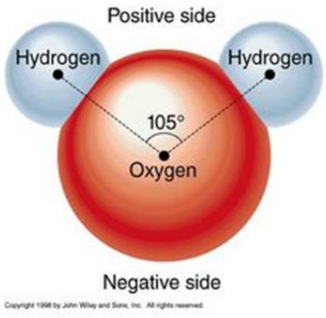
Properties of Water Lab

Understanding the Properties of Water

Name: _____ **Date:** _____ **Block:** _____

Introduction:



Water's chemical formula is H_2O. As the diagram to the left shows, **one** atom of **Oxygen** (negatively charged) is bound to **two Hydrogen** atoms (positively charged). There are more electrons orbiting the oxygen atom compared to the hydrogen atoms, resulting in a water molecule having a **positive** charge on the side where they Hydrogen atoms are and a **negative** charge on the other side, where the Oxygen atom is.

This uneven distribution of charge is called ***polarity***. Since opposite electrical charges attract, water molecules tend to attract each other, making water kind of "sticky."

Root Terms:

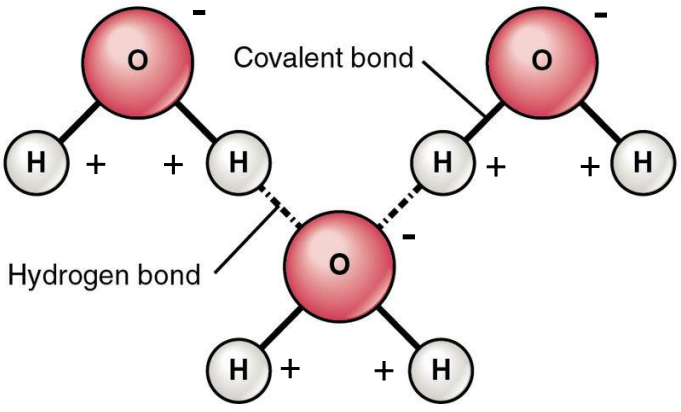
The INTRA-molecular bonds that hold the *hydrogen* and *oxygen* atoms together to make a water molecule are covalent bonds.

1. Explain what a **covalent bond** is:

The INTER-molecular bonds that hold water molecules to each other are the result of the unequal sharing of electrons within a water molecule. Water is considered a **POLAR** molecule because of this unequal sharing; part of water is negatively charged and part of water is positively charged.

Look at the diagram to the right:

2. What atoms in water have a more negative charge?
3. What atoms in water have a more positive charge?
4. What kind of bond holds **water molecules** to each other?



This property of water is known as COHESION. The attraction between all these water molecules causes them to clump together. This is why water drops are, in fact drop! If it wasn't for some of Earth's forces, such as gravity, a drop of water would be ball shaped—a perfect sphere. Even if it doesn't form a perfect sphere on Earth, we should be happy water is "sticky."

Station #1: Clean up ALL equipment after use.

The **POLAR** nature of this molecule allows water to be a "dissolver" of other polar substances. Water is called the ***"universal solvent"*** because it dissolves more substances than any other liquid. This means that wherever water goes, either through the ground or through our bodies, it takes along valuable chemicals, minerals, and substances that do not break apart, or dissolve, in water are called **NONPOLAR**.

What to do: Take a spoonful of sugar and put it into a beaker. Now fill the beaker halfway with warm water. CAUTION: the water could be HOT! Gently swirl the mixture for 15-30 seconds.

1. After observing the result, do you think sugar is polar or nonpolar? **EXPLAIN why.**

2. Sometimes nonpolar substances are called ***hydrophobic***. What do you think this term means?

3. The opposite of hydrophobic is ***hydrophilic***. What do you think this term means?

NEXT: Look at the salad dressing container filled with oil and vinegar. Gently swirl the mixture and allow it to sit for 2 minutes.

4. Does the oil dissolve?
    a. Does that mean that it is hydrophilic or hydrophobic? **Why?**

5. Oil is a type of **LIPID** and all lipids will have the same reaction with water as oil. THINK ABOUT IT!
    a. What do you think the term lipid means?

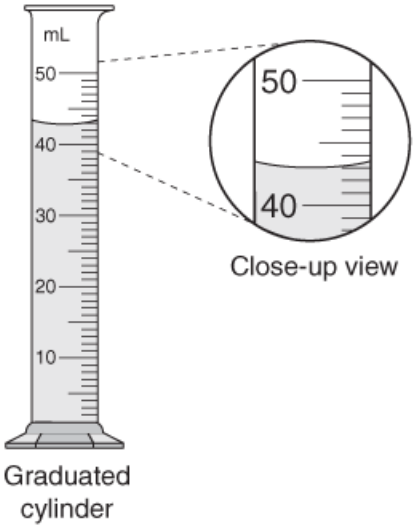
    b. Why does it make sense that our **cell membranes**, the cells' boarder protection that allows certain particles and molecules in and out of the cell, are made of lipids?

Station #2: Clean up ALL equipment after use.

Water molecules are not only attracted to each other, but can also be attracted to substances and surfaces around them. This attraction to other surfaces is called ADHESION.

What to do: Fill **BOTH** the graduated cylinders **(glass and plastic)** with 25mL of water. Notice the level of the water at the top of the cylinder.

1. How is the level of water at the top of each cylinder differ?



When the water molecules are attracted to the surface and stick to the sides of the cylinder causing it to dip down in the center, this is called a MENISCUS. When reading a graduated cylinder, always ready the number at the **BOTTOM** of the meniscus. **The picture shows 43mL of water.**

2. The forces of **ADHESION** are greatest between water and which surface? ☐ **PLASTIC** ☐ **GLASS**

EXPLAIN YOUR ANSWER:

NEXT: Place the construction paper strip vertically into a beaker filled with 25mL of water. Tape the top of the paper to the top of the beaker. Be sure the end fo the construction paper is submerged into the water. Wait 5 minutes.

1. What happens to the water and the paper?

2. The ability of water to **MOVE ALONG THE PAPER** is called CAPILLARY ACTION. Tape is sometimes called an adhesive. What do you think adhesive means?

3. One of water's properties is adhesion. Thinking about how the water moved up the paper, what do you think adhesion means?

4. How is this different than cohesion?

5. If water enters a plant through the roots, how do you think the property adhesion help the water get to the leaves?

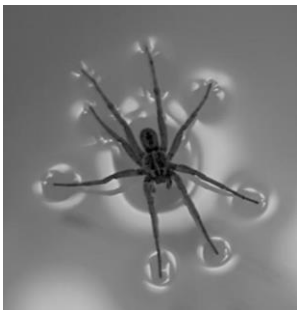
Station #3: Clean up ALL equipment after use.

What to do: Fill a beaker with water and try to balance a paperclip on the surface of the water.

1. Why is the paperclip able to sit on the top of the water? **[Think about the properties of water we've discovered in this inquiry so far.]**

2. When the paperclip is floating, push on the top of the paperclip. What happens and why?

3. The floating paperclip is similar to how animals like the "water strider" can walk on the water. Describe what is happening when insects like this can walk on the water and explain why humans (except…maybe one notable man in history) cannot walk on the water.



Next: You are going to compare the cohesive properties of three mystery liquids.

A. Using your dropper, place a couple of drops of mystery liquid 1 to a square of wax paper, mystery liquid 2 on a square of wax paper, and mystery liquid 3 to a square of wax paper. **DO NOT SMELL OR TASTE THE LIQUIDS!**

Record your observations below:

- Mystery Liquid #1: _____
- Mystery Liquid #2: _____
- Mystery Liquid #3: _____

B. **NEXT:** Using the dropper(s), slowly and carefully place one drop of the liquid at a time on the surface of a penny, **counting the number of drops until the liquid spills over the sides.** How many drops of the liquid will the penny hold before spilling over? Run three (3) trials for **EACH** of the mystery liquids.

	Liquid #1	**Liquid #2**	**Liquid #3**
Trial 1	Drops held?	Drops held?	Drops held?
Trial 2	Drops held?	Drops held?	Drops held?
Trial 3	Drops held?	Drops held?	Drops held?

C. Guess the identities of the mystery liquids.
Liquid #1 _____ **Liquid #2**_____ **Liquid #3**_____

4. Which of water's super special properties might explain your results and why?

5. Why do you think you were asked to perform the activity 3 times for each liquid instead of only once?

Station #4: Clean up ALL equipment after use.

What to do: Add enough water to cover the bottom of the glass bowl. Sprinkle enough pepper to cover the surface of the water, **AND ONLY THE SURFACE.** Insert a plain toothpick into the pepper.

1. Describe what happened?

In order to clean clothes or wash dishes/hands, SURFACE TENSION must be reduced so water can spread and wet surfaces. Chemicals that are able to do this effectively are called **surface active agents**, or **surfactants.** They are said to make water "wetter." Surfactants perform other important functions in cleaning, such as loosening emulsifying (dispersing in water) and holding soil in suspension until it can be rinsed away. Surfactants can also provide alkalinity, which is useful in removing acidic soils.

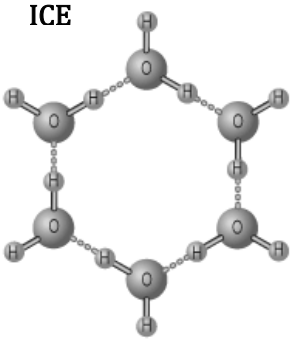
2. In order to clean a surface, surface tension must be?

☐ INCREASED ☐ REDUCED

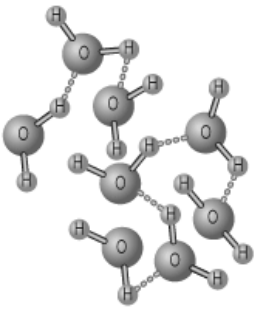
EXPLAIN YOUR ANSWER:

NEXT: Observe the ice in the water:

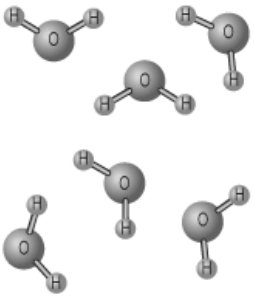
ICE



WATER



STEAM



1. The hydrogen bonds between water molecules in ice are further apart than when water is a liquid. How do you think this affects the amount of space water takes up when frozen as opposed to as a liquid?

2. How would life in a lake be affected if ice sank and lakes froze from the bottom up? **[Think about aquatic life and what you know about how life originated on Earth.]**

3. How do you think this property of water is responsible for all the potholed roads in Kentucky?

The Universal Solvent:

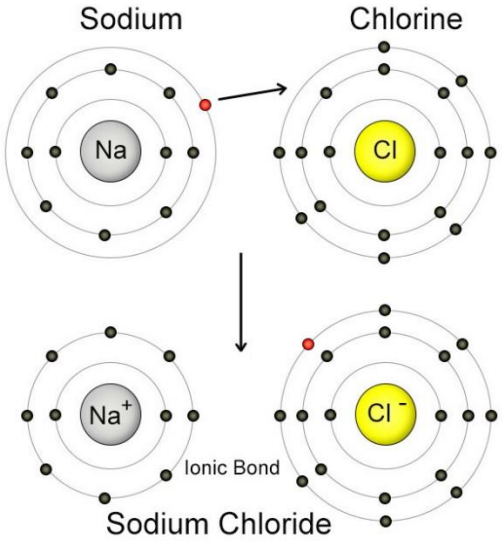
Without exaggeration, water is the greatest **SOLVENT** on earth! Water's polarity allows it to dissolve **IONIC** compounds like salt and non-ionic compounds like sugar.

1. Salt is an ionic compound that consists of one atom of **Sodium** and one atom of **Chlorine**. Because it is ionic and not covalent, the electrons are not shared between atoms. They are _____from the sodium atom to the chlorine atom.

2. A regular sodium has _____ electrons. A regular chlorine atom has _____ electrons.

3. After forming an ionic compound, sodium has _____electrons and chlorine has _____ electrons.

4. What is the scientific name for table salt? _____ _____



Since the number of protons the atoms have is still the same, altering the number of electrons creates **IONS!** The positive charge on sodium is attracted to the negative charge on chlorine.

DRAW a picture of how salt would interact with water molecules. You may use the book or notes.