NAMES\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Envirothon Lab-Water Properties-Mrs. Weimer

**Background:** Water has some peculiar properties, but because it is the most common liquid on Earth, we typically do not recognize how truly peculiar water really is. Water is everywhere. It's in the air we breathe. It's in our sink faucets, and it's in every cell of our body. Water is an unusual substance with special properties. Just think about the wonder of water:

How does water rise from the roots of a redwood tree to the very top?

How do insects walk on water?

Why does ice float rather than sink?

Why do people become seriously ill, or die, if they go without liquid for a week or so?

How would life in a lake be affected if ice sank and lakes froze from the bottom up?

**When it is your turn to run your station:** read aloud the information and instructions to your group.

Perform any necessary activity & clean-up…get help from lab table-mates when you need it. Then, lead the discussion of what happened. Run one test at a time with everyone in your group paying attention.

**What to write down:** the number of the station, **the title of the station,** the data from the station (i.e. what you observe (qualitative data), any quantitative data, & answer any question(s) for that section.

**Station 1: Solubility - Water the Super Solvent – The Universal Solvent!**

salt

2 stir rods

beaker with

salt & oil

beaker with

water

Solubility is the ability of one substance to dissolve another substance. (Remember: the chemical being dissolved is the solute and the chemical doing the dissolving is the solvent!). Water is a good solvent, especially for ionic compounds – salt is an ionic compound.

Ions have to be able to dissolve quickly in cell fluids for cellular metabolism (the energy pathways of a cell) to work properly! As a matter of fact, water is called the UNIVERSAL SOLVENT….Do you remember what this term means? If not, Look at your unit 1 notes!

1. Put a pinch of salt in the water that is already in the beaker.

2. Stir vigorously for 1 minute. Record what happens? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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3. The beaker with oil already has salt in it. Stir vigorously for 1 minute. Record what happens? \_\_\_\_\_\_\_\_\_

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4. Which is a better solvent for an ionic substance like salt …. water? or oil? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Is it the non-polar oil?, or is it the polar water?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Clean-up – Leave the oil and salt as you found it. Pour the beaker of salty water into the sink. Rinse it and dry it (and dry the lab table), and fill the beaker with the same volume of water as there is oil in the beaker. Re-set the station as you found it…beakers, stir rods, salt, etc…**

**Station 2: Surface Tension** –

Petri dish

pepper water

soapy water

sm. beaker

q-tip

2 droppers

2 pennies

Paperclip

Water

Beaker

Adhesion (water other) and Cohesion (water water)

Because each water molecule is polar, the water molecules are highly attracted to one another. This is especially true at the surface, where the water is much more attracted to itself than it is attracted to the air…It almost seems like water can form a skin on the surface…this is called surface tension… Surface tension is really a combination of:

the attraction between molecules of water = cohesion = water sticks to water = think: “water attracted to water”

& the molecular attraction between water molecules and other substances = adhesion = water sticking to something else…think: “adhesive tape”!

1. Pour a small amount of water on a Petri dish, sprinkle the surface with some pepper….

2. Observe the pepper floating on the surface of the Petri dish.

3. Take the Q-tip from the soapy water and barely touch it to the center of the surface of the peppery water in the center of the dish.

4. Record what happened to the pepper? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Why do you think this happened?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Station 3 Surface Tension & Adhesion Drop Behavior - Water on Penny

Part A

1. Obtain a medicine dropper and a small (10 ml) graduated cylinder. Make sure the dropper is clean.

2. Drop water into the graduated cylinder with the dropper, counting each drop.

3. How many drops, of the size produced by your medicine dropper, are in each cubic centimeter (cc) of water? (1 cubic centimeter = 1 milliliter)? \_\_\_\_\_\_\_\_\_\_ drops

4. Conversely, how much water is in each drop? (divide 1cc by the number of drops) \_\_\_\_\_\_\_\_\_\_ cc. per drop, average.

Station 3 Surface Tension & Adhesion Drop Behavior - Water on Penny

Part B

1 How many drops of water can pile on a penny before it overflows? Predict in a table like below:

Table 1. Number of Drops Predicted

Person #1\_\_\_\_\_

Person #2\_\_\_\_\_

Person #3\_\_\_\_\_

Person #4\_\_\_\_\_

Total 1 – 4\_\_\_\_\_

Average\_\_\_\_\_\_\_

6. Now, let's see how many drops of water you can you place on the surface of a penny before it overflows. Drop water from the dropper onto a penny, keeping careful count of each drop. Draw a diagram like the one below, showing the shape of the water on the penny after one drop, when the penny is about half full, and just before it overflows.

Figure 1. Drawing of Drops on a Penny

7. How many drops were you able to place on the surface of the penny before it overflowed?

\_\_\_\_\_\_\_\_\_\_ drops

8. How is the number of drops different from your prediction, explain what accounts for any difference.

Explain your results in terms of cohesion\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Station 3 Surface Tension & Adhesion Drop Behavior - Water on Penny

Part C Effects of Detergent

1. With your finger, spread one small drop of detergent on the surface of a dry penny.

2. How many drops do you think this penny will hold after being smeared with detergent, more, less, or the same as before? \_\_\_\_\_\_\_\_\_\_Why?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Exactly how many drops do you think it will hold? Draw this table with a ruler and complete!

Table 2. Prediction of # of Drops of Water on a Penny with Detergent

Person #1\_\_\_\_\_

Person #2\_\_\_\_\_

Person #3\_\_\_\_\_

Person #4\_\_\_\_\_

Average\_\_\_\_\_\_

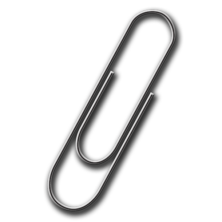
4.Using the same dropper as before, add drops of water to the penny surface. Keep careful count of the number of drops, and draw the water on the penny after one drop, about half full, and just before overflowing.

Figure 2. Drawing of Drops on a Penny with Detergent

5. How many drops were you able to place on the penny before it overflowed this time?

\_\_\_\_\_\_\_\_\_\_ drops

6. Did the detergent make a difference? Describe the effect of the detergent.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

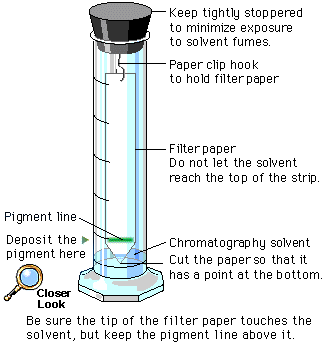
Station 4: Surface Tension - Floating Paperclip

Using a steady hand and a piece of string, see if you can get the paper clip to rest on the surface of the water in such a way that it will not sink. After you succeed, answer the question below:

1. What property(ies) of water allows the paperclip to rest on the surface of the water?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Station 5: The Climbing Property of Water

Water moves to the tops of tall trees due to capillary action combined with root pressure and evaporation from the stomata (openings) in the leaves. Water will also climb up paper, and often the migrating water will carry other molecules along with it. The distance traveled by these other molecules will vary with their mass and charge.

1. How fast do you think water would climb a strip of absorbent paper about 1.5cm wide? about one cm per \_\_\_\_\_\_\_minutes

2. Observe the demonstration: 50 ml graduated cylinder, with a torn off strip of chromatography paper that is just long enough to hang over the side of the cylinder (inside) and reach to the bottom.

A single small drop of ink from a marker was placed on the paper, about one inch from the bottom, and it dried completely.

Then 10mL of water was added to the gradated cylinder so the bottom end of the paper below the ink was in the water.

3. Note the time the paper was placed in the water.

4. Ho

w does the ink change?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. How long did it take the water to climb to the top?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. What was the rate of water flow up the paper? \_\_\_\_\_\_cm/min

CONCLUSION:

Describe the chemical and physical properties (abiotic) factors of water-EVERY student needs to write at least one and initial beside what you wrote.

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