Biology 101 Chapter 2
The Chemical Basis of Life

Chemistry = the study of matter and the changes matter undergoes.

Nature of Matter:

Element defined: the basic kinds or types of matter, a substance that cannot be broken down further by chemical means.

- substances whose atoms have the same # of protons
- 92 elements occur naturally, 25 found in living things
- 118 known elements
- <u>the 4 most important elements</u> (>97% mass)
    1) Carbon [C]
    2) Oxygen [O]
    3) Hydrogen [H]
    4) Nitrogen [N]
- trace elements

Atom defined: the smallest fundamental particles of matter that still retain the identity of an element.

<u>Atomic Structure</u>
Same for all atoms
Atoms have two basic regions
    1) Nucleus
    2) Orbitals (shells)

Composed of 3 smaller particles (subatomic particles)

1. Protons
2. Electrons
3. Neutrons

	Charge	Mass	Location	# in atom
Protons	Positive	1	Nucleus	Constant
Electrons	Negative	1/1837	Orbitals	Lost or Gained
Neutrons	Neutral	1	Nucleus	Can alter

Atoms in an **uncombined state** have the same number of protons and electrons; therefore they are electrically neutral.

Most of the mass of an atom is in the nucleus.
Most of the volume is empty space occupied by orbitals.
Periodic table always refers to atoms in an uncombined state.

The Periodic Table:
Atomic Symbols:
The Atomic Number:
The Atomic Mass:

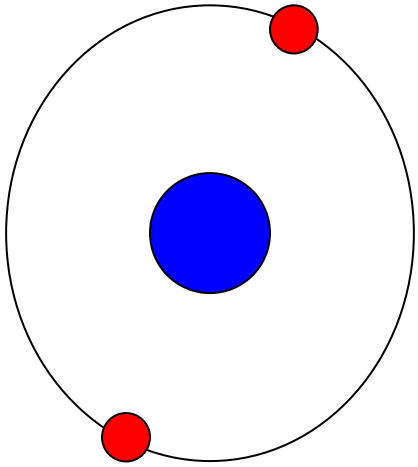
Isotopes and mass number

Molecule defined:

Diatomic molecules: H_2, O_2, N_2, F_2, Cl_2, Br_2, I_2

Compound defined:

Atomic Structure Part II



Electron Arrangements

Electron shells:

- certain energy levels
- 2e- in 1st
- 8e- in outermost

Valence electrons = bonding electrons and the octet rule

Chemical Bonds

3 types:

Ionic Covalent Hydrogen

Ionic bonds and ions:

- atoms can gain or lose electrons and become charged
- ions can form independent of ionic bonds

Ion = an atom or molecule with an electrical charge resulting from the gain or loss of 1 or more electrons.

Ionic bond: attraction of opposite charges, fairly strong, most common, found in metals and salts. *Ex. NaCl*

Covalent bond: (molecular bond) in which two atoms *share* 1 or more pairs of electrons, strongest bond, organic compounds.

Structure of a covalent bond
Single, double and triple bonds

Hydrogen bond: most rare, weakest, water and some organics.

- Always formed between an H atom *already covalently bonded* and an atom in another molecule
- Unique because of H atom structure

<u>The Properties of Water</u> (due to H-bonds)

1. Polarity
2. Cohesion + surface tension
3. Temperature Stability
4. Universal Solvent
   Solution, solvent and solute

<u>Acids and Bases</u>

pH = measures the level of acidity of a solution, level of H+ (ion) in solution.

Hydrogen ion (H+) plus Hydroxide ion (OH-) = H_2O

Acid: any compound that releases H+ to solution
Base: or alkali, any compound that removes H+ from solution (most have OH-)
pH Scale:

- ranges from 0-14
- 0-6.9 acidic, 7 neutral, 7.1-14 basic
- Water is neutral