Name: _____

Period: _____

Water—the (*Nearly*) Universal Solvent

Why does water dissolve so many solutes?

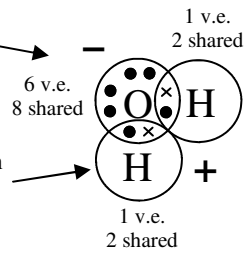
Because water is a <u>polar</u> molecule.

Polar molecules have positive and negative sides. (Like magnets have north and south poles.)

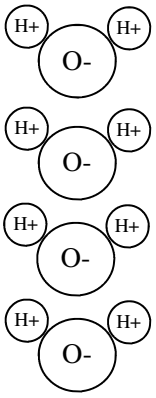
The Covalent Water Molecule.

Negative side (Oxygen with 2 extra electrons from the Hydrogens).

Positive side (Hydrogen without its one electron leaves a proton).



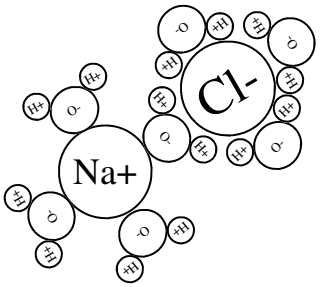
The Oxygen atom has more protons than the Hydrogens and, close to a full shell, is more attractive to the electrons, so the electrons from the Hydrogens spend more time around the Oxygen.



A water "chain" is held together by molecular **<u>cohesion</u>**. This attraction between the negative oxygens and the positive hydrogens is called a **hydrogen bond**.

These internal electromagnetic forces (opposites attracting) are responsible for <u>water tension</u> (why bugs can walk on water) and <u>capillary action</u> (how plants can "suck up" water from their roots).

Salt (NaCl) dissolved in water.



The negative Chlorines are attracted to the Hydrogens; the positive Sodiums are attracted to the negative Oxygens.

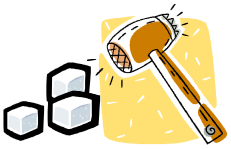
Ionic compound are made up of **positive and negative ions**. When placed in water, the **polarity** of water pulls the ions apart (called **dissociation**) and the compounds **dissolves**.

Polar molecules will dissolve in water. Nonpolar molecules will not (like oil).

Water is called the "nearly" universal solvent because it dissolves so many things. Water will dissolve ionic and polar compounds, but NOT non-polar ones, like wax or oil.

Changing Dissolving Rate

Crushing (make particles smaller) —Smaller particles really mean more surface area for the solvent to touch the solute (more sides available). Powders dissolve faster than cubes.



Stirring —speeds up how fast the solvent touches the solute and moves solute into unsaturated regions of the solvent.

Increasing Temperature — speeds up how fast the solute dissolves because increased temperature means faster moving molecules AND more room for more solute (*see below*).

Increasing Amount Dissolved

Increasing Pressure (gases only)

Increasing pressure forces more gas into solution (holding it in). This is why colas fizz when opened. The CO_2 is forced in under pressure: release the pressure (open it) and the gas escapes. Since solids are not compressible, pressure has no effect on solid solutes.

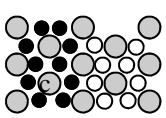
Temperature

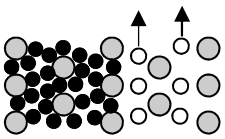
When liquids heat up they expand (a bit). The extra space between molecules affects solids differently than gases, since solids tend to sink and gases tend to rise (and are compressible).

Cold liquid: *closer molecules, so more gas can be trapped inside.*

Warm liquid: *more room between molecules, so gases can escape.*

- Solid
- Gas
- Liquid (solvent)





Cold liquid: *less solids can fit between the closer molecules.*

Warm liquid: *more solids can fit between the spread out molecules.*