Chapter Two: The Chemistry of Life
Lesson 2.2: Properties of Water

The presence of liquid water is a strong indication of life.

Water:

- Can be found in all 3 states (solid, liquid, gas) in normal temperatures found on Earth
- Partially positive end on the hydrogen side
- Partially negative end on the oxygen side
- **Hydrogen bond:** the attraction between a hydrogen atom with a partial positive charge and another atom with a partial negative charge (F, O, N)

Special properties of water:

- Water is polar because of the partially positive and negative ends
- Water expands slightly when frozen – therefore ice floats rather than sinks
- **Cohesion:** the attraction between molecules of the same substance
    - Attraction to itself
    - Forming of beads on smooth surface
    - Insects can "walk" on water
- **Adhesion:** the attraction between molecules of different substances
    - Attraction to other molecules
    - Meniscus in a graduated cylinder
    - Colors forming in the cups (red-orange-yellow-green-blue)
    - Capillary action: the movement of water flowing "up" in a narrow tube against the force of gravity

- Heat capacity: the amount of energy needed to raise its temperature by making its molecules move faster
    - Water has a high heat capacity
    - Water can absorb large amounts of heat with only small changes in temperature
- Water is living things
    - Water accounts for 60-70% of the mass of the human body

Mixture: a material composed of two or more elements or compounds that are physically mixed together but not chemically combined

- Think of a supreme pizza

Solution: type of mixture in which all the components are evenly distributed

- **Solute:** substance that is dissolved in a solution
- **Solvent:** dissolving substance in a solution
- Water easily dissolves salts, sugars, minerals, and gases
    - Dissolve both ionic compounds and other polar molecules
- Water is the most important solvent
- Think of making Gatorade from a powder substance
    - Gatorade powder = solute
    - Water = solvent
    - Gatorade drink = solution

Suspensions: mixtures of water and non-dissolved material

- Think of muddy water
- Biology example: blood contains cells that are suspended in blood that moves throughout the body

pH scale: scale with values from 0 to 14, used to measure the concentration of H+ ions in a solution

- $H_2O \leftrightarrow H^+ + OH^-$
    - Breaks down into hydrogen ions and hydroxide ions
- pH of 0 to 7 is acidic
- pH of 7 is neutral
- pH of 7 to 14 is basic

Acid: compound that forms hydrogen ions (H+) in solution

- a solution with a pH of less than 7
- Hydrochloric acid (HCl) is in your stomach has a pH of 1.5-3.0

Base: compound that produces hydroxide ions (OH-) in solution

- a solution with a pH of more than 7
- Lye (NaOH) is used in soapmaking has a pH of 11-14

Buffers: weak acids or bases that can react with strong acids or bases to prevents sharp, sudden changes in pH

- Controlling pH in cells is important for maintaining homeostasis
    - Internal pH of most cells is between 6.5 and 7.5