**Magnet Biology: Properties of Water Lab**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Block: \_\_\_\_\_**

**#: \_\_\_\_\_\_\_**

**Introduction**: Water is essential to life. This molecule exhibits some unique properties due to its ability to form hydrogen bonds or because of its polarity. Those properties include: cohesion, adhesion, specific heat capacity, density, pH, and surface tension. Water is one of the simplest yet most important molecules in the natural world. Our bodies are made up of about 60% water. Nutrients and minerals need to dissolve in our blood, which is primarily made of water. This is one way we are able to stay alive. As you complete this lab, you will be investigating the properties of water. It is important to refer back to your notes during this lab.

Before beginning the lab, define the following terms using only your notes. These terms will be used throughout the lab.

1. Polarity (Polar Molecule):
2. Hydrogen Bond:
3. Adhesion:
4. Cohesion:
5. Surface Tension:
6. High Specific Heat/specific heat capacity:
7. Nonpolar Molecule:
8. Universal solvent:
9. Density:
10. pH

1. Draw a water molecule, labeling the partially positive ‘end’, the partially negative ‘end’, the oxygen, and the hydrogen atoms, and display the bond(s) to another water molecule. Label the bond it forms when it connects to another water molecule.

**Drawing:**

**\* It is important to make predictions for each station before you start the activity at that station. \***

**PROCEDURE:**

1. **Lab groups will rotate stations. Each group MUST thoroughly rinse all glassware, and put disposables in trash, before proceeding to the next station**
2. **Whichever station is your group’s LAST station, you MUST wipe the area down with a disinfectant wipe and throw all disposables away. I MUST CHECK YOUR GROUP OFF before you can leave the station.**

**Station 1**: **The Universal Solvent**

Focus Questions**:** What kind of substances can water dissolve? Can it dissolve everything?

**1. Answer to focus questions:**

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Prediction: What will happen when you mix salt, sugar, and sulfur in three separate beakers of water?

**Answer to prediction question:**

**Procedure**

1. Fill all three beakers/containers approximately ¾ full with water.
2. Use a scoop to add a small amount of salt, about the size of a pea, into beaker A. Stir.
3. Record your results in the table below.
4. Use a different scoop to add a small amount of sugar into beaker B. Stir. Record results.
5. Use the third scoop to add a small amount of sulfur into beaker C and stir. Record results
6. Thoroughly rinse all glassware, and put disposables in trash, before proceeding to the next station

|  |  |  |  |
| --- | --- | --- | --- |
| **3.**  | Beaker A (NaCl (Salt) & Water) | Beaker B (Sucrose and Water) | Beaker C (Sulfur and Water) |
| Reaction |  |  |  |

**4.** Go back in your notes to our discussion of polarity and solutions. This information should help you properly explain what is happening in these three beakers. Be sure to use the terms polar, nonpolar, solution, solvent, and solute.

**5**. Now, look back at your introduction to this lab, re-read it, make a connection. How is this station something you can apply to living things? (Make sure to discuss: salt, sugar, non-polar substances, and blood)

**Station 2: Cohesion/Polarity**

**Prediction:**

1. How will water behave when you drop it, drop by drop, on a piece of wax paper?

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2. How will oil behave when you drop it drop by drop on a piece of wax paper?

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At this station, you will be investigating the behavior of water, which is polar, on wax, which is nonpolar. Using a disposable pipette marked water, drop several drops of water across several places on the wax paper. Place a toothpick in the middle of one of the drops, move the drop of water around the wax paper bumping it into the other drops of water on the paper.

**3.** Using your notes and thinking back to our discussion in class, explain what property of water is being demonstrated here. What property of water allows it to build up on the wax paper and form a big bubble on the wax paper? Answers should name the property of water and give a complete explanation.

**Use the same procedure as above, except this time use oil (nonpolar), use a plastic disposable pipet labeled ‘oil’.**

**4.** What happened between the oil and the wax paper? Why do you think this occurred?

**5.** How can you apply what happened in this simulation to living things?

**Station 3: Capillary Action**

Prediction: What will happen when you place a hollow capillary tube (which mimics the tubing system in a living organism) in a petri dish filled with colored water?

**1. Answer to prediction:**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Procedure:** **1**- Stand a hollow capillary tube up and into a small container filled with (colored) water.

**2**. What happens to the solution when the tube is placed in it?

**3.** What property of water is being shown here?

**4.** How does life depend on this property of water? (think about blood in the body, and water moving from the ground ten feet up to the leaves in a tree). Discuss below (short paragraph)

**Station 4: pH**

Acids turn pH paper red and bases turn pH paper blue.

**Prediction**:

1.What color will be seen when vinegar is tested with pH paper?

2.Bleach (or Ammonia)?

3.Water?

**Procedure**:

1. Obtain a piece of pH paper and lay it on a clean paper towel.
2. Using a stirring rod, place 1 drop of vinegar on the pH paper. Record Results.
3. Rinse the stirring rod, obtain another paper towel and a new piece of pH paper. Repeat with bleach (or ammonia).
4. Repeat step 3, using distilled (deionized) water.
5. Throw all paper in trash

**Results**:

|  |  |  |
| --- | --- | --- |
| Substance | Color | Approximate pH |
|  |  |  |
|  |  |  |
|  |  |  |

**In terms of H+ concentration (molarity), explain the results**:

**Station 5: Density (possibly teacher demo)**

**Predictions:**

1. What will happen when ice is placed in a beaker filled with water?  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**2.** What will happen to ice when it is placed in a beaker of alcohol? **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Results**: Add a small amount of ice to a small beaker of water, and then add ice to a small beaker of alcohol.

**3.** What happened when ice was added to water? Why did this occur? (Hint: think density **and** hydrogen bonds)

**4.** What happened when ice was added to alcohol? Why did this occur? (Hint: think density)

**5**. How is what you witnessed (density) in this station very important for aquatic life in the winter when lakes freeze?

**6.** Apply the property of high specific heat to the lake scenario. (How is the water below the ice able to stay in liquid form)

**\*\*If we have time, we’ll also do the Penny Lab. Ask me!**

**EACH LAB GROUP MUST GET CHECKED OFF BEFORE LEAVING THE FINAL STATION OR THERE WILL BE A 10 POINT DEDUCTION**

**Additional Questions:**

1. Because water is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ it has the ability to form \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bonds.

2. Because water can form \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bonds it can stick to other water molecules giving it the property of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3. Because water can form bonds with other polar molecules, it has the property of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

4. Because water can form \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bonds, it has the ability to resist extreme changes in temperature, this is known as the property of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

1. Compare the specific heat of a heavy metal with the specific heat of water. Explain in terms of both heat and temperature.
2. Why does ice at 0 C keep things colder than liquid water at ~0 C?
3. Which would cause a more severe burn: steam at 100 C or hot water ~100 C? Explain why.
4. If the pH of a substance is 5, what is the pOH?

What is the H+ concentration and the OH- concentration of the above substance?

1. Pick one of the properties of water that you learned about and describe to me how life is dependent upon that property of water. Be clear and concise in your explanation.