

The Structure of Atoms

- Atomic number = the number of protons in the nucleus
- Atomic mass = the number of protons plus the number of neutrons in the nucleus
- **Chemical Elements**
 - All atoms with the same number of protons behave the same way and are classified as elements
 - 92 naturally occurring elements
 - Isotope: same element, same number of protons but different number of neutrons changing the atomic mass
 - When written, the number on top is the atomic mass and the number on the bottom is the atomic number
- **Electronic Configuration**
 - 2 electrons in the innermost shell and 8 in the second and third shells
 - The shells after that can hold up to 18
 - Outermost shell = valence shell
 - Tends to be filled, chemically stable
 - When filled, atom is not very reactive to other elements (halogens)
 - Unfilled = chemically unstable and tends to react
- ◻ **How Atoms Form Molecules: Chemical Bonds**
 - Valence: combining capacity of an atom that includes the missing or extra electrons in the outermost shell
 - Compound: molecule made up of two or more different atoms
 - Each chemical bond possesses a certain amount of potential energy
 - **Ionic Bonds:**

- o Gaining an electron gives an atom an overall negative charge and losing an electron gives it an overall positive charge
 - o These opposite charges attract each other and create an ionic bond
 - o Cations = positively charged ions
 - o Anion = negatively charged ions (electron acceptor)
- **Covalent Bonds:**
 - o Two atoms sharing electrons that orbit the nuclei of both atoms
 - o Stronger and more common than ionic bonds
 - o Single, double and triple covalent bond represent how many pairs of electrons are being shared
- **Hydrogen Bonds:**
 - o A hydrogen atom that is covalently bonded to an oxygen or nitrogen atom is also attracted to another oxygen or nitrogen atom
 - o Weak
 - o Serve as bridges
 - o Oxygen portion of a molecule has a slightly negative charge and the hydrogen atom has a slightly positive charge
 - o Formed and broken easily
- **Molecular Weight and Moles**
 - o Molecular weight of a molecule is the sum of the atomic weights of all its atoms
 - o Talk about it in moles
- **Chemical Reactions**
 - The making or breaking of bonds between atoms
 - **Energy in Chemical Reactions**
 - o Chemical energy is formed when bonds are formed or broken during a chemical reaction

- Endogenic reaction: absorbs more energy than it releases
 - Exergonic reaction: releases more energy than it absorbs
- **Synthesis Reactions**
 - When two or more atoms, ions, or molecules combine and form larger molecules
 - $A + B \rightarrow AB$
 - Synthesis reactions in living organisms are called anabolic/anabolism
 - Sugar molecules combining to form starch and amino acids to form proteins
- **Decomposition Reactions**
 - To break down into smaller parts, opposite of synthesis reactions
 - $AB \rightarrow A + B$
 - Bonds are broken
 - Catabolism
 - Break down of sugar
- **Exchange Reactions**
 - Actually a part of synthesis and a part of decomposition
 - $AB + CD \rightarrow AD + BC$
 - Creation of table salt
- **The Reversibility of Chemical Reactions**
 - A reaction that is readily reversible
 - Shown by two arrows going back and forth
 - Some occur when the reactants and products aren't stable but some require heat/water