Introduction to Chemistry Notes

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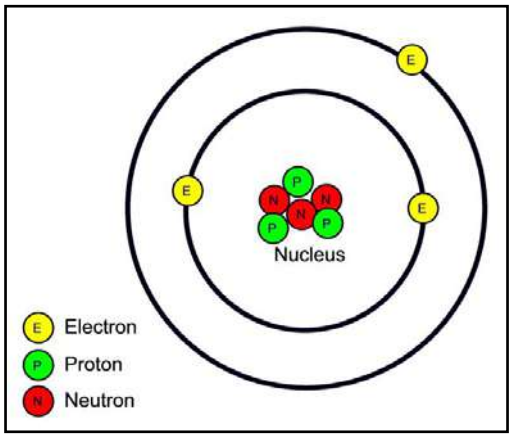
Introduction to Chemistry



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^+ ions in water
  - Example: Lemon (pH=2)
- pH 7: Neutral
  - Example: Pure water and blood
- pH 8-14: Base
  - Bases form OH^- 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.
  - $HCl + NaOH \rightarrow HOH + NaCl$
  - pH1 + pH14 → pH7