Properties of Water: What makes water Special?

An investigation of the liquid that makes all life possible

Name: ____________________

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 on water?
- How would life in a lake be affected if ice sank and lakes froze from the bottom up?
- Why do people become seriously ill, or die, if they go without water for a week or so?

Directions: You will be working with your group (assigned by your teacher) at 7 stations. The goal of this activity is to explore the properties of water. The properties of water we will be investigating through this activity are:

- Universal Solvent
- Polar molecule
- Cohesion
- Adhesion
- Surface Tension
- Capillary Action
- Water Density

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

Perform any necessary activity & clean-up... please seek help from group members when you need it. Discuss what you observed at your station. As a group run one test at a time with everyone in your group paying attention.

At each station, you must pay attention to the number of the station you are at, 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).

You must clean-up when you are finished at each station – it is imperative that you clean up each station so that the next set of students will be ready to go!

Your teacher will dismiss everyone at the same time from one station to begin the next one.
**Station 1: Solubility - Water the Super Solvent - The Universal Solvent**

**Read with your group:** Solubility is the ability of one substance to dissolve another substance. The chemical being dissolved is the solute and the chemical doing the dissolving is the solvent. Water is a good solvent, meaning a lot of substances are able to dissolve in water. As a matter of fact, **water is called the UNIVERSAL SOLVENT!** In the space provided below, with your group discuss and come up with the definition of Universal Solvent.

______________________________________________________________________________

______________________________________________________________________________

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**Station 1:** Please check to make sure you have all the following materials at this station:

- ✔ salt
- ✔ 2 stir rods
- ✔ 1 beaker with salt & oil
- ✔ 1 beaker with ____ mL of water

**Steps:**

1. Put a pinch of salt in the water that is already in the beaker.
2. Stir vigorously for 1 minute. What do you notice? __________________________________________
3. The beaker with oil already has salt in it. Stir vigorously for 1 minute. What do you notice? ______________________________________________________________________________________

**Answer the following questions. Remember to discuss your answers with your group before writing it down.**

1. Which is a better solvent for a substance like salt - Water or Oil? __________________________________________
   Why might that be?
   ______________________________________________________________________________________
   ______________________________________________________________________________________

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**Clean-up** – Leave the oil and salt beaker as you found it. Pour the beaker of salty water into the sink. Rinse it and dry the beaker. Clean your station, 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...

***As ALWAYS Clean-up - Return your station to the condition in which you found it! ...or cleaner!***

Wait to begin Station 2.

Teacher Initials: ______________
Station 2: Surface Tension - Cohesion and Adhesion

Read with your group: 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: Cohesion and Adhesion. Discuss with your group and write down the following:

Cohesion is: ______________________________________________________________________________

Adhesion is: ______________________________________________________________________________

Station 2: Please check to see if you have the following materials:

- Petri dish
- Pepper
- A pitcher with water
- Soap
- Toothpick/Q tip

Steps:

1. Pour a small amount of water on a petri dish; sprinkle the surface with some pepper.

2. Write down what you observe ____________________________________________________________
   ___________________________________________________________________________________

3. Take a Q-tip dipped in soap and gently touch the center of the surface of the peppery water.

4. Record what happened to the pepper? _____________________________________________________
   ___________________________________________________________________________________

5. Why do you think this happened? _______________________________________________________
   ___________________________________________________________________________________

To be filled during classroom discussion: ___________________________________________________
   ___________________________________________________________________________________
   ___________________________________________________________________________________
   ___________________________________________________________________________________

***As ALWAYS Clean-up - Return your station to the condition in which you found it! ...or cleaner!
Wait to begin Station 3.

Teacher Initials: ______________
Station 3: Surface Tension and Adhesion  Drop Behavior- Water on penny

Part A:

✓ a 10 mL graduated cylinder
✓ Beaker with water
✓ One dropper

1. Obtain a dropper and a small (10 ml) graduated cylinder. Make sure the dropper is clean.
2. Drop water into the graduated cylinder with the dropper. Count 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. Can you calculate how much water is in each drop? (Divide 1cc by the number of drops) __________ cc. per drop.

Part B:

5. With your group discuss how many drops of water can pile on a penny before it overflows? Make a prediction and write down your prediction. Prediction= ______________ drops.

6. Now, drop water from the dropper onto a penny, keeping careful count of each drop. Draw a diagram 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.

   **Diagram 1. Drops of water on a Penny**

   Figure 1          Figure 2          Figure 3

   After 1 drop       About half full   Before it overflowed

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

8. Is the number of drops different from your prediction? Why? Explain which property/properties of water is responsible for this.

   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________

Teacher Initials: _____________
Station 3 Surface Tension & Adhesion Drop Behavior - Water on Penny

Part C: Effects of soap

1. With your finger, spread one small drop of soap/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? _______________________________________________________________________

3. Make a prediction of how many drops do you think it will hold? ___________ drops.

4. Use the same dropper as before, and 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.

**Diagram 2. Drops of water on a Penny with Detergent**

<table>
<thead>
<tr>
<th>Figure 1</th>
<th>Figure 2</th>
<th>Figure 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>After 1 drop</td>
<td>About half full</td>
<td>Before it overflowed</td>
</tr>
</tbody>
</table>

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? Why? Describe the effect of the detergent.
___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

7. In the experiment conducted at this station

7 a) What was the independent variable? ____________________________________________

7 b) What was the dependent variable? ____________________________________________

****As ALWAYS Clean-up - Return your station to the condition in which you found it! ...or cleaner!

Wait to begin Station 4.

Teacher Initials: ____________
Station 4: Surface Tension - Floating paper clip

With your group discuss and define Surface Tension: ________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________

Materials:

✓ Paper clip     ✓ Water in a beaker     ✓ Petri dish

Using a steady hand and 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. With your group discuss what property (ies) of water allowed the paperclip to rest on the surface of the water? Explain in the space provided below.

________________________________________________________________________________________
________________________________________________________________________________________

*****As ALWAYS Clean-up - Return your station to the condition in which you found it! ...
or cleaner! Wait to begin Station 5.

Teacher Initials __________________________

Station 5: Capillary Action – Can water climb up? –

Materials:

A beaker,   pitcher with water,   paper towel,

With the people at your table: Discuss and write down the definition of Capillary Action. You may use your foldable.

________________________________________________________________________________________
________________________________________________________________________________________

Write down scenarios where you have seen water climb up __________________________________________
________________________________________________________________________________________

1. Fill the beaker with ________ mL of water.
2. Add a few drops of food color in the water and stir it.
3. Roll the paper towel and dip it in the colored water in such a way that some of it sticks out. Write down your observations below.
**Station 5: Capillary Action – Can water climb up? – Continued..**

1. What did you notice happened to the water and the paper towel?  
   ___________________________________________________________________________
   ___________________________________________________________________________
   ___________________________________________________________________________

2. With your group discuss what properties of water might be responsible for what you observed.  
   Explain in the space provided.  ___________________________________________________________________________
   ___________________________________________________________________________
   ___________________________________________________________________________
   ___________________________________________________________________________

****As ALWAYS clean up - Return your station to the condition in which you found it! ...or cleaner!

**Station 6: Demonstration**

Observe the teacher demonstration and answer the following questions:

Draw what you observed in the box to the right.

What can be the reason for water to behave the way it did?
   ___________________________________________________________________________
   ___________________________________________________________________________
   ___________________________________________________________________________

Which property of water is evident in this demonstration? ______________________________

When you are done at this station, head back to your seat and work on the next part of the worksheet independently.
Making Connections

Pick at least 3 different properties of water from the list below and describe at least one observation you have made outside the class that illustrates that property of water.

1. Universal Solvent
2. Cohesion
3. Adhesion
4. Capillary Action
5. Surface Tension
6. Polar Molecule

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