

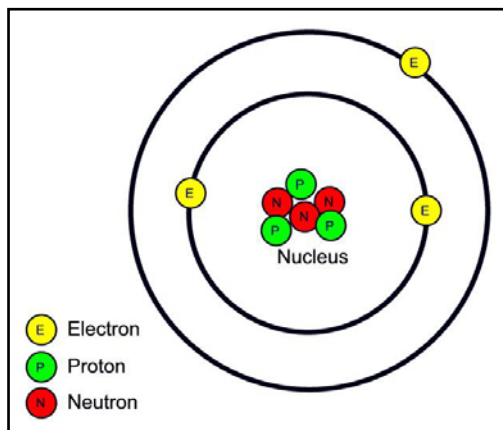
# Introduction to Chemistry Notes

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## Introduction to Chemistry

### 1. Atoms

- **Atom**: Smallest particle of an element that retains the characteristics of that element.
- **Element**: The pure chemical substance containing only one type of atom
- Ex: H = hydrogen  
C = carbon  
O = Oxygen
- Elements are usually found combined with other elements
- **Compound** – a substance formed when two or more elements are **chemically bonded**
- Ex:  $C_6H_{12}O_6$



### 2. Structure of an Atom

- Composed of a Nucleus
- The nucleus contains **Protons** ( $p^+$ )
  - # protons = Atomic Number
- The nucleus also contains **Neutrons** ( $n^0$ )
  - Protons + Neutrons = Atomic Mass
- The nucleus is surrounded by **Electrons** ( $e^-$ )
  - Electrons travel in regions called energy levels (shells)
    - 2  $e^-$  in 1st shell
    - 8  $e^-$  in 2nd shell
    - 8  $e^-$  in 3rd shell
    - Not all atoms have all shells!

### 3. Periodic Table Crash Course

- A table of elements, arranged by atomic number
- Each element is identified via 1 letter or 2 letter abbreviation
- Metals are left of the zigzag (except H), Nonmetals to the right
- Elements are uncharged, which means the number of protons **MUST EQUAL** the number of electrons
- Column numbers tell you valence shell electron number
- Valence shell electrons: The outermost electrons on an atom.
- Hydrogen: 1 valence  $e^-$
- Carbon: 4 valence  $e^-$
- Nitrogen: 5 valence  $e^-$
- Oxygen: 6 valence  $e^-$

### 4. Chemical Bonding

- Elements become most stable when they have a full valence electron shell (2  $e^-$ , 8  $e^-$ , 8  $e^-$ , etc)

#### **Ionic bonds**

- Elements only 1 or 2 electrons away from a full shell will lose or gain electrons.
- The charge between elements keeps them attracted together (ions)
- Ionic Bonds **CREATE IONS**, and are always between metals and nonmetals.

## Covalent bonds

- When elements have about 4 electrons to gain or lose, they share electrons
- Covalent bonds are the most common type of bond in living organisms.
- Occurs between nonmetals.
- Water uses covalent bonds.
- Molecule: Atoms held together by covalent bonds.
  - Single Covalent Bond
    - If two atoms each share 1 electron (for a total of 2 shared electrons), a single covalent bond is formed.
    - Represented by a single line “—” (Ex: C—C)
  - Double Covalent Bond
    - If two atoms each share 2 electrons (for a total of 4 shared electrons), a double covalent bond is formed.
    - Represented by a double line = (Ex: O=O)
    - Stronger and more rigid than a single bond.

## 6. Mixtures

- Mixture: A combination of substances where both substances keep their original properties.
  - Physically mixed, not chemically mixed.
- Solution: One or more substances (solutes) are distributed evenly in another substance (solvent)
  - The more solute in a solvent, the higher the concentration.
- Suspensions: Mixtures of water and non-dissolved particles
  - Example: Blood

## 7. pH Scale

- pH: a measure of how acidic or basic something is (pH: power of Hydrogen)
- pH 0-6: Acid
  - Acids form H<sup>+</sup> ions in water
  - Example: Lemon (pH=2)
- pH 7: Neutral
  - Example: Pure water and blood
- pH 8-14: Base
  - Bases form OH<sup>-</sup> ions in water
  - Example: Ammonia (pH=12)
- Buffers: Solutions that prevent sudden changes in pH.
- Neutralization reaction: A reaction between an acid and a base that results in the formation of salt and water and a neutral pH.
  - $\text{HCl} + \text{NaOH} \rightarrow \text{HOH} + \text{NaCl}$
  - pH1 + pH14 → pH7