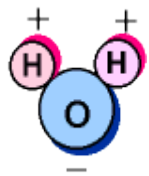


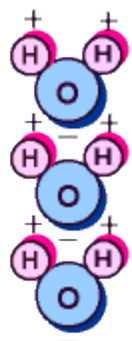
Properties of Water Activities – Background Information

Introduction:



Water's chemical description is H_2O . The oxygen atom has a higher electronegativity than hydrogen, resulting in a water molecule having a positive charge on the side where the hydrogen atoms are and a negative charge on the other side, where the oxygen atom is. This uneven distribution of charge is called **polarity**. Since opposite electrical charges attract, water molecules tend to attract each other, via **hydrogen bonds**, making water kind of "sticky."

This property of water is known as **cohesion**. Polarity also causes water to hydrogen bond, or attract, to other substances, like when water climbs up a piece of paper towel. This is known as **adhesion**.



Since water molecules attract each other they tend to clump together. This is why water drops are, in fact, drops! If it wasn't for some of Earth's forces, such as gravity, a drop of water would be ball shaped -- a perfect sphere. Even if it doesn't form a perfect sphere on Earth, we should be happy water is sticky.

Water is called the "universal solvent" because it dissolves more substances than any other liquid. Water will dissolve other polar molecules. This means that wherever water goes, either through the ground or through our bodies, it takes along valuable chemicals, minerals, and nutrients.



Water, the liquid commonly used for cleaning, has a property called **surface tension**. In the body of the water, each molecule is surrounded and attracted by other water molecules. However, at the surface, those molecules are not completely surrounded by other water molecules. A tension is created as the water molecules at the surface are pulled into the body of the water. This tension causes water to bead up on surfaces (glass, fabric), which slows wetting of the surface and inhibits the cleaning process. You can see surface tension at work by placing a drop of water onto a counter top.



The drop will hold its shape and will not spread. In the cleaning process, surface tension must be reduced so water can spread and wet surfaces.

Polarity also allows water to absorb **thermal energy**. Hydrogen bonding causes water to absorb large amounts of thermal energy as its temperature increases, or lose large amounts of thermal energy as its temperature decreases. This is seen in temperature moderation in animals. Hydrogen bonds also causes liquid water to absorb large amounts of thermal energy in order to become a vapour (gas). In order to evaporate the bonds between water molecules must be broken which requires energy. This is seen in evaporation as a cooling mechanism.

Questions to Think About:

1. Explain why water is referred to as the universal solvent.
2. What is the overall charge on a molecule of water?
3. Water is a polar molecule (appears to have a charge). Explain why this is so.
4. How does the structure of water account for its properties such as its boiling point, adhesion and cohesion?

Procedure: Part A

1. Rip a paper towel in half and crunch it into a long piece.
2. Place one end of the paper towel into a beaker filled with water and the other into the empty beaker.
3. Watch what happens (this experiment takes a little bit of patience). Count the drops of water in the beaker that started empty every 2 minutes for 8 minutes.

Procedure: Part B

1. **How many paper clips will float on top of a completely full cup of water?**
2. Fill a cup with tap water.
3. Add water by eyedropper until the top surface of water in the cup appears rounded.
4. Slowly add paper clips one at a time to the cup
5. Stop adding paper clips to the container when one sinks
6. Record your paper clip count.
7. Repeat with soapy water

Procedure: Part C

1. **How many beads will fit into a completely full cup of water before it overflows?**
2. Fill a cup with water.
3. Add water by eyedropper until the top surface of water in the cup appears rounded.
4. Slowly add beads one at a time to the cup.
5. Stop adding bead to the container when water spills from the top.
6. Record your bead count.
7. Repeat using soapy water

Procedure: Part D

1. Put a few grains of sugar in each container (oil & water).
2. Stir for 30 seconds. Record your observations (dissolve/not...).
3. Put 2-3 iodine crystals in each beaker.
4. Stir for 30 seconds. Record your observations.
5. Put some of the "mystery powder" in each beaker.
6. Stir for 30 seconds. Record your observations.

Properties of Water Activities Worksheet**Table 1: Part A**

Time	Number of Drops of Water in the Second Beaker
2 minutes	
4 minutes	
6 minutes	
8 minutes	

1. Using words from this course & your data, describe what is happening.

2. Describe how adhesive and cohesive forces are involved with capillary action in plants.

Table 2: Parts B & C

Solution	Tap Water	Soapy Water
Floating paper clips		
Beads before overflowing		

3. What property of water was shown in Part B & C?

4. Give an example of how/where is this property of water used in nature?

5. Why is the property problematic to cleaning companies? Using your data, explain what affect soap has on water. Be specific (ie. mention the specific characteristics)

Table 3: Part D

Solute	Water	Oil	Polar or Non-Polar
Sugar			
Iodine			
Mystery Substance			

6. What can you conclude about the mystery substance? Be specific!