The Extraordinary Properties of Water
Water

• A water molecule (H₂O), is made up of three atoms --- one oxygen and two hydrogen.
Water is Polar

- In each water molecule, the oxygen atom attracts more than its "fair share" of electrons
- The oxygen end “acts” negative
- The hydrogen end “acts” positive
- Causes the water to be POLAR
- However, Water is neutral (equal number of e- and p+) --- Zero Net Charge
Because water is POLAR….

- A crystal of salt is dropped into a glass of water.
Interaction Between Water Molecules

Negative Oxygen end of one water molecule is attracted to the Positive Hydrogen end of another water molecule to form a HYDROGEN BOND.

- One hydrogen bond is weak, but many hydrogen bonds are strong.
What are the Properties of Water?
Properties of Water

• At sea level, pure water boils at 100 °C and freezes at 0 °C.

• The boiling temperature of water decreases at higher elevations (lower atmospheric pressure).

• For this reason, an egg will take longer to boil at higher altitudes.
Cohesion

- Attraction between particles of the same substance (why water is attracted to itself)

- Results in Surface tension (a measure of the strength of water’s surface)

- Produces a surface film on water that allows insects to walk on the surface of water

When water molecules stick to water molecules.
Cohesion causes surface tension

the tension of the surface film of a liquid caused by the attraction of the particles in the surface layer
Adhesion

• Attraction between two different substances.
• Water will make hydrogen bonds with other surfaces such as glass, soil, plant tissues, and cotton.
• Capillary action—water molecules will “tow” each other along when in a thin glass tube.
• Example: transpiration process which plants and trees remove water from the soil, and paper towels soak up water.
Adhesion Causes Capillary Action

Which gives water the ability to “climb” structures
High Specific Heat

- Amount of heat needed to raise or lower 1g of a substance 1° C.
- Water resists temperature change, both for heating and cooling.
- Water can absorb or release large amounts of heat energy with little change in actual temperature.

Water takes a long time to change temperature (ex. Heat up)

After LOTS of thermal energy is added
Water is Less Dense as a Solid

• **Ice is less dense** as a solid than as a liquid (ice floats)

• Liquid water has hydrogen bonds that are constantly being broken and reformed.
Water is Less Dense as a Solid

Which is ice and which is water?
Water is Less Dense as a Solid

Water

Ice
Temperature

Hot water

Cold water
Water is a Universal Solvent

- Water is capable of dissolving a variety of different substances.
- It is called the "universal solvent" because it dissolves more substances than any other liquid.
- This property is important to every living thing on earth.