock candy) by dissolving sugar in hot water and leaving it overnight. By mixing water, glycerine and dishwashing

liquid they will make their own bubble mix. They will recycle part of a newspaper and learn what a valuable tool recycling can be. They will see that water drops can make interesting shapes on poster paints applied to paper.

Evaluation:

Can students discuss the importance of water as an everyday tool and cite specific examples?

Extending the Idea:

1. Have the students write the steps to their own water activity. Some examples they may use include a cooking recipe, making lemonade or freezing popsicles. Ask them to include a sentence describing what they think would happen if they did not use the water in their activity.

2. Ask the students to keep a journal from the time they get up in the morning until bedtime. Have them record in the journal each time they use water (i.e. shower, brush teeth) as well as each time they see an instance where water is in use (i.e. lawn sprinkler, corner lemonade stand). Have them write a paragraph discussing their thoughts on how much or little they thought water was used in one day.

References:

Brownie Girl Scout Handbook. New York, NY: Girl Scouts of the United States of America, 1993.

Inside The Gardens. Pine Mountain, GA: Callaway Gardens, Summer 1996.

ANSWER KEY
WORKSHEET 2.1: Definitions

Directions: In the left column are definitions to the *Words to Remember* and in the right column are the words. Match the words with the correct definitions. Place the letter of the correct definition in the blank to the left of the word.

- | | | |
|----------|--|----------------------|
| <u>I</u> | 1. Water which has a high mineral content. It is difficult to make soap suds because of this high mineral content. | A. atom |
| | | B. capillarity |
| | | C. Celsius |
| | | D. dissolve |
| <u>P</u> | 2. A chemical element that is present in air. | E. distilled |
| | | F. Fahrenheit |
| <u>R</u> | 3. The water which falls to earth after condensing into either rain or snow. | G. gravity |
| | | H. H ₂ O |
| | | I. hard water |
| <u>J</u> | 4. When air contains a lot of moisture. It makes the air feel wet and heavy. | J. humidity |
| | | K. hydrogen |
| | | L. hydrogen bond |
| <u>C</u> | 5. Relating to a temperature scale divided into 100 degrees, where 0 degrees is the freezing point of water and 100 degrees is the boiling point of water. Based on the metric system, it is most commonly used in other countries other than the United States. | M. metric system |
| | | N. microorganism |
| | | O. molecule |
| | | P. oxygen |
| | | Q. pollutants |
| | | R. precipitation |
| <u>H</u> | 6. An abbreviation for "water," a compound composed of 2 atoms of hydrogen (H) and 1 atom of oxygen (O). | S. soft water |
| | | T. surface water |
| | | U. universal solvent |
| | | V. water vapor |
| <u>B</u> | 7. Water's ability to move upward in small pores or cavities through the soil against the force of gravity supporting life for plants and animals. | |
| <u>D</u> | 8. A condition where solid particles mix with a liquid and appear to become part of the liquid. | |
| <u>G</u> | 9. A force that causes smaller objects to move toward the center of the earth. | |
| <u>Q</u> | 10. Substances which harm the quality of air, land or water. | |

- E 11. Water that has been purified of minerals and has no taste.
- S 12. Water which has a very low mineral content.
- U 13. Water.
- K 14. A chemical element that mixes with **oxygen** to make water.
- V 15. Water that is in the gaseous state which is produced by evaporation or transpiration.
- T 16. Water which is found on the exterior surface of the earth, such as in rivers and lakes.
- L 17. A bond that holds water **molecules** together.
- O 18. The smallest part of a substance that retains the properties of the substance and is composed of one or more **atoms**.
- F 19. Temperature scale most commonly used in the United States that indicates the freezing point of water as 32 degrees and the boiling point of water as 212 degrees.
- M 20. A system of weights and measures in which the meter is the basic unit of length, the kilogram is the basic unit of mass or weight, and the liter is the basic unit of liquid volume.
- A 21. The smallest unit of an element that can exist by itself or in combination with other units.
- N 22. An organism that can only be seen by a microscope, such as a bacteria; bacteria aid in wastewater treatment.

ANSWER KEY
WORKSHEET 2.2: Vocabulary (Word Puzzle)

Unscramble the following letters to make the correct words:

Water is a special substance because it can exist in three different forms.
orsfm

The water molecule has two atoms of hydrogen and one atom
lemeculo eyrnhdog

of oxygen. The atoms of the water molecule form a unique bond called the
gonyxe

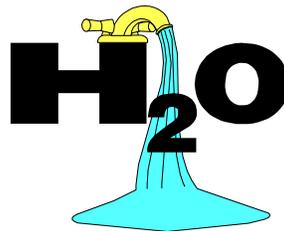
hydrogen bond. Water is called the universal solvent because of its
eyrnhdog nobd ravilunes sletvon

ability to dissolve many substances. Water with a high mineral content is
ledvisso

hard water. Water's ability to form a "skin" on its outside surface is an example
radh

of the property called surface tension. This is the reason water molecules can
acesfur notesin

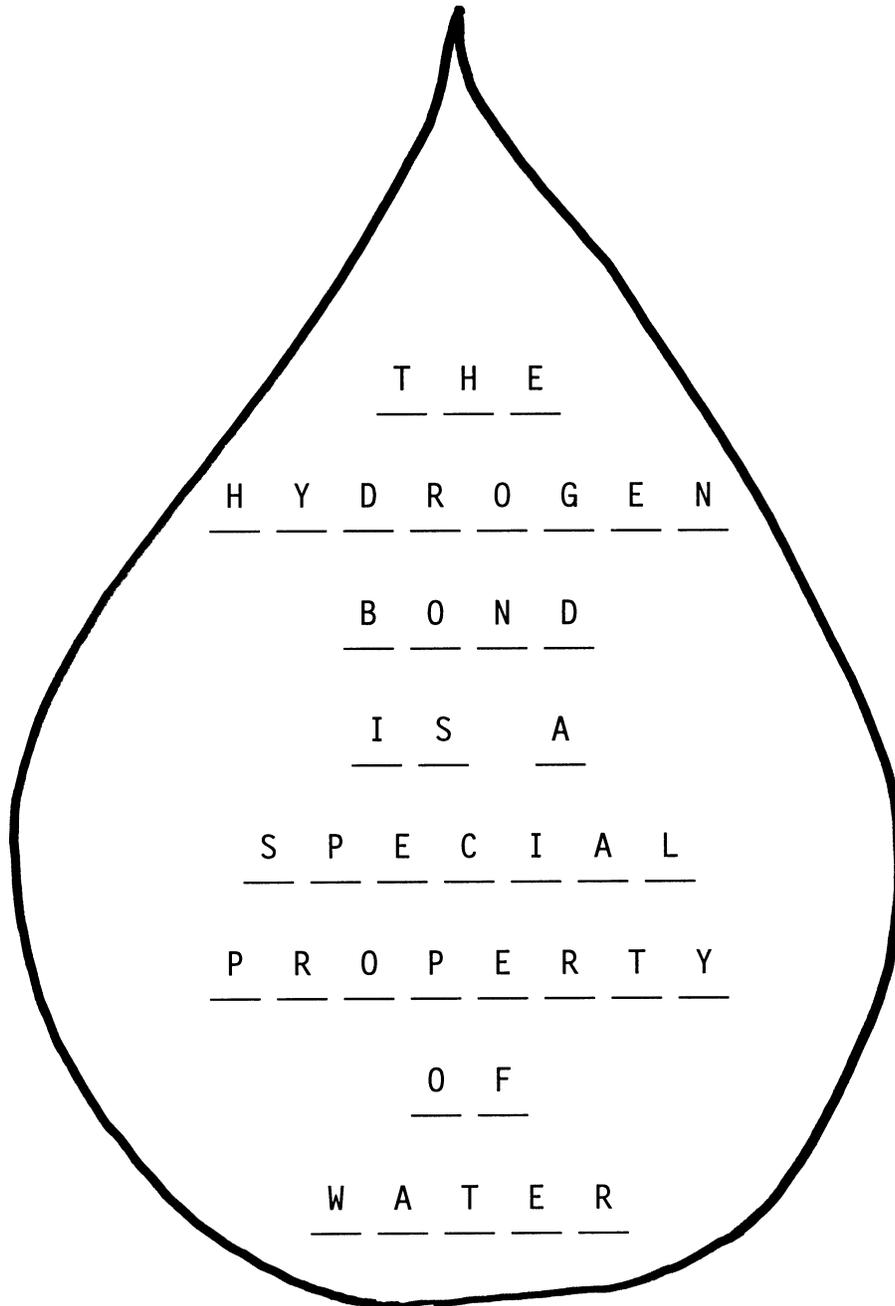
move upward in plant roots, against the force of gravity, is because of capillarity.
raliticplay



ANSWER KEY
WORKSHEET 2.3: Facts About Water

Directions: Use the secret code to find a water fact

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
14	15	16	17	18	19	20	21	22	23	24	25	26



HOW AM I DOING?

Page	<u>Yes</u>	<u>No</u>	<u>Date</u>
2-3 Practice reading and saying Words to Remember	_____	_____	_____
2-6 Answer Questions for Review	_____	_____	_____
2-6 Answer Questions for Thought	_____	_____	_____
2-8 Read Fact Sheet	_____	_____	_____
2-9 Review Glossary	_____	_____	_____
	<u>Possible</u> <u>Score</u>	<u>My</u> <u>Score</u>	<u>Date</u>
2-11 Worksheet 2.1: Definitions	<u>22</u>	_____	_____
2-13 Worksheet 2.2: Vocabulary (Word Puzzle)	<u>13</u>	_____	_____
2-14 Worksheet 2.3: Facts About Water (Word Puzzle)	<u>9</u>	_____	_____
	<u>Complete</u>	<u>In-Complete</u>	<u>Date</u>
2-15 Activity 2.1: Properties of Water: Surface Tension	_____	_____	_____
2-17 Activity 2.2: Capillarity of Water	_____	_____	_____
2-18 Activity 2.3: Hard and Soft Water	_____	_____	_____
2-20 Activity 2.4: Fun Experiments With Water	_____	_____	_____