DO NOT WRITE ON THIS SHEET: PUT ALL WORK IN YOUR NOTEBOOK!!!

LAB: Investigating the Unique Properties of Water·

Directions: Use the pages 40-44 in your book to help you. You need to be in your POGIL groups

The molecular structure of water resembles that of a teddy bear's head. The hydrogen and the oxygen atoms have a very tight ***covalent bond*** formed where the hydrogen and oxygen share electrons. While water molecules tend to electrically neutral, the oxygen holds a small negative charge and the two hydrogen atoms hold small positive charges. Water molecules are sticky and attracted to each other and form ***hydrogen bonds*** due to the *positive* hydrogen end and *negative* oxygen charges, (as it is opposite forces attract). The polarity of water or water's usual electrical balancing, gives water some of its remarkable properties.

Question 1: At the left draw a water ***molecules*** in the space provided. Be sure to include, *covalent bonds, hydrogen bonds, oxygen, hydrogen and the charges.* Use the information above to help you.

Investigation #1: Heating and Cooling of Water vs Sand

Directions :

1. Make a data table showing initial and final temp after heating. Also include temperatures during the cool down. You should record every 2 minutes:

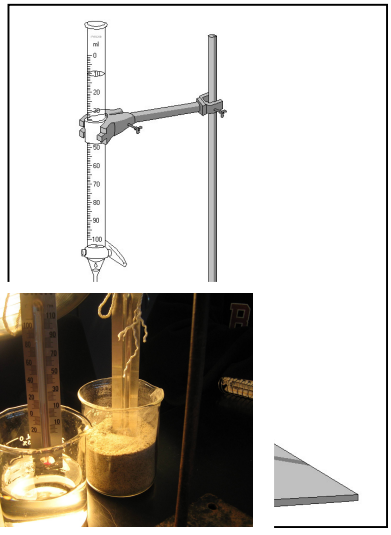
Directions: Use a beaker filled with sand and a beaker filled with the same amount of water. Measure the initial temperature of the water and the sand. Place both beakers on a hot plate for 10 minutes. After 10 minutes record the temperature of each, make sure that the thermometer is 3 cm below the surface of the water and sand.

1a. What is your result

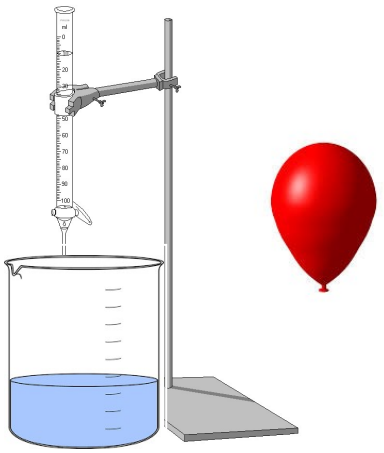
1b. Which property of water explains this result?

1c. Why is this property important in biology?

Don't forget data table:



Investigation #3: Titration:



Directions: Use the plastic beaker to carefully fill the **titration pipette** near to the top with water. Take the balloon and rub the balloon on your head or a piece of clothing. Take the balloon and put the side that was rubbed on the hair/clothing near to the stream of water, (turn the titration pipette to **"on"** position so that a steady stream of water flows).

3a. What did you observe?

3b. What was being rubbed off of your hair/clothing onto the balloon?

3c. What is the property of water that explains this?

3d. Explain how this is happening

3d.What is the property of water responsible for this demonstration?

Investigation #2: Wax paper and Water

Directions: Place small drops of water on a small piece of wax paper. Observe, describe, and draw in detail the appearance of the water. Use a toothpick to draw the water apart and bring the water droplets together.

2a. Draw a side view of the water drop.

2b. What is the property of water that explains this?

Now use a toothpick and dip the end into a small drop of soap and watch the results.

2c. Explain what happened molecularly when the soap was dipped into the water?

Investigation #4 The Penny:

You will need to record data in a table.

Directions:

Place a penny on the table. *Before you do anything* write a ***hypothesis***, (in an If…..then ….because statement) making a prediction to how many water droplets you think a penny can hold. Carefully add one drop at a time to the top of the penny. When one runs off that is when you stop and record your results. All members of the group should participate and you should be able to gather 3 to 4 pieces of data.

4a. What is the property of water that allows so much water to stay on the penny?

4b. Why is this property important in living things?

Place the penny on the table again, clean and dry, this time you will make a ***hypothesis*** on how many alcohol drops will fit on a penny. Alcohols formula is C_3H_8O Be sure to add another column to your data table to record your results. Again your entire group should participate in data collection.

Data Table :

Investigation #5 The Paper Clip:

(This demo is available two people to be working simultaneously)
You will notice plastic cup at the table, fill the plastic cup to the very top using a plastic beaker. The water should look as if it is just about to spill over the sides. First you will try to get a paper clip to sit on top of the water try a couple of times just using your hand to balance there.

Or…. use a piece of filter paper and set it on top of the water in the plastic cup. Then carefully place the paper clip on top of the filter paper. Use a tooth pick, pen or some pointed object to gradually sink the filter paper beneath until it drops to the bottom of the cup or you can take it out of the cup, the paper clip should now be floating on top of the water.

5a. What property of water allows the paper clip to stay on top of the water?

5b. What forces create this property of water?

5c. Why do you think that you could not make the paper clip balance with just your hands?

Investigation #6 The String:

(This demo is will need the help of 3 people in the group)
In this demo there are 2 large plastic pans. The group will use different strategies to determine what helps water to flow down a string.

First space the pans out on either side of the table. Then two group members are to hold the string taught between the two pans, one person is to be on one side of the table and the other person at the opposite end. For the initial test use a dry string, hold the string at approximately at a 45° angle from the table use the water bottle to gently drip water onto the string.

6a. Record what happens with the dry string.

6b. How far does the water travel?

Now use a wet string, two group members are to hold the string taught between the two pans, one person is to be on one side of the table and the other person at the opposite end. The string should be held at 45° angle again. Use the water bottle to gently drip the water onto the string.

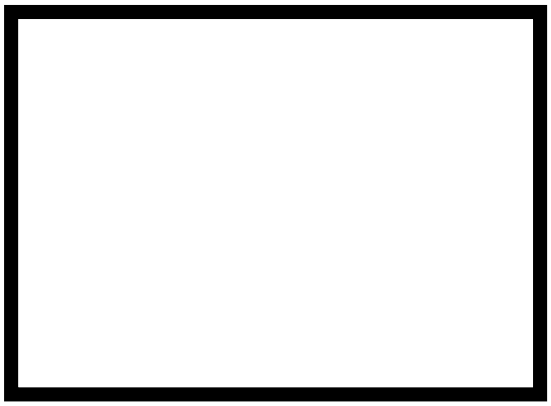
6c. Record what happens with the wet string.

6d. How far did the water travel before it dripped off the string this time?

6e. What properties of water are allowing the water to behave in this manner, explain both scenarios.

Investigation #7 Glass Tubes:

In this demo there is a glass dish with three different sized tubes, with a couple drop of food coloring in the water. **Draw the set up below in the box provided below**.



7a. What do you notice about the water level in each of glass tubes?

7b. What two forces are at play here, why does each tube have a different water level? Explain

7c. What property of water does this demo explain?

7d. How is this property important in plants?

Investigation #8 Water Density:

Water is unique in that when it freezes it becomes _____ dense, and will _____ when put into water. We have all experienced this in the winter when we step on frozen-over puddles and underneath there is water that is not frozen and our shoe gets all wet.

8a. Why would this phenomena with water be advantageous to organisms in the winter? Explain

Investigation #9 Water dissolves or NOT·

Water is often referred to as the _____ _____ because it dissolves many things. The rules for dissolving are that ***like dissolves like***. Water is a polar molecule, so other polar molecules or hydrophilic molecules will dissolve in water, and those that are hydrophobic and nonpolar will not.

Procedure:

In a test tube measure 5ml of water into a test tube add one of the substances at a time and record **whether it is dissolved by water, and why**. Your results should be put into a data table.

Investigation #10 pH

Another quality of water is called **dissociation**. This property of water is responsible for the formation of acids and bases. In water dissociation, a hydrogen atom breaks away from the oxygen atom. Here is an example of what happens

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In this lab you will categorize the various solutions in order from lowest pH to highest. You must also record the pH that you measured for each in a data table. When using pH strips to test for pH you must read the color that it gives immediately.

In pure water there are an equal number of H^+ ions and OH^- ions. The amount or number of H^+ ions to OH^- ions determines the pH of a substance or whether the substance is acid, base or neutral. This brings us to the pH scale.

10a. What does pH stand for?

10b. When you are measuring pH you are measuring the concentration of what in solution?

10c. If milk has the pH of 8 and orange juice is pH of 6, how many times more acidic is orange juice?

10d. What does it mean "water dissociates"?