

## Ch. 2: The Chemistry of Life

### Section 2.1 Atoms, Ions, and Molecules

#### I. Elements

= *a substance that can't be broken down into simpler chemical substances.*

#### A. Natural elements in living things

- Four elements make up **96%** of the mass of the human body: **H, O, N, C**
- Other common elements, include **Ca, P, K, S, Na, Cl, Mg**

#### B. Trace Elements (part of the other **4%** of body mass)

= *elements that play a vital role in healthy cells*, but are needed very small amounts.

*Ex: Fe and Cu*

**Table 6.1 Some Elements That Make Up the Human Body**

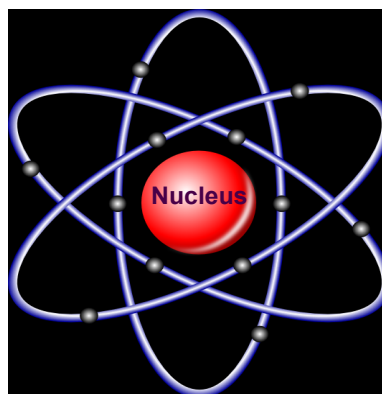
Element	Symbol	Percent By Mass in Human Body	Element	Symbol	Percent By Mass in Human Body
Oxygen	O	65.0	Iron	Fe	trace
Carbon	C	18.5	Zinc	Zn	trace
Hydrogen	H	9.5	Copper	Cu	trace
Nitrogen	N	3.3	Iodine	I	trace
Calcium	Ca	1.5	Manganese	Mn	trace
Phosphorus	P	1.0	Boron	B	trace
Potassium	K	0.4	Chromium	Cr	trace
Sulfur	S	0.3	Molybdenum	Mo	trace
Sodium	Na	0.2	Cobalt	Co	trace
Chlorine	Cl	0.2	Selenium	Se	trace
Magnesium	Mg	0.1	Fluorine	F	trace

## II. Atoms: The Building Blocks of Elements

\***Atom** = the *smallest particle* of an element that has *the characteristics* of that element.

### A. The structure of an atom

1. The center of an atom is the *nucleus*.



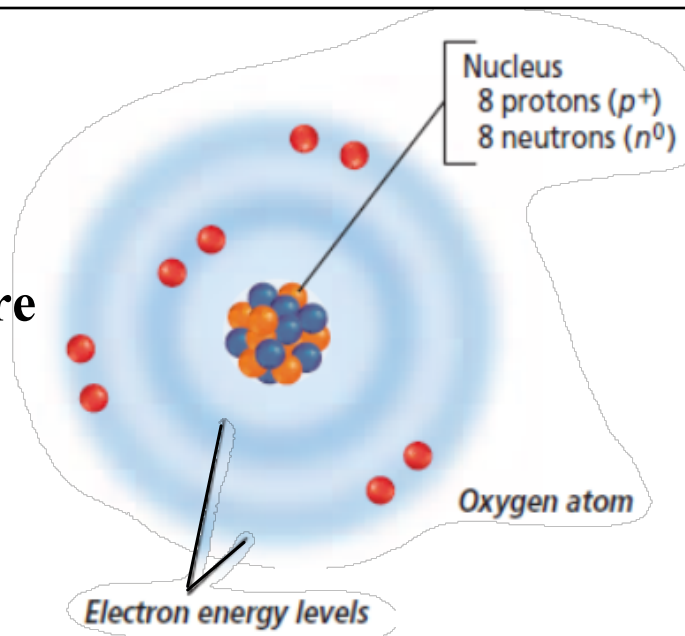
2. The nucleus is made up of *protons ( $p^+$ ) which are positively* charged and *neutrons ( $n^0$ ) which are neutral (no charge)*.
3. Elements are arranged on the Periodic Table according to the *number of protons they naturally have*. This number is called the *atomic number*.

4. The region of space surrounding the nucleus contains extremely small, *negatively charged particles called electrons ( $e^-$ )*. This region is also known as the *electron cloud*.

**B. Electrons energy levels (page 143, fig. 6.2)**

= Within the electron cloud, there are *energy levels, or valences, which the electrons move around.*  $2(n)^2$ ;  $n = \text{energy level}$

**Bohr's model of an atom's structure**

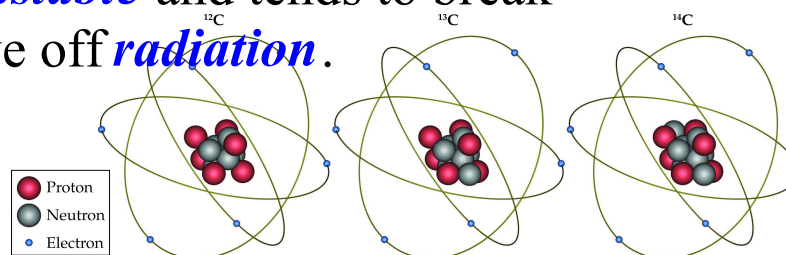


### III. Isotopes of an Element

Isotopes = atoms of the *same element that have the same number protons*, but a *different number of neutrons*.

Ex: Carbon-12 (naturally occurring)  
Carbon-14 (2 more neutrons) -

Most isotopes are *radioactive*, meaning the nucleus is *unstable* and tends to break apart and give off *radiation*.



### IV. Compounds and Bonding

\***Compound** = a substance that is composed of *atoms of two or more different elements that are chemically combined. Ex: NaCl*

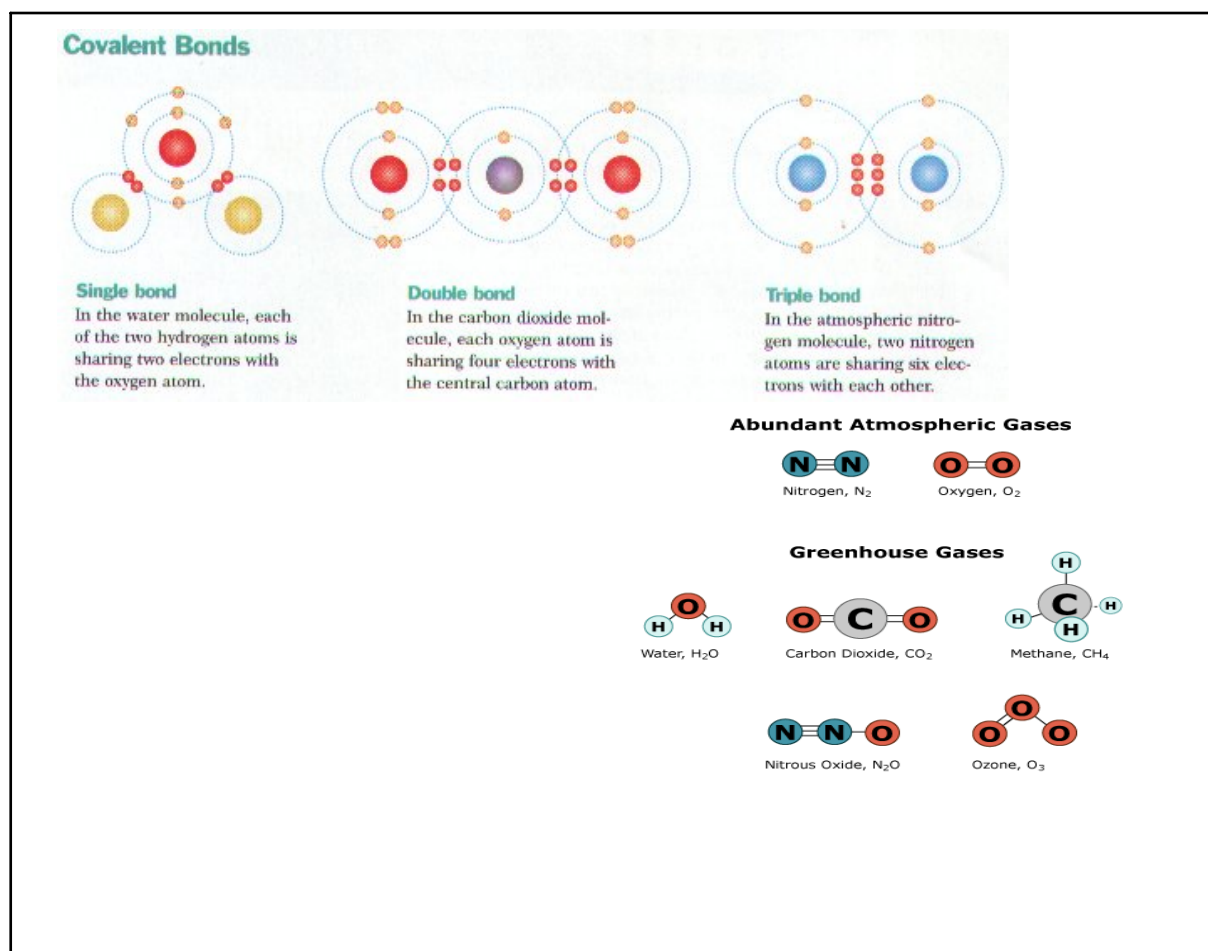
\***How and why do elements combine?**

Atoms combine with each other only when the resulting compound is *more stable than the individual atoms*.

\*For many elements, an atom becomes *stable* when its' *outermost* energy level is full. (either **2** or **8** electrons)

## A. How covalent bonds

1. Covalent bond - *the force between two atoms that share electrons* .
2. The electrons being shared *move around both elements holding them close together* .
3. Molecule = *a group of atoms held together by covalent bonds* . Ex: Water (H<sub>2</sub>O)



## B. How ionic bonds form

1. Ionic bond = *the attractive force between two ions of opposite charge*.
2. Ion = *a charged atom that gained or lost electrons*. If more protons, positively charged (+); if more electrons, negatively charged (-).
3. These bonds are *less* abundant in living things than covalent molecules, but ions are important *in biological processes*. Ex: sodium ( $\text{Na}^+$ ) and potassium ( $\text{K}^+$ ) pumps conduct nerve impulses.

### \*Diagrams of ionic bonds:

