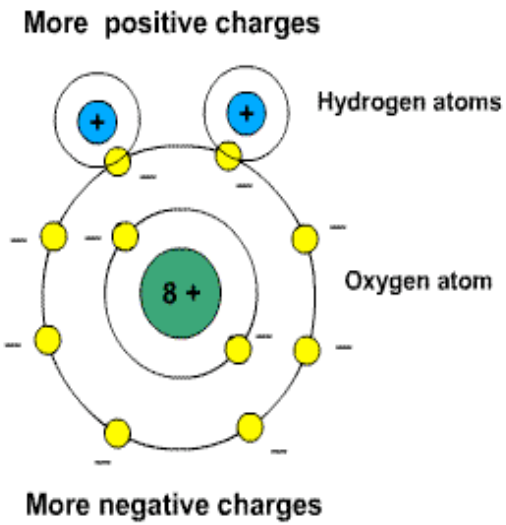
2-2 Properties of Water

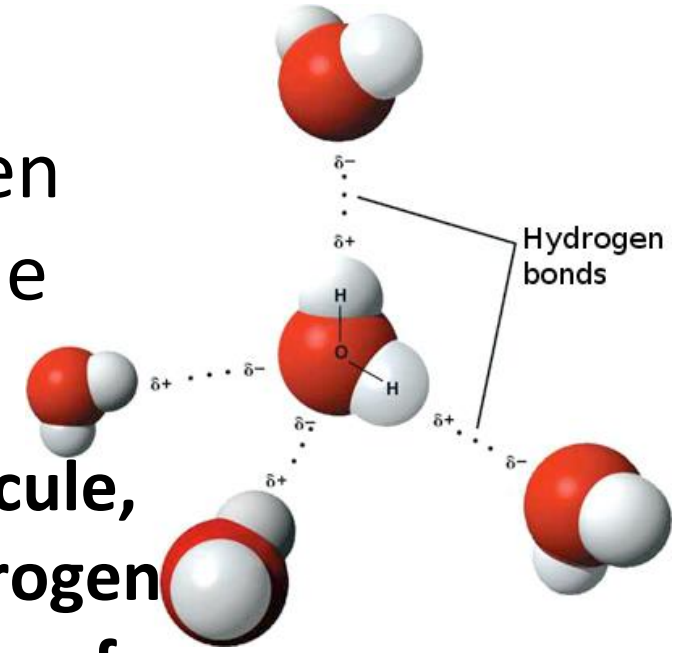
The Water Molecule

- Water is one of the only few compounds that naturally occur as a liquid
- **Polarity**
  - Oxygen's 8 protons vs. Hydrogen's 1 proton = Oxygen with a greater pull on electrons
  - So, the Oxygen end is slightly negative and Hydrogen slightly positive
  - "Polar" molecules behave like poles of magnets
- Water molecule is polar because there is an uneven distribution of electrons between the oxygen and hydrogen atoms.



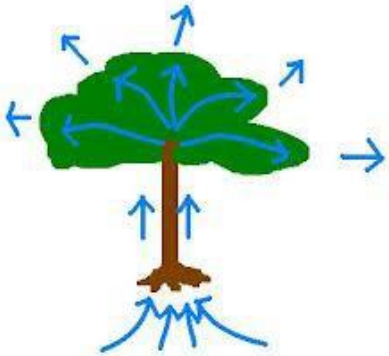
The Water Molecule

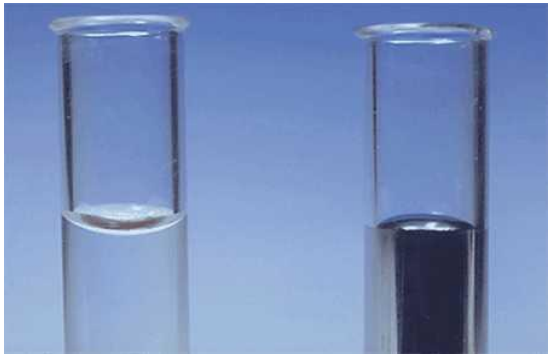
- **Hydrogen Bonding -** The attraction between a hydrogen atom on one molecule and the oxygen atom of another
  - **Because water is a polar molecule, it is able to form multiple hydrogen bonds, which account for many of water's special properties.**



The Water Molecule

- **Cohesion** – an attraction between molecules of the same substance.
  - Ex: Surface Tension
- **Adhesion** – an attraction between molecules of different substances.
  - Ex: Water meniscus
  - Ex: Capillary Action

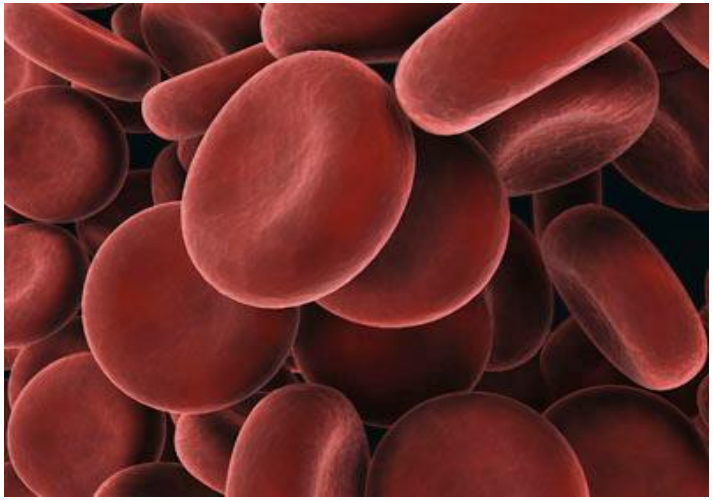


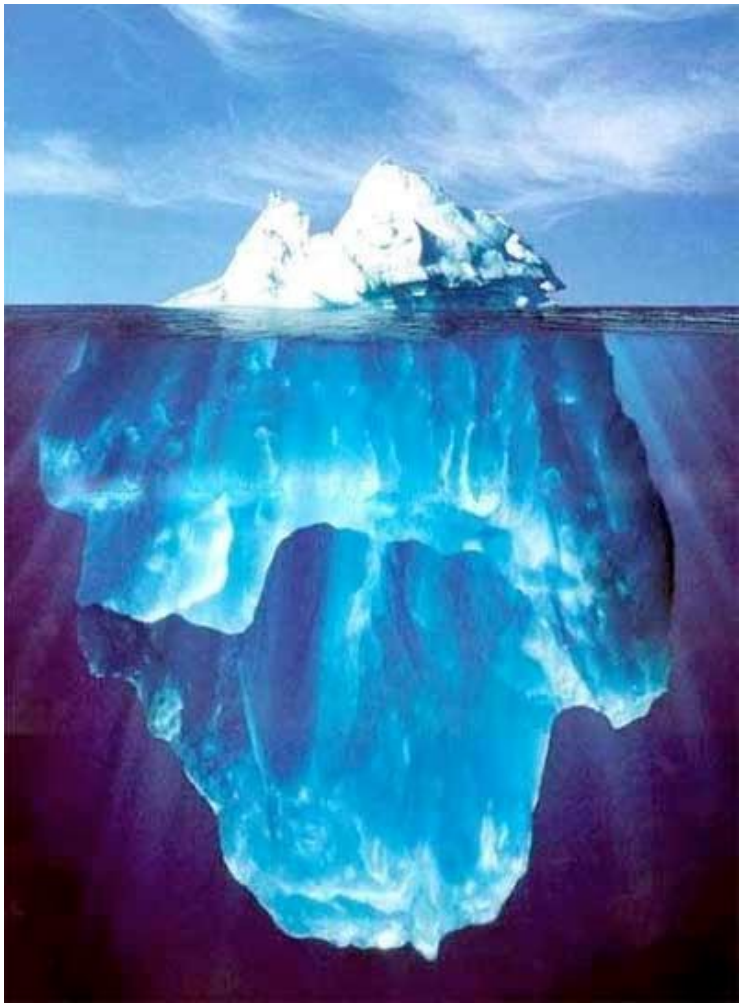


The Water Molecule

– **Heat Capacity**

- It takes a large amount of energy to have water molecules move faster to raise the temperature of water
- Ex: Ocean temperature
- Ex: Cell Processes





Solutions and Suspensions

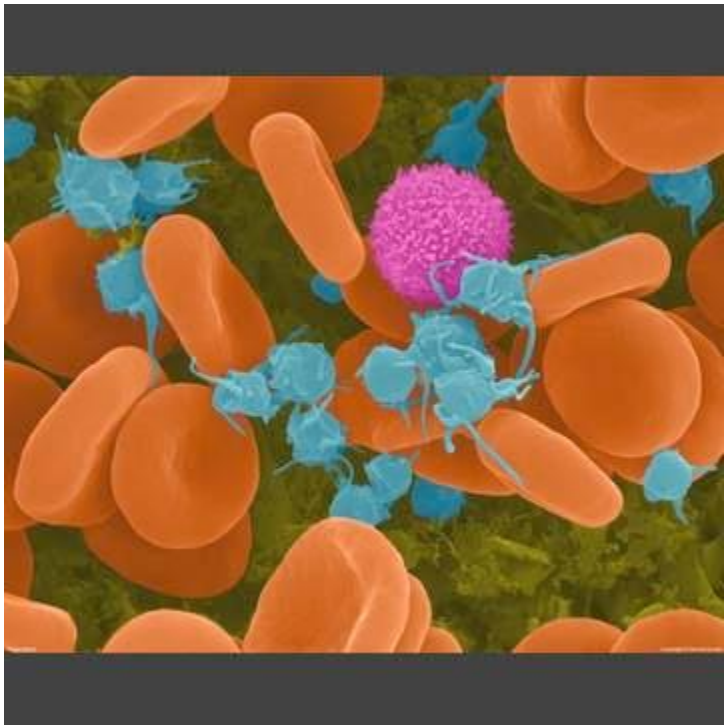
- **Mixture** – is a material composed of two or more elements or compounds that are physically mixed together but not chemically combined.
  - Ex: Saline Solutions

Solutions and Suspensions

- **Solutions** – a mixture in which all materials are evenly distributed throughout the solution.
  - Solute – The substance dissolved
  - Solvent – The substance in which the solute dissolves
  - **Water's polarity gives it the ability to dissolve both ionic compounds and other polar molecules.**
  - Water is the universal solvent with some limitations
  - Ex: Salt Water

Solutions and Suspensions

- **Suspensions** – mixtures of water and non-dissolved material
  - Ex: Human Blood



Acid, Base, pH

- Water does split apart into ions every 1 in 550 million molecules

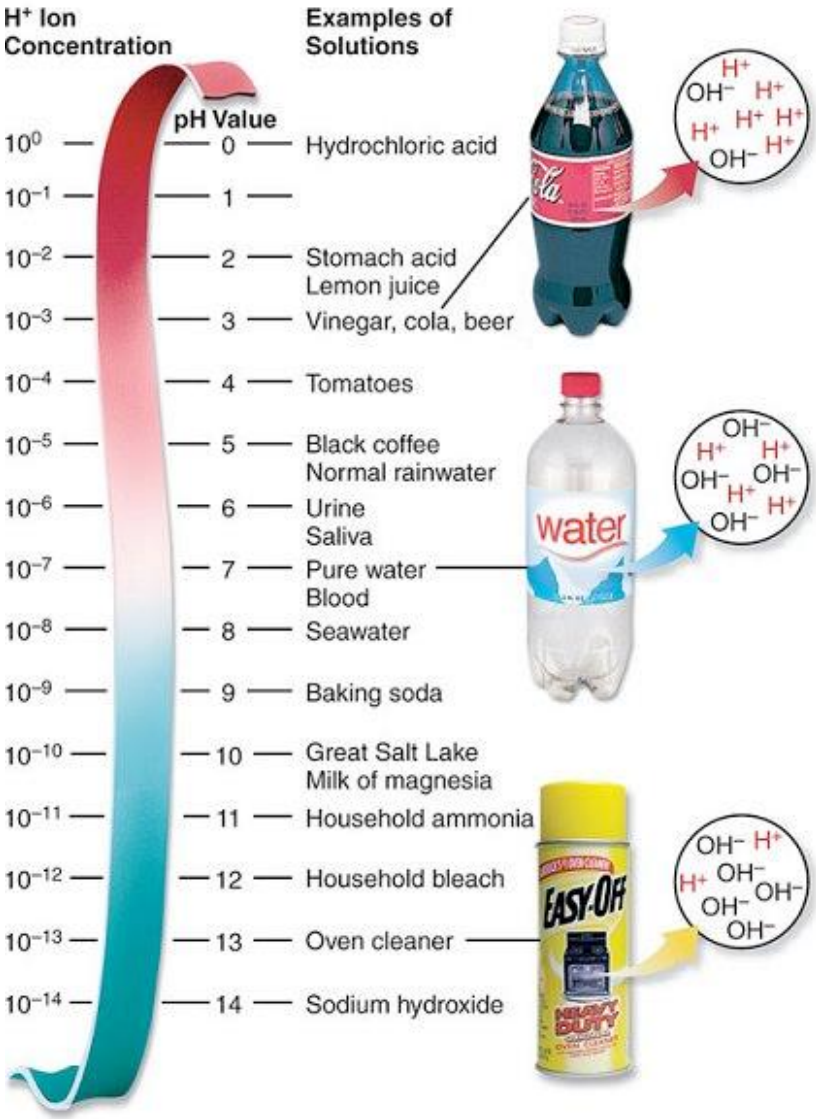
$$H_2O \rightleftharpoons H^+ + OH^-$$

water ⇌ hydrogen ion + hydroxide ion

- Remember though, the number of H+ ions is equal to OH- ions therefore water is neutral

Acid, Base, pH

- **The pH Scale** – a system of measurement that indicates the concentration of H+ ions in a solution.
  - Ranges from 0-14
  - 7 is neutral (equal H+ and OH-)
  - <7 Acidic (more H+ than OH-)
  - >7 Basic (more OH- than H+)
  - Each step represents a factor of 10



Acid, Base, pH

- **Acid** – a compound that forms H+ ions in a solution.
  - Ex: Hydrochloric acid for stomach digestion
- **Base** – a compound that produces hydroxide (OH-) ions in a solution.
  - Ex: Lye (NaOH – Sodium Hydroxide) for soap making

Acid, Base, pH

- **Buffer** – a weak acid or base that can react with strong acids or bases to prevent sharp, sudden changes in pH.
  - The human body needs to maintain a pH of a 6.5 to 7.5 to maintain homeostasis
  - **Buffers dissolved in life's fluids play an important role in maintaining homeostasis in organisms.**