Properties of Water Lab

Background Information:

Water is a polar molecule. The oxygen atom in water has a greater electronegativity, or a stronger “pull”, on the electrons that it shares with the two hydrogens it is covalently bonded to. As a result, molecule ends up have a partially negatively charged end, near the oxygen and a partially positively charged end near the hydrogen. Much like a magnet, opposite charges will attract and similar ones 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. Lame 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- also related to surface tension.
* It sticks to other polar or charged molecules -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-that is, is can absorb a great deal of heat energy while displaying only small increases in temperature.
* It has a neutral pH of 7, which means the concentrations of H+ and OH- ions are equal.

Pre-Lab Questions: Use the above background information and other available resources to answer the following questions.

1. Why is water considered to be polar?

2. Sketch a molecule of water (include the partial charges).

3. Which type of bonds form between the oxygen and hydrogen atoms of TWO DIFFERENT water molecules?

4. Which type of bonds form between the oxygen and hydrogen atoms of WITHIN a water molecule?

Hypothesis:

Question: How does soap affect hydrogen bonds between different water moelcules?

Materials: Penny, distilled water, soap, pipette, paper towels

Procedure:

1. Obtain a DRY penny and place it on a DRY paper towel.

2. Using a clean pipette, add distilled water to the penny drop by drop until it overflows. Be sure to count the drops! Record the number of drops for Trial 1 in Data Table 1 below.

3. Repeat steps 1-2 for a total of five trials.

4. Obtain a DRY penny and place it on a DRY paper towel.

5. spread a thin layer of soap on the penny.

6. Using a clean pipette, add distilled water to the penny drop by drop until it overflows. Be sure to count the drops! Record the number of drops for Trial 1 in a Data Table 1 below.

7. Repeat steps 4-6 for a total of five trials. Be sure to add a new layer of soap between trials.

Data Collection:

Data Table 1: Number of Drops of Distilled Water Contained on the Surface of a Penny.

|  |  |  |
| --- | --- | --- |
| Trial  | # Drops Distilled Water | # Drops Distilled Water & Soap |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| Average |  |  |

Data Analysis: Do the appropriate calculations in Data Table 2 below.

Data Table 2: Statistical Analysis of the # of Drops of Distilled Water Contained on the Surface of a Penny.

|  |  |  |
| --- | --- | --- |
| Calculation | #Drops Distilled Water | # Drops Distilled Water & Soap |
| Mean |  |  |
| Standard Deviation |  |  |
| +/- 1 std dev |  |  |
| +/- 2 std dev |  |  |
| Standard Error |  |  |
| +/- 2 SEM (95% CI)  |  |  |

Post Lab Questions:

1. Make a Claim about how soap affects hydrogen bonds between water molecules.

2. Using data from this experiment, provide Evidence that supports the claim.

3. Using Background knowledge and data from this lab, provide Reasoning that uses the evidence to justify the claim.