

Chapter 2 Chemistry of Life

- Atoms, Ions, Molecules
 - Chemical Elements: the simplest form of matter to have unique chemical properties
 - Protons, neutrons, and electrons
 - Atomic number: number of protons
 - All naturally occurring elements
 - 98.5% of the human body
 - Carbon, hydrogen, nitrogen, phosphorous, oxygen, calcium
 - 0.8% of the human body
 - Potassium, sodium, sulfur, chlorine, magnesium, iron
 - 0.7% of the human body (**trace elements**)
 - Chromium, cobalt, copper, fluorine, Iodine, manganese, molybdenum, selenium, silicon, tin, vanadium, zinc
 - **Minerals**: Inorganic molecules that are extracted from the soil by plants and passed up the food chain to humans
 - 4% of the body weight
 - Atomic Structure
 - Neils Bohr: planetary model
 - Protons p^+ , neutrons n^0 , electrons e^-
 - Proton & Neutron
 - 1 amu
 - Electrons
 - $\frac{1}{2}$ amu
 - Electron Shell
 - 7 (human body doesn't exceed 4)
 - Valence electrons: determine chemical bonding properties of an atom
 - Isotope & Radioactivity
 - **Isotope**: variety within an element
 - Same number of protons, but different number of neutrons and therefore a different atomic mass
 - **Radioactivity**: decaying of radioisotopes that are unstable
 - All elements have at least one radioisotope
 - Radiation:
 - Low energy is harmless
 - High energy: ejects electrons from atoms converting atoms into ions
 - Ionizing radiation: creates dangerous free radicals & ions in human tissue
 - Mutagenic & carcinogenic

- **Alpha particles** = helium
 - **Beta particles** = electron
 - **Gamma rays**
 - **Physical half lives:** the time required for 50% of its atoms to decay to a more stable state
 - **Biological Half Life:** time required for half of it to disappear from the body
- Ions, Electrolytes, & Free Radicals
 - **Ions** are charged particles with unequal number of protons and electrons
 - Form because elements with 1-3 valence electrons tend to give them up
 - 4-7 valence electrons gain them
 - Ionization
 - Cations & anions
 - Some exist in multiple ionized forms
 - **Electrolytes:** ionize in water & form solutions capable of conducting electricity
 - Electrical activity in brain, muscles, & heart
 - **Free Radicals:** chemical particle with odd number of electrons
 - Produced by metabolic reactions, radiation, and chemicals
 - Short-lived & combine quickly
 - Cause lots of damage
 - Antioxidants: neutralize free radicals
 - Deficiencies cause heart attack, muscular dystrophy, and sterility
- Molecules and Chemical Bonds
 - **Molecules** are chemical particles composed of two or more atoms united by a chemical bond
 - 2 or more elements is a **compound**
 - Represented by a molecular formula
 - Different arrangements of their atoms is an **isomer**
 - Molecular weight: sum of all the atomic weights of its atoms
 - Chemical Bonds:
 - **Ionic:** attraction of an anion & cation
 - Weak and easily disassociated
 - $\delta^+ \delta^-$
 - **Hydrogen Bond:** Weak attraction between slightly positive hydrogen and slightly negative oxygen or nitrogen
 - **Van der Waal:** weak, brief attractions between neutral atoms
 - Random fluctuations
 - 1% as strong as a covalent

- Water & Mixtures
 - **Mixture:** substances that are blended together but not chemically combined
 - Retains chemical properties
 - Water
 - Most mixtures consist of chemicals dissolved or suspended in water
 - **Solvency:** ability to dissolve other chemicals
 - Hydrophilic: dissolves in water
 - Polarized or charged
 - **Adhesion:** one substance ability to cling to another
 - **Cohesion:** molecules of the same substance cling to each other
 - Thermal Stability: helps stabilize internal temperature of the body
 - High heat capacity
 - Calorie is 1 g of water increased temperature by 1° C
 - Solution, Colloids, & Suspensions
 - **Solution:** solute + solvent
 - Particles are under 1 nm for the solute mixed with a more abundant solvent
 - Particles do not scatter in light noticeably
 - Pass through most selectively permeable membranes
 - Doesn't separate
 - **Colloids:** mixture of protein and water
 - 1-100 nm
 - Scatter in light, usually cloudy
 - Too large to pass through selectively permeable membrane
 - Small enough to remain mixed
 - **Suspension:**
 - >100 nm
 - Cloudy or opaque
 - Too large to pass selectively permeable membrane
 - Usually separates
 - **Emulsion:** suspension of one liquid in another
 - Measure of Concentration
 - Weight per volume
 - (g/L)
 - Percentages
 - Specify to weight or to volume
 - Molarity
 - Mols/ L = M
 - Electrolyte Concentration:
 - Takes charges into account
 - Equivalent (eq)