Properties of Water

Mrs. DeLine 2017

Bio- Chem

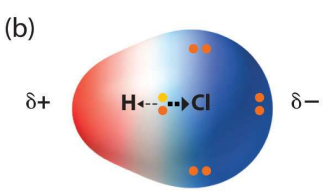
Properties of Water

Covalent bonds hook oxygen and hydrogen together

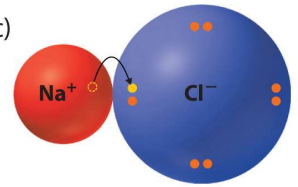
Polar covalent bond – unequal sharing of electrons this happens in water!

What is a partial **positive** and partial **negative** charge?

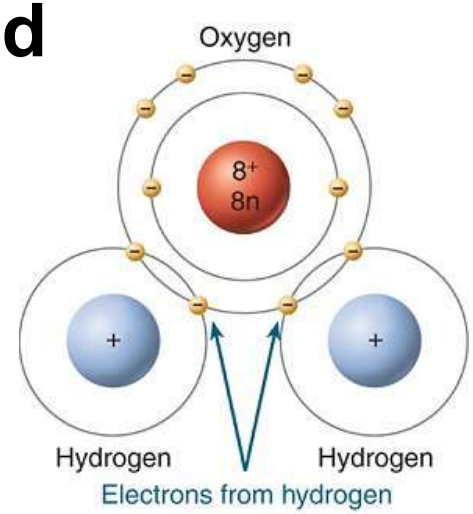
Nonpolar covalent bond
Bonding electrons shared equally between two atoms.
No charges on atoms.



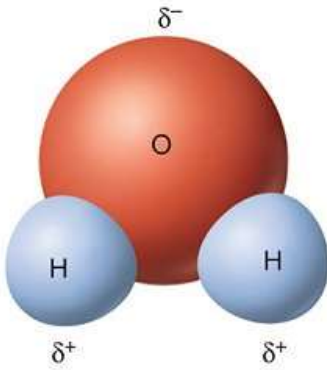
Polar covalent bond
Bonding electrons shared unequally between two atoms.
Partial charges on atoms.



Ionic bond
Complete transfer of one or more valence electrons.
Full charges on resulting ions.



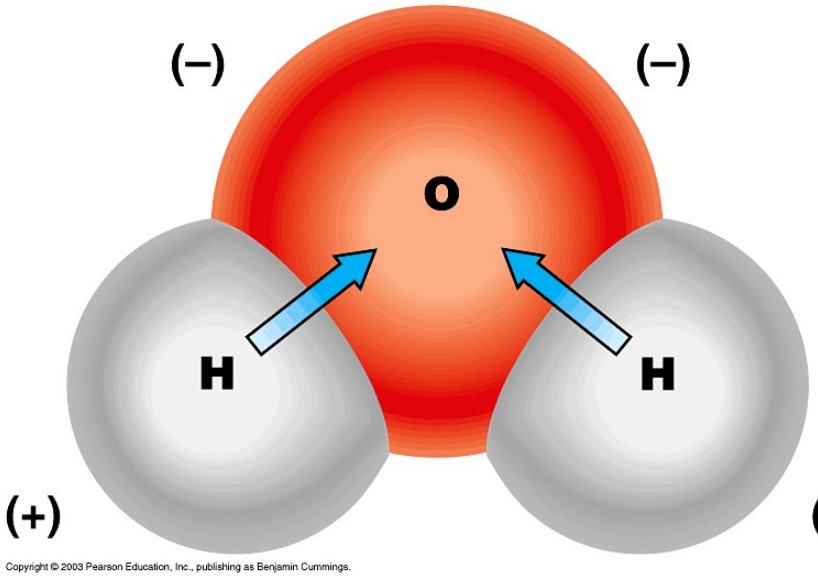
(a) Electron shells in a water molecule



(b) Distribution of partial charges in a water molecule

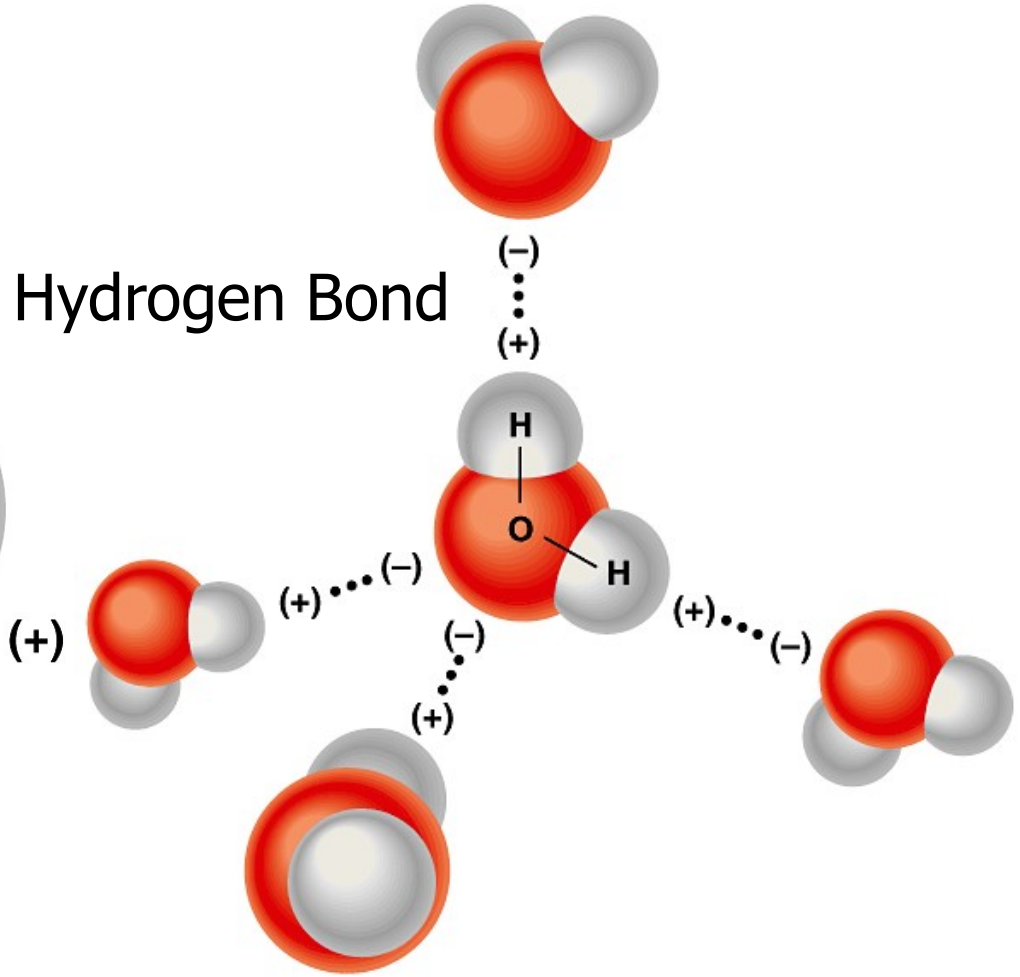
Properties of Water

Hydrogen bonding



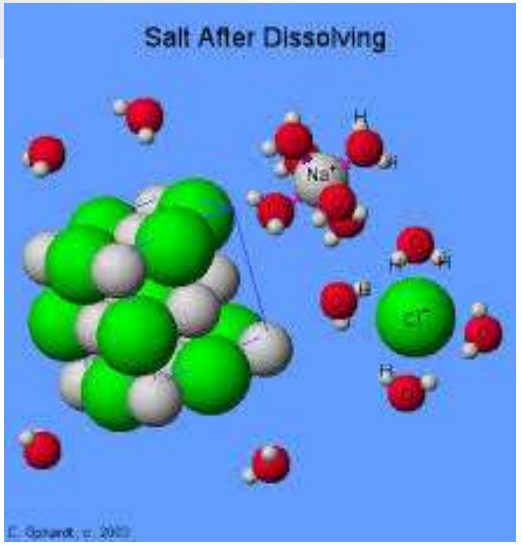
Covalent Bond

Hydrogen Bond



Properties of Water

Universal Solvent



Water is the "Universal solvent"

Like dissolves Like, Polar dissolves Polar

Water dissolves most everything

<u>Solute</u> – substance dissolved in a solvent to form a solution

<u>Solvent</u> – fluid that dissolves solutes

Example: Ice Tea – water is the solvent and tea and sugar the solutes

Properties of Water

Cohesion & Surface Tension

Cohesion **= force of water attracted to other water molecules because of polar properties**

Surface tension **= when cohesive force is strong large area for water to stick to itself.**

Example: floating a paper clip, water bug above

Adhesion & Capillary Action

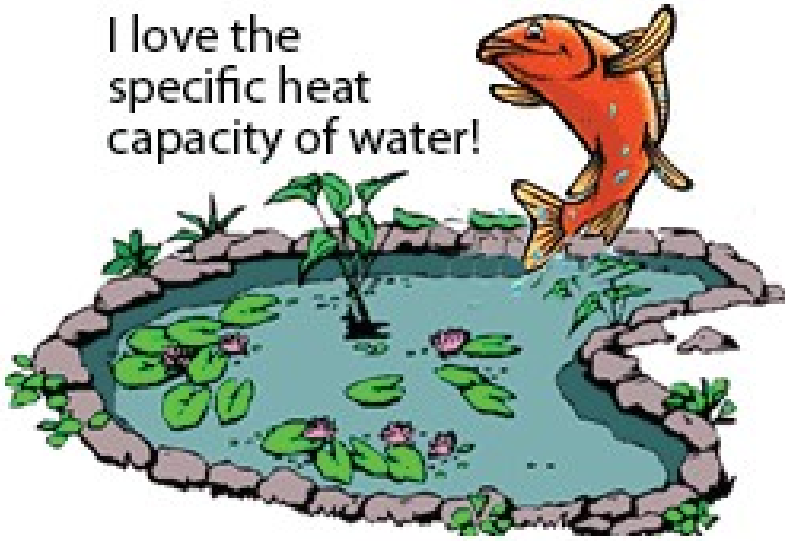
Adhesion **= water attracted to other materials more than to itself**

Capillary Action- when adhesive force is greater than cohesive force.

Example: causes a meniscus, the smaller the diameter of a tube the higher the water rises or stronger the adhesive force.

Properties of Water

High Heat Capacity



In order to raise the temperature of water, the average molecular speed has to increase.

It takes much more energy to raise the temperature of water compared to other solvents because hydrogen bonds hold the water molecules together!

Water has a *high heat capacity.*

"The specific heat/ energy is the amount of heat per unit mass required to raise the temperature by one degree Celsius."

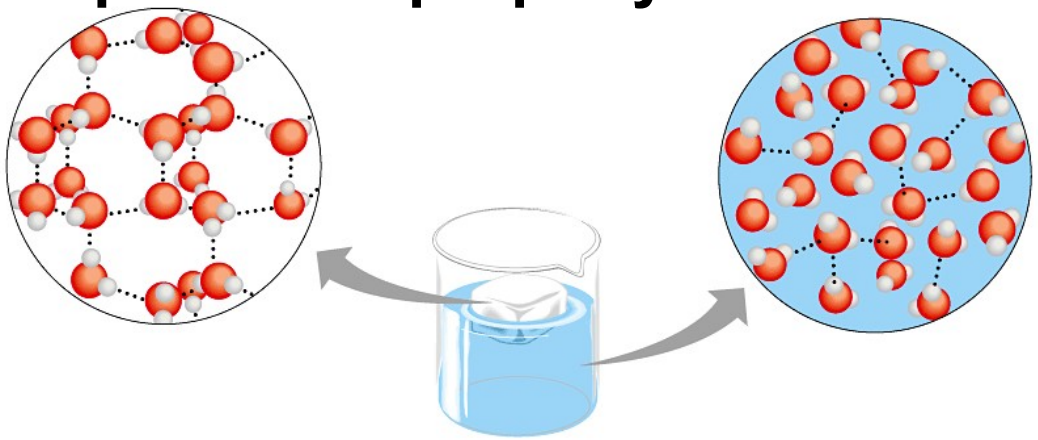
Example: land heats up and cools down faster than water.
The oceans and large bodies of water help to minimize huge tempature changes on Earth.

Properties of Water

Density

Water is less dense as a solid! This is because the hydrogen bonds are stable in ice – each molecule of water is bound to four of its neighbors.

No other liquid becomes less dense as a solid- water is unique in this property



Solid – water molecules are bonded together – space between fixed

Liquid – water molecules are constantly bonding and rebonding – space is always changing

It helps every living thing that lives in water survive through the winter.

Properties of Water

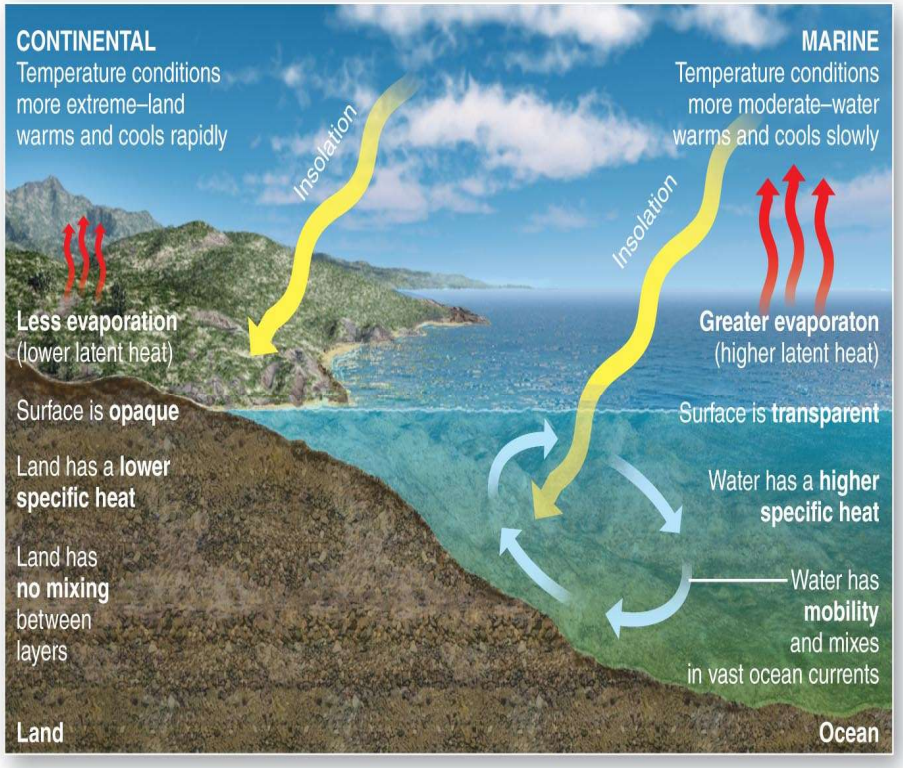
High Heat of Vaporization

Heat of vaporization: is the amount of heat required for 1 gram of a substance to be converted from a liquid to a gas.

Hydrogen bonds because they can absorb so much energy make it hard for water to escape the liquid state.

Helps our bodies and our planet maintain temperature- when we get hot we sweat which is called evaporative cooling.

Same thing happens on earth planet evaporates from oceans and bodies of water to cool temperatures.



Properties of Water

Water can ionize polar substances

Acids and Bases

pH scale- Stands for Power of Hydrogen H+ ions

Ranges from 0 – 14

Logarithmic Scale (gets 10x bigger/smaller)

Acid – donates H+ when added to aqueous solutions

Ranges from pH 0-6.9

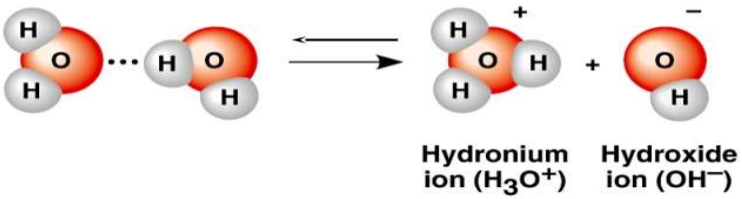
Base – H+ acceptor breaks up into hydroxide (OH-) ions and another compound when placed in an aqueous solution

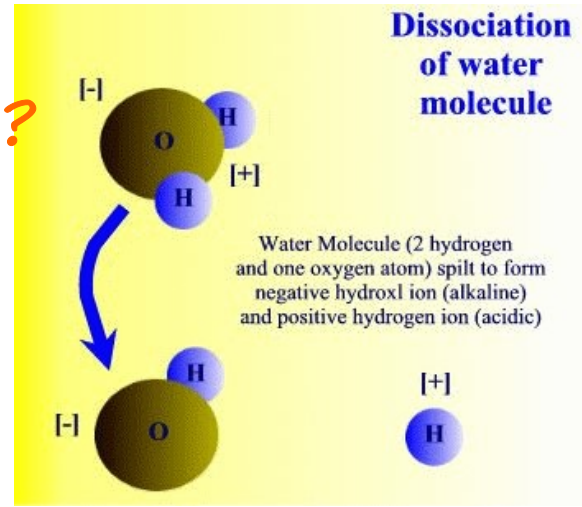
Ranges from pH 7.1 – 14

Distilled water is pH 7.0 or neutral. Why?

$H_2O \longrightarrow H+ + OH-$

"Dissociation" of water





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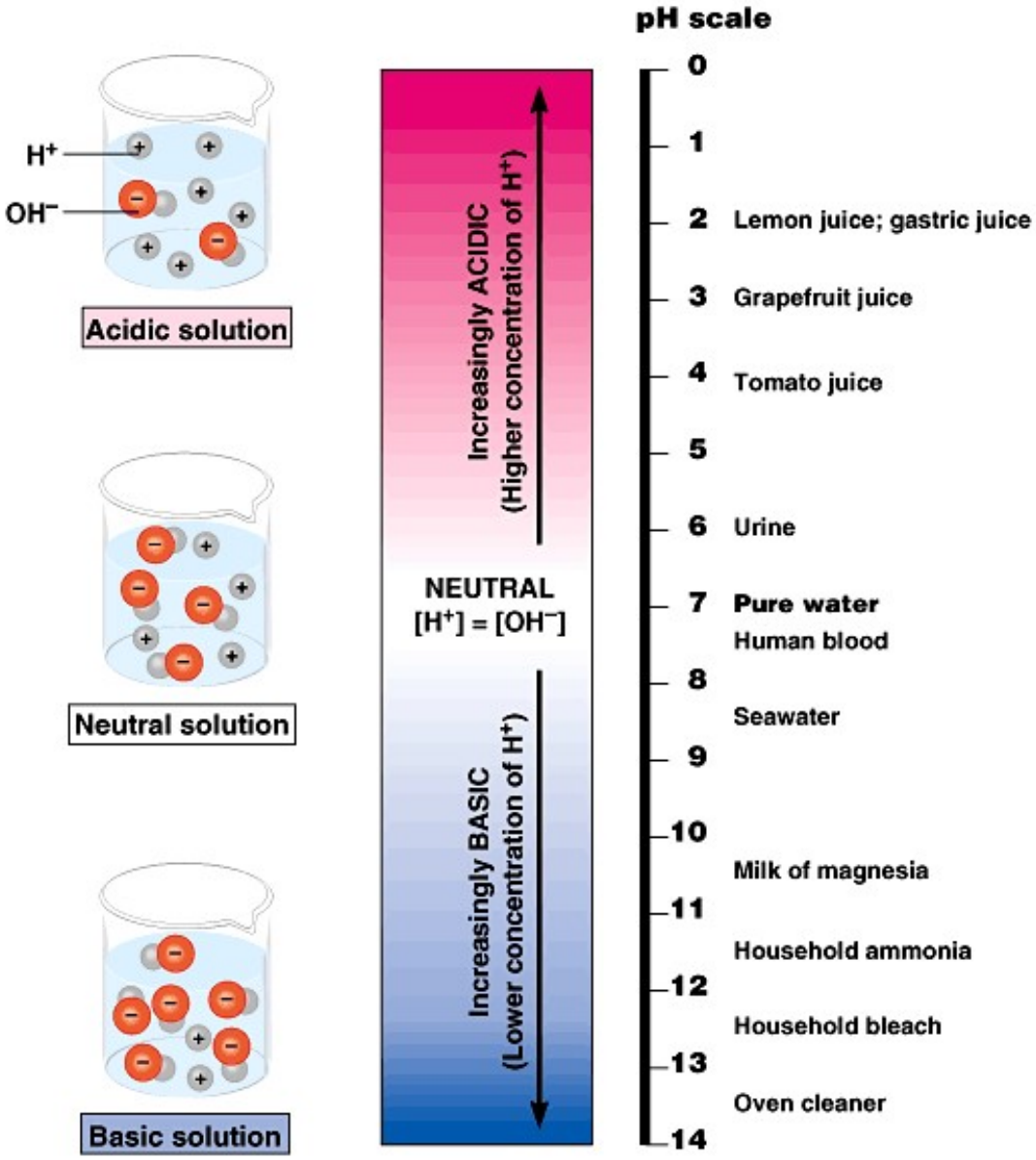

Acids and Bases

Buffers – compounds used to maintain a contant pH within a system. They are weak acids and bases that are used in the body to resist sharp changes in pH.

$$H_2CO_3 \longrightarrow H^+ + HCO_3^-$$

Carbonic acid **bicarbonate ion**

Acids and Bases