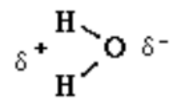
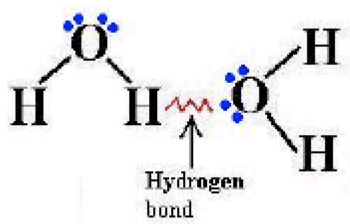
Name:__________________________ Hr:_____

Properties of Water Lab

Water is a polar molecule. The oxygen atom in water has a greater electronegativity, or a strong “pull on the electrons that it shares with the two hydrogens it is covalently boded to. As a result, the molecule ends up having a *partially* negatively charged end, near the oxygen, and a *partially* positively charged end near the hydrogens – much like a magnet.



And much like a magnet, opposite charges will attract and likes will repel, so that the slightly negatively charged oxygen of one water molecule will be attracted to the slightly positively charged hydrogen of a neighboring water molecule. This weak attraction and “sticking together” of polar molecules is called **hydrogen bonding**.



Water is an extremely important molecule in biology. Life came from the earliest watery environments, and thus all life depends upon the unique features of water, which result from its polar nature and “stickiness”. Some of the unique properties of water that allow life to exist are:

- It is less dense as a solid than as a liquid.
- It sticks to itself – *cohesion* – cohesion is also related to *surface tension*.
- It sticks to other polar or charged molecules – *adhesion* – adhesion results in phenomena such as *capillary action*.
- It is a great solvent for other polar or charged molecules.
- It has a very high *specific heat (heat of fusion* and *heat of vaporization)* – that is, it can absorb a great deal of heat energy while displaying only small increases in temperature.

Procedure

In this lab, you will explore these unique properties by completing several different stations setup throughout the room. You will work with an assigned group to complete a series of **six stations**. After the designated time, you will move to the next station in the sequence. See the attached documents for directions for each station. Do not move to the next station until Mrs. Skakal announces time to rotate.

STATION 1: Water as glue?

1. Put two wet slides together and then try to pull the wet slides apart. **What do you observe?**

2. Given that glass has a charged surface, how would you explain your observations in terms of water chemistry? What specific property or properties of water is/are involved here?

STATION 2: Paperclip Float

1. Fill a clean petri dish with fresh tap water. Gently, try to float a clean, dry paperclip on the surface of the water. *Tip: Lower the paperclip so that the entire surface hits the water at the same time.*
2. After you are successful, revel in your success! Then, carefully add one drop of detergent solution to the dish. **Record your observations below**. ***After finishing, rinse out the petri dishes and the paperclip to thoroughly remove the soap. Leave the petri dish upside down to dry for the next group, and put the damp paperclip in the "Used Clean Paperclips" container.

3. Explain what happened in terms of water chemistry. Why does the paperclip float? Can you explain what happens when you add the detergent? (Refer to station 4, item 5 for background on the chemistry of soap molecules.)

STATION 3: Drops on a Penny

1. Take a dry penny and place it on a dry paper towel.
2. Using a dropper, *slowly* drop water (count the drops!) onto the surface of the penny. Just before it overflows, sketch the shape of the water on the penny below. Continue until it overflows. How many drops did it take?
3. Try this whole process again with alcohol.

Liquid	Drops to Overflow	Sketch
Water		
Alcohol		

Why would these differ? What is your prediction as to the chemical nature of alcohol, compared to water?

4. Now dry your penny off. Slowly drop soapy water onto its surface until it overflows – counting each drop. How many drops did it take? _________________ ***Rinse off and dry the penny thoroughly once you have recorded your data.

5. Soaps are **amphipathic** molecules, meaning that they possess both a charged or polar region at one end and a non-polar region at the other. Using what you know about the behavior of polar and non-polar substances, hypothesize what is happening at a molecular level to cause the phenomenon you observed in the step above. Feel free to use drawings as part of your explanation.

STATION 4: Drops on Glass and Wax Paper

1. Before you begin: What do you predict the shape of a drop of water will be on a glass slide? On a piece of wax paper? (You may draw your predictions.)

2. Why did you make these predictions? What assumptions are guiding your thinking?

3. Now, place a drop of water on each surface and draw the results below.

Glass Slide	Wax Paper

4. Compare your predictions with your results and explain your observations. What do you think the chemical nature of the glass and wax paper is, given what you know about the polar nature of water molecules? What property of water is at play here?

STATION 5: Can water and oil mix?

1. Half fill a clean beaker with water. What do you predict will happen if you add cooking oil to this? Oil is *hydrophobic*, or *non-polar*, and cannot form hydrogen bonds with polar molecules.

2. Gently add enough oil to the water surface to cover the surface entirely. What happened? Explain your observations in terms of the interaction of polar and non-polar molecules.

***When done, pour the contents of the beaker down the sink. Wash the beaker thoroughly and return it to the station.

STATION 6: Capillary Action

1. Obtain a stalk of celery that has been soaking in water. Holding the celery stalk under water, use a razor blade to make a new horizontal cut on the far end of the celery (away from the leaves). Measure 100mL of water into a 250mL beaker and add 10 drops of food coloring. Place the cut end of the celery into the colored water. Record the time below:
    a. Time placed celery in colored water: __________________

2. After completing all other stations (approximately 50 minutes), remove the celery from the colored water and dry it off with a paper towel. Observe the cut end of the celery. Describe and draw your observations below.

3. Using a razor blade and a ruler, slice off 2mm from the end of the celery. Observe the cut end of the celery. Does it appear the same? ________________ Keep cutting in 2mm increments until there is a change in appearance. Draw the celery each time it appears different and label the distance of the total amount of cut celery.

4. What happened to the colored water?

5. Did the colored water travel through all parts of the celery? Explain.

6. If the water traveled differently in different places, suggest a reason for the difference you observed.