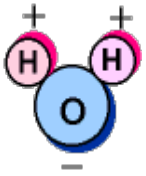
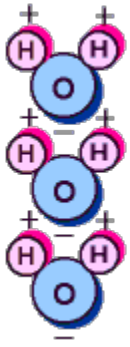
Properties of Water

Introduction:



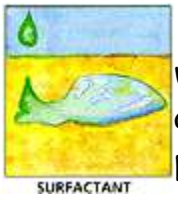
Water's chemical description is H_2O. As the diagram to the left shows, that is one atom of oxygen bound to two atoms of hydrogen. The hydrogen atoms are "attached" to one side of the oxygen atom, resulting in a water molecule having a positive charge on the side where the hydrogen atoms are and a negative 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, making water kind of "sticky." As the right-side diagram shows, the side with the hydrogen atoms (positive charge) attracts the oxygen side (negative charge) of a different water molecule. (If the water molecule here looks familiar, remember that everyone's favorite mouse is mostly water, too). This property of water is known as **cohesion.**



All these water molecules attracting each other mean 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. This means that wherever water goes, either through the ground or through our bodies, it takes along valuable chemicals, minerals, and nutrients.


SURFACE TENSION

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 surrounded by other water molecules only on the water side. 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.


SURFACTANT

In the cleaning process, surface tension must be reduced so water can spread and wet surfaces. Chemicals that are able to do this effectively are called surface active agents, or surfactants. They are said to make water "wetter." Surfactants perform other important functions in cleaning, such as loosening, emulsifying (dispersing in water) and holding soil in suspension

until it can be rinsed away. Surfactants can also provide alkalinity, which is useful in removing acidic soils.

Materials:

Box of small paper clips, small plastic container, eyedropper, cup, stirring rod, water, liquid soap, plastic tray

Procedure (Part A) Cohesiveness of Water:

1. Estimate how many paper clips will fit into a completely full cup of water. Record this number in data table 1.
2. Place your small container on a tray to contain any water that may spill.
3. Fill a plastic cup with tap water.
4. Pour tap water from your cup into your small container.
5. Continue to add water by eyedropper until the top surface appears rounded.
6. Slowly add paper clips one at a time to the cup keeping count of all paper clips that you add.
7. Stop adding paper clips to the container whenever water spills from the top.
8. Record your paper clip count. Compare the actual number of paper clips to the estimated number.

Procedure (Part B) Soap's effect on Surface Tension:

1. Again estimate how many paper clips will fit into a completely full cup of soapy water. Record this number in data table 2.
2. Place your small container on a tray to contain any water that may spill.
3. Fill a plastic cup with tap water.
4. Add several drops of liquid soap & use a stirring rod to mix.
5. Pour soapy water from your cup into your small container.
6. Continue to add soapy water by eyedropper until the top surface appears rounded.
7. Slowly add paper clips one at a time to the cup keeping count of all paper clips that you add.
8. Stop adding paper clips to the container whenever water spills from the top.
9. Record your paper clip count. Compare the actual number of paper clips to the estimated number.

Name: _____ Properties of Water Lab

Pre-Lab Questions:

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. Which end of a water molecule "acts negative"? Which "acts positive"?

5. Is water the only molecule that is polar?

6. Explain what occurs whenever several water molecules are near each other in a droplet. Include a sketch of this.

7. The property of water molecules being attracted to other water molecules is called _____.

8. Explain what causes water to have surface tension.

9. Surface tension causes water to _____ on surfaces such as glass.

10. In order to clean a surface, what must happen to surface tension? What type of chemicals can do this? Give an example

11. Besides reducing surface tension, what 4 other things can surfactants perform?

Name: _____ Properties of Water Lab

Data:

Table 1

Cohesiveness of Tap water		
Estimated Number of Paper Clips	Actual Number of paper Clips	Difference

Table 2

Cohesiveness of Soapy water		
Estimated Number of Paper Clips	Actual Number of paper Clips	Difference

Questions:

1. How did your estimated number compare to your actual number?

2. What happened to the surface of the water as more clips were added?

3. What property of water was shown in Part A?

4. How is this property of water used in nature?

5. Explain why water shows surface tension.

6. Explain why water is a polar molecule and include a diagram of several water molecules in a drop of water.

7. In order to clean a surface, what must happen to surface tension?

8. What is the job of a surfactant?

9.Name a surfactant used in Part B?

10. Using your data from Part B, explain what proof you gathered in Part B to support your answer to question 9.