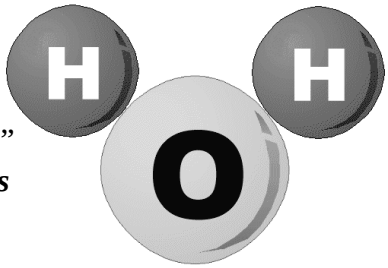
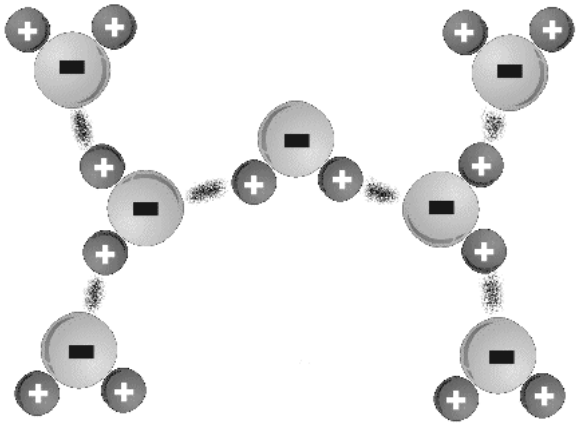
Activity #3:
Tension On The Surface

Background

If you took an average drop of water and a very sharp knife, and "cut" the drop in two, cut it again, and again, and again... by the 80th cut, you would be left with one ***molecule*** of water. One *molecule* of water is the smallest amount that you can have, and still be able to call it "water." If you divided up a molecule of water, you would be left with two ***atoms*** of hydrogen, and one atom of oxygen. (There are ninety-one different types of *atoms* that are found in nature... each different type of atom is called an ***element***.)



One water molecule.
H *— Hydrogen atom*
O *— Oxygen atom*



*Water molecules want to stick to each other. The oxygen atom has a small **negative** electrical charge, but the hydrogen atoms have a small **positive** charge. Different charges attract, and so the molecules want to stick together.*

The atoms inside a molecule always want to stay together. Water is different from most other liquids in that the *molecules* want to stick together, too. This is an *extremely* important fact, since most liquids with molecules as small and light as water (with only three atoms) would fly off and become a gas at room temperature.

This makes some rather strange things happen. Water always wants to stick to itself — this behaviour is called ***cohesion***. Water vapour (water as a gas) in the air is invisible, but since it wants to stick to other water, it forms tiny droplets that we see as ***steam***. Steam is actually *liquid* water in the air, and not a gas.

This "stickiness" can be seen easily. If you look at a window that has recently been rained upon, you'll notice that some of the remaining water doesn't just run right down the window and onto the ledge. It will pull itself into round drops and stick to the glass for a while. This "pulling force" is called ***surface tension***, and it's the reason that raindrops form in the first place... or clouds, for that matter. (Clouds are tiny droplets of water high up in the air — a lot like steam, but at a much lower temperature.)

Activity: *Playing With Surface Tension*

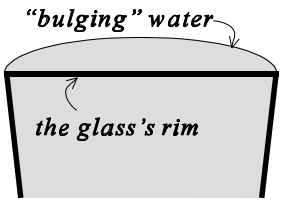
The surface of any amount of water, be it a a drop, a glass or a lake, wants to stick together through *surface tension*. Surface tension causes the formation of an invisible "skin" on the water, which you can easily see at work.

You need:

- two drinking glasses
- a sewing needle
- a spoon
- a piece of toilet paper (the non-scented kind)
- liquid dishwashing soap

Part One — My Cup Runneth Over?

Fill both the glasses nearly full of water (to within a few millimetres of the rim). With the spoon, scoop water from one glass to fill the other slowly to the top... and then over the top. *How far above the rim of the glass can you get the water to "sit"?*



The force at work here is *surface tension*. The water would rather pull itself together and "bubble up" over the top of the glass rather than separate and run down the side. There's a limit to how high you can get the water up over the glass, though. That's the point where where gravity finally wins against surface tension, and the bubble falls apart.

Part Two — The Floating Needle

Take a piece of toilet paper that is slightly larger than a sewing needle and lay it on the surface of a glass of water. (You might want to use the almost-full glass from Part One.) Once the toilet paper is soaked and laying flat on the surface, carefully lay the needle on the toilet paper. Now, using either the handle of a spoon or your finger (if you're careful), poke down at the each corner of the toilet paper so it sinks to the bottom. *What happened to the needle? What's keeping it from sinking?*

The molecules of water are pulling on each other, creating surface tension. This force is strong enough so that even a piece of metal (the needle) can be supported on it. Now put a tiny drop of dishwashing soap into the water... *what happened to the needle, and why?*

Extension: *Smart Insects*

If you go to a local lake or pond, you might be able to catch a glimpse of an insect called a *water strider*. These insects use surface tension to walk on the water's surface — they float for the same reason the needle floated. Take a field trip to a pond, a lake, a river, or even a drainage ditch near you, and try to find a water strider, or any other type of water-walking, surface-tension-using bug!