Properties of Water

J. Mitchell

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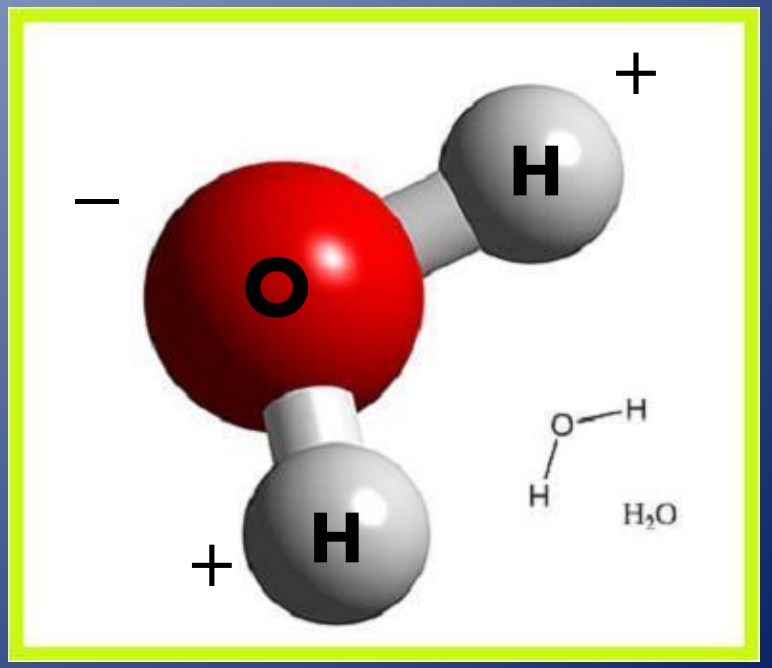
The Very Basics of Chemistry…

- An atom is the basic unit of matter.
- An element (like Carbon, Hydrogen, Oxygen, etc.) is a pure substance made of only one type of atom.
- A chemical compound (or molecule) is a combination of atoms that are held together by different types of bonds.
  - Ex: H_2O; CO_2; CH_4; or $C_6H_{12}O_6$

Polar vs. Non Polar

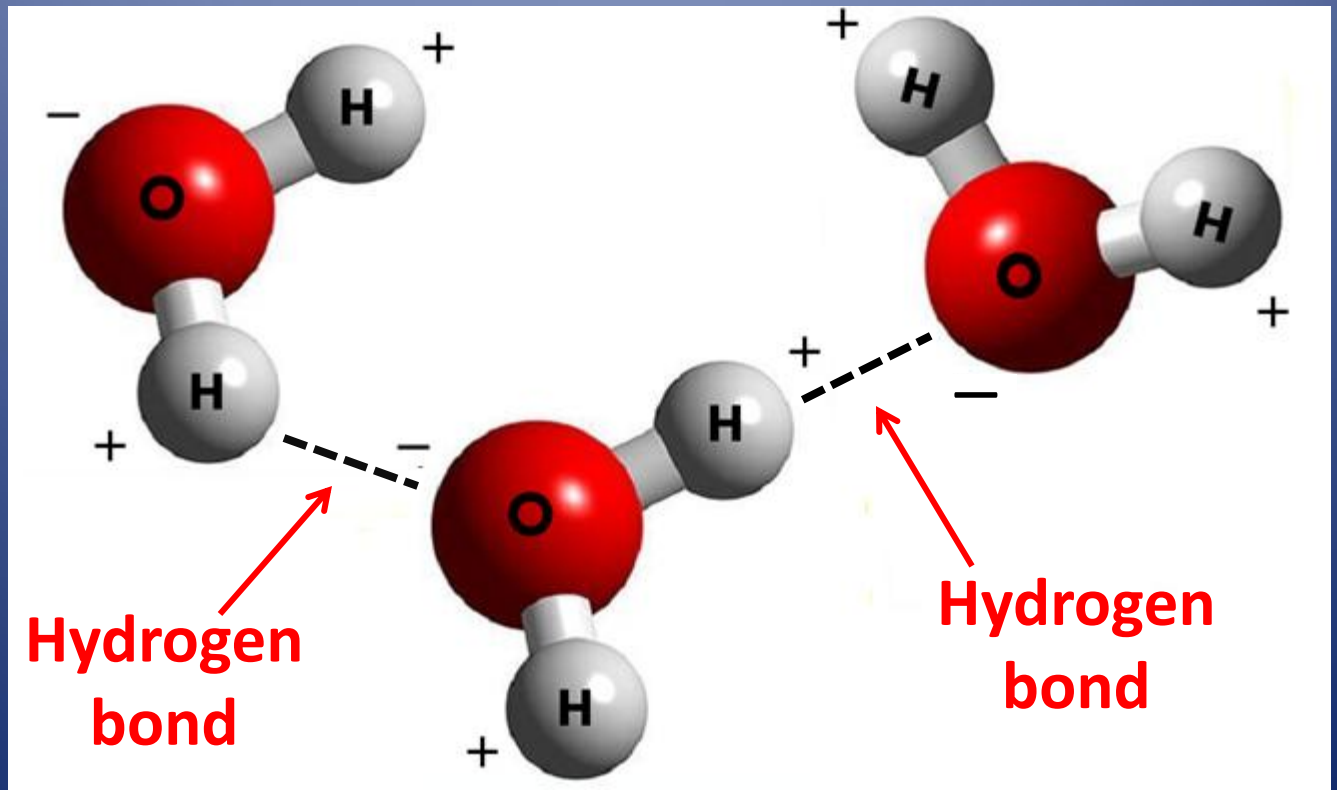
- In polar molecules, opposite ends of the molecule have opposite charges.
- Non polar molecules essentially have no charge.
- H_2O molecules are POLAR… the oxygen end is more negative (-) and the hydrogen ends are positive (+).



Hydrogen Bonds

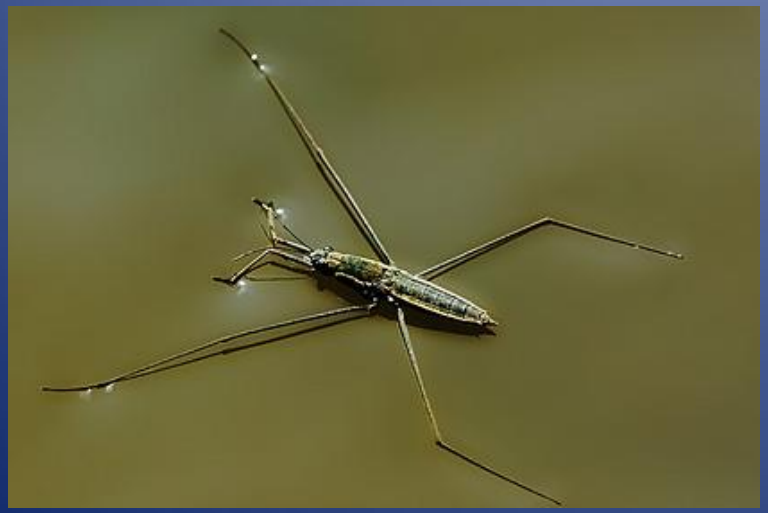
- **Hydrogen bonds are bonds between a negative atom and a hydrogen atom. They can form because H_2O is a polar molecule.**

Water molecules can form up to 4 hydrogen bonds with other water molecules at a time.



Cohesion

- **Cohesion is an attraction between molecules of the same type.**
- **This is what creates *surface tension in water*.**
- **Water is very cohesive – H_2O molecules are attracted to other H_2O molecules.**
- **A result of hydrogen bonding!**

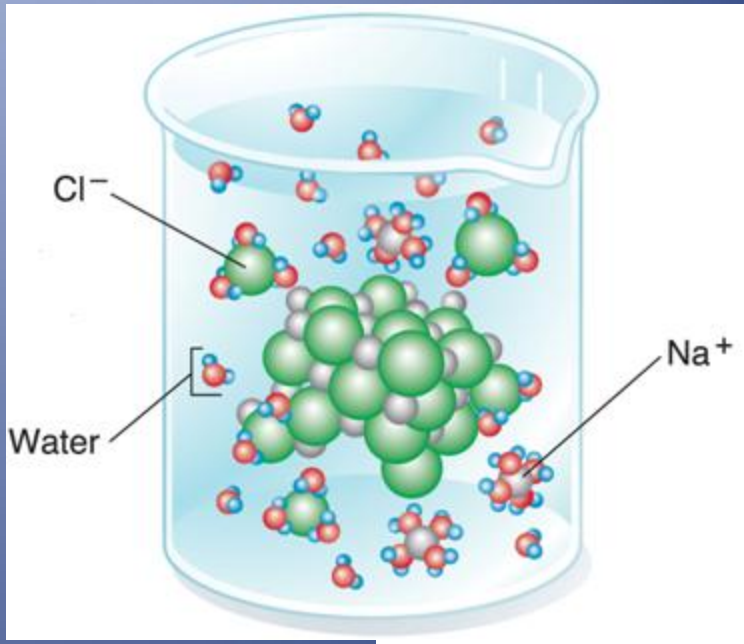


Adhesion

- **Adhesion is the ability of water to bond with other substances.**
- **Adhesion and cohesion are responsible for uptake of water in plants and trees (also called capillary action).**
- ***Because of hydrogen bonding!***

A ***Solution*** is a Type of ***Mixture***

- A **SOLUTION** is a mixture with all of the contents evenly distributed throughout. One of the components of the solution is dissolved.
- A **solvent** dissolves.
- A **solute** gets dissolved.
- Water is a great ***solvent*** for ***solutes*** like salts or sugars or other polar molecules.



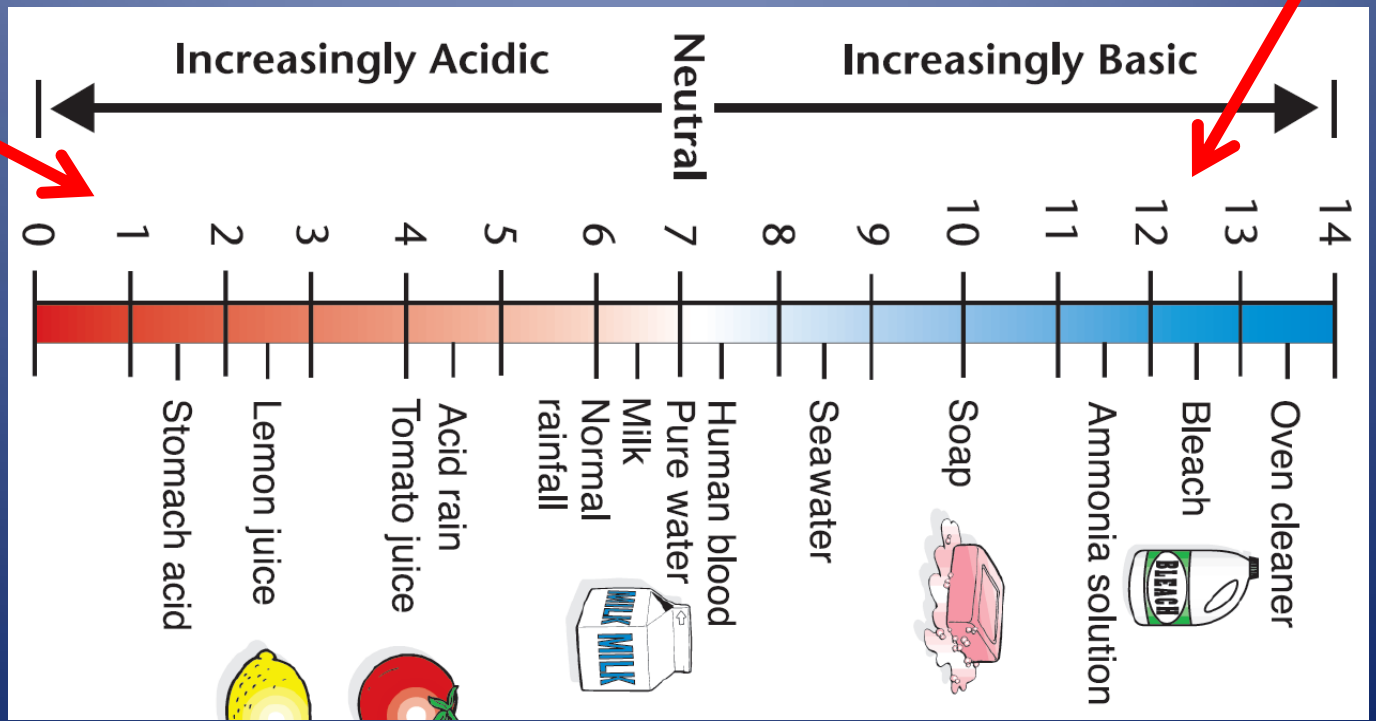
Salt-water Solution

A ***Suspension*** is Another Type of ***Mixture***

- A **SUSPENSION** is a mixture of water and materials that can't be dissolved by water.
- These materials might separate into pieces so small that they don't settle out & are kept suspended by movement of H_2O molecules.
- Examples: sand in water, salad dressing

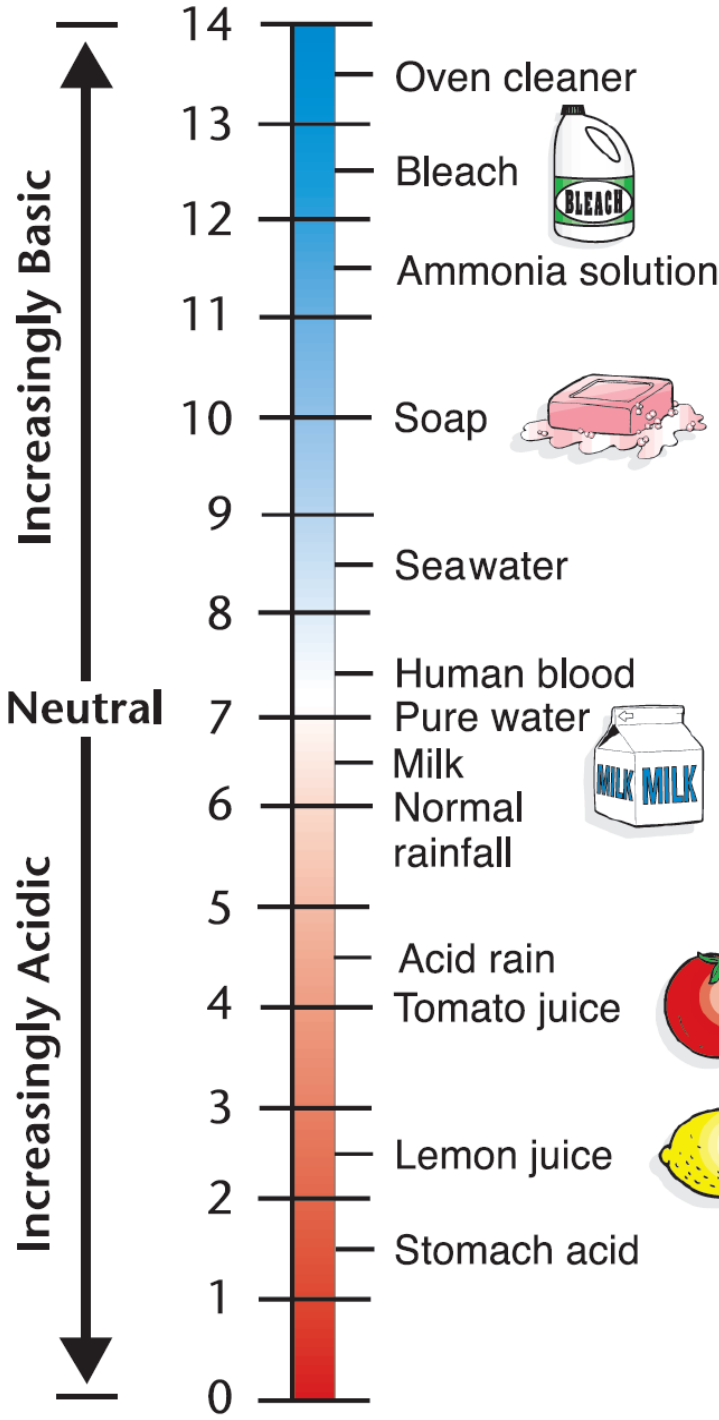
Acids vs. Bases (& the pH Scale)

- Individual H_2O molecules sometimes separate (or dissociate) into H^+ and OH^-
- Acids add H^+ to solutions
- Bases add OH^- to solutions
- Buffers minimize H^+ or OH^- concentrations



pH Scale

pH 7 = neutral (same amts of H^+, OH^-)



Water Moderates Temperatures

- Water can absorb & release heat without changing its own temperature very much
  - Due to Hydrogen bonds!
- This helps stabilize temperatures of large bodies of water
- Holds heat during the day & releases it at night

Density of Water

- Less dense as a solid than liquid
- Crystalline lattice keeps molecules at a distance
- Ice Floats – preventing oceans & lakes from being frozen solid all year