**Water: It’s Amazing!!**

**Crash Course:** [**Liquid Awesome**](https://youtu.be/HVT3Y3_gHGg)

1. After watching the “Liquid Awesome” video, please sketch a water molecule in the space below. Identify the atoms that make up the molecule, the positions of those atoms, and anything else about the molecule that is especially important to scientists, ESPECIALLY information about electric charges.

2. A ***chemical bond*** is the fancy term that scientists use to describe the electrical force that pulls two atoms together to form a molecule. Chemical bonds exist because “opposites attract”—negative electric charges and positive electric charges pull on each other because… that’s how the Universe was created. Electrons have a negative electric charge. Protons have a positive electric charge.

Different molecules can stick to each other because of these electric forces—a substance that is solid (like your pencil, or the chair you are sitting on) is “solid” because the atoms and molecules that it is made out of stick to each other with a lot of force. Frozen water, which is called ice or snow, is solid because the molecules that it is made out of stick to each other with a stronger force than the pull that holds liquid water drops together. Molecules in water vapor don’t stick to each other at all.

3. Get two plastic drinking cups. In one, put cold tap water. In the other, put hot tap water. Place them side by side on your desk.

Carefully place one drop of food coloring in each cup, making sure not to “splash” the drop… just carefully place the drop of food coloring in the cup.

Compare how long it takes for the food coloring to spread out and fill up each of the cups. Which cup, hot or cold, does the food coloring move through more quickly?

What is a possible explanation for this observation?

4. Can you make a paper clip float on top of a cup of water? Empty out your food coloring, place new cold water in the cup, and then see if you can get a paper clip to float on the surface of the water.

If liquid water is able to keep a paper clip from sinking, what does this tell you about the force that holds two water molecules together?

**Cohesion** is the scientific term that is used to describe the force that makes two water molecules stick to each other. Let’s examine another demonstration of cohesion…

5. Take a guess… if you took an eye dropper and used it to place water drops on a penny (one at a time), how many drops of water would fit on the penny before water ran off the penny and onto the table?

My guess: a penny will hold \_\_\_\_\_\_\_\_ drops of water before spilling.

In order to answer this question, let’s perform a little experiment. Grab an eyedropper and a penny, and fill a cup with water to share with your table group. Using the eyedropper, carefully place drops on the surface of the penny, one at a time, until the water runs off of the penny down onto the table. Count the number of drops that you place on the penny. And place the total number in the space below:

My experiment: a penny held \_\_\_\_\_\_\_\_ drops of water before spilling.

How close was your guess? Was your guess too high, too low, or magically accurate?

If the box in the space above is a penny (as seen from the side), draw what the water looked like on the penny just before it all spilled off.

Put on your science thinking cap: why does water do that??? Why does it stick together and make a tallish mound instead of just running off of the penny??

6. **Adhesion** is the scientific term that is used to describe the force that makes a water molecule stick to a substance that is NOT water. Let’s examine a demonstration of adhesion…

Put some cold tap water in a plastic cup, and then add a single drop of food coloring to the water. Once the food coloring has spread out through the water, take a piece of paper towel and hold it just above, but NOT TOUCHING, the surface of the water.

If the towel does not touch the water, does it get wet? Does water leap up and onto the paper towel?

Now, place a teeny, tiny corner of the towel into the water, and hold it in place. Does water move into the towel (does the towel get wet)? Is water moving up into the towel ABOVE the surface of the water in the cup?

Is this magic???? HOW is the water moving upwards into the towel? What is pushing/pulling it???

That, my friends, is **adhesion**. The atoms and molecules in the paper towel are pulling on the water molecules in the cup, lifting them out of the cup and into the paper. Crazy, isn’t it?

Draw a picture that shows the water moving upwards out of the cup and into the paper towel:

Wanna see another example of adhesion, one that you are super familiar with? Put your fingertip into the cup of water, and then lift your finger out of the cup. Is there a water drop hanging from the end of your finger? If so, then you are seeing **adhesion**: the water is sticking to your skin, even though it wants to stay in the cup with all of its other water molecule buddies.

7. **Specific Heat Capacity** (water has a *very high* **Specific Heat Capacity**)

Imagine what would happen to a balloon filled with air if you put a flame to it. Better yet, let’s not imagine it… let’s see for ourselves…

Watch (and hear!) what happens to the balloon when it gets close to the flame. What do you think is happening to the balloon as it gets close to the flame?

Now, let’s repeat the demonstration, but we’ll put a little water in the balloon before we blow it up with air. Do you think that the balloon will pop? Let’s find out…

What happened to the balloon that had water in it when it touched the flame? ***WHY*** did this happen?

Even though we take it for granted, water is actually pretty amazing. One of the things that is unusual about water is that it is really, *really* good at absorbing heat energy without changing its temperature. Why do lakes and oceans stay cool when it gets really hot in the summer? Because even though the warm air is putting lots and lots of heat into the water, the temperature of the water changes very, very little. Scientists say that water has a “High Specific Heat Capacity”, which basically means that its difficult to change the temperature of water. Why doesn’t Casco Bay freeze solid when the air temperature drops to -10? Because the temperature of the water isn’t -10… it’s probably still around 32 degrees. Again, it’s really difficult to change the temperature of water.

8. Grab a cup of cold tap water and add a little salt to it. Stir the mixture around. What happens to the salt?

Watching salt dissolve into water is probably something that you’ve seen before, so it doesn’t seem very impressive. But it’s actually pretty cool! Where did the salt go??? Why did the salt disappear from view?

Great questions. What makes water so effective at dissolving other substances (or, what is it about water molecules that make them so good at breaking substances apart?) The secret is that water molecules are **polar**. A **polar molecule** is one that has a small positive electric charge on one end, and a small negative electric charge on the other end.

Electric charge are pretty good at pushing and pulling things. When salt is added to water, the electric charges in the water start to push and pull on the salt.

Salt is made of Sodium atoms (Na) and Chlorine atoms (Cl). Sodium often has a positive electric charge; chlorine often has a negative electric charge. When salt touches water, the water pulls and pushes the Na and Cl atoms apart, and then moves them around so that they “spread out” through the water.

In the space below, draw 4 water molecules. Next to the hydrogen atoms on one of the water molecules, draw a small circle. In the circle, put Cl-. Now, move to a different water molecule. Next to the Oxygen atom, draw a small circle and write Na+ inside the circle.