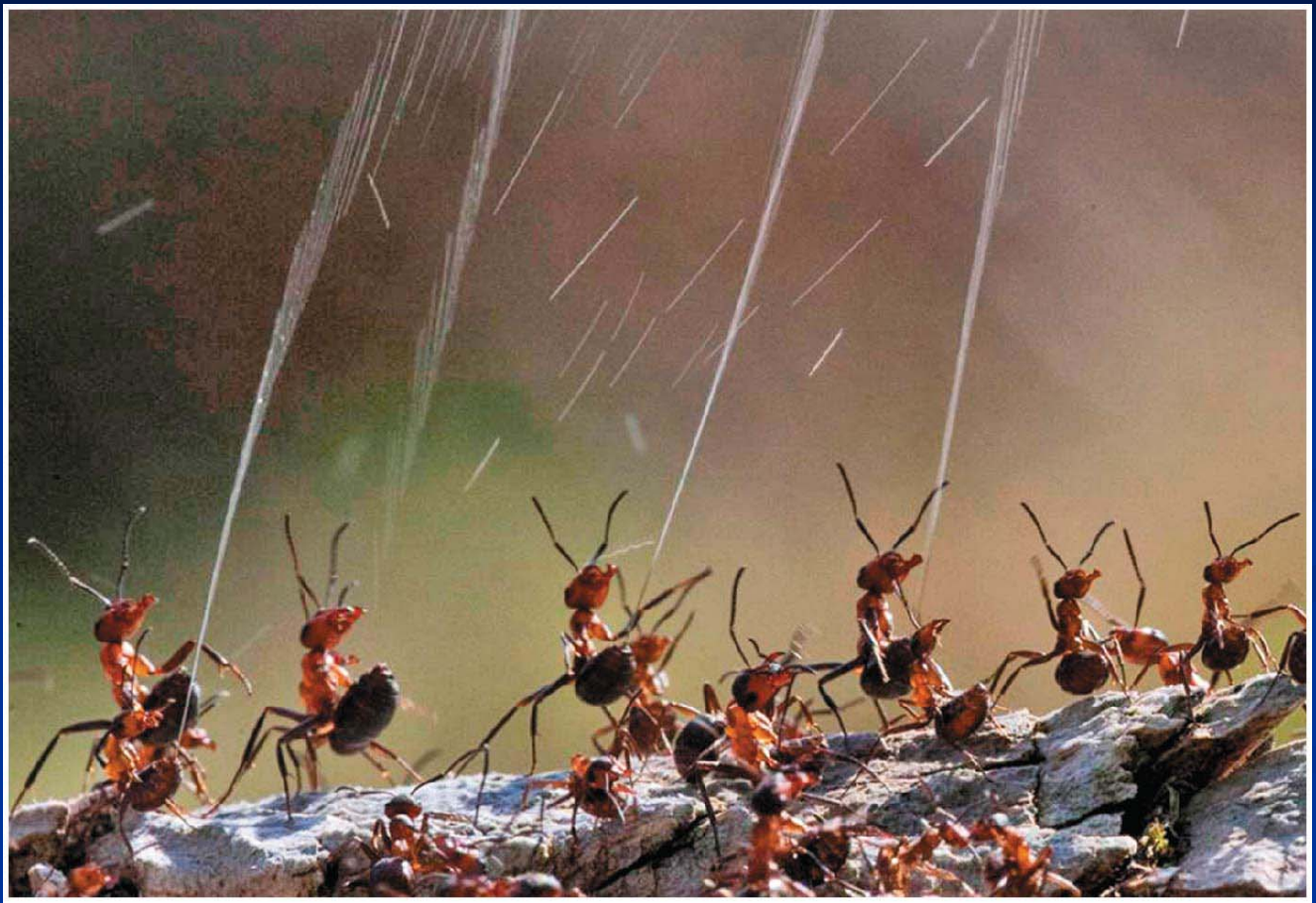
Chapter 2

The Chemical Context of Life

Wood Ants & Acid



Ants shoot formic acid to defend themselves from attacks from predators (birds).

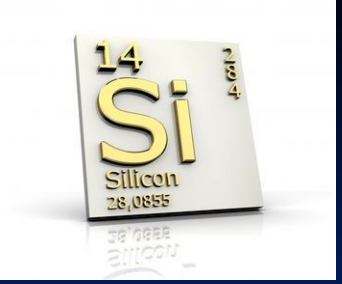
You Must Know

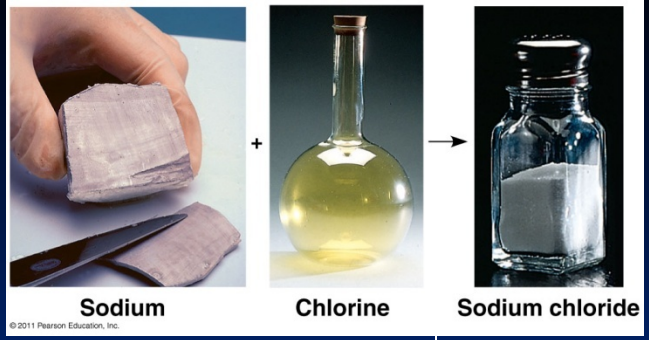
- The three subatomic particles and their significance.
- The types of bonds and how they form.

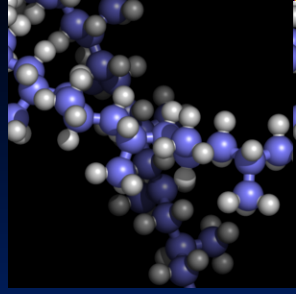
I. Matter vs. Energy

$E = mc^2$ Energy = (mass)(speed of light)^2

Matter	Energy
▪ Has mass & takes up space	▪ Moves matter
▪ Affected by gravity	▪ Potential, kinetic PE = mgh position KE = $\frac{1}{2}mv^2$ movement
▪ Consists of elements and compounds atoms collection of atoms	▪ Ability to do work
	▪ Conversions
	▪ Sound, light, heat







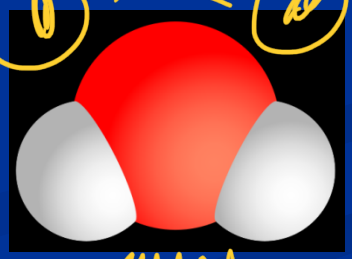
Element → atoms

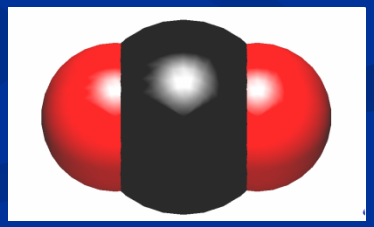
- "pure" substance
- Can't be broken down by "ordinary" means to another substance
- Ex. hydrogen (H), nitrogen (N)

Compound

- 2 or more different elements combined in a fixed ratio
- Ex. H_2O, CO_2

O_2 → atom





Elements of Life

macromolecules
proteins, fats, carbohydrate
nucleotides (DNA)

- 25 elements
  - 96% : O, C, H, N
  - ~ 4% : P, S, Ca, K & trace elements (ex: Fe, I)

Hint: Remember **CHNOPS**

phosphorus sulfur

Table 2.1 Elements in the Human Body

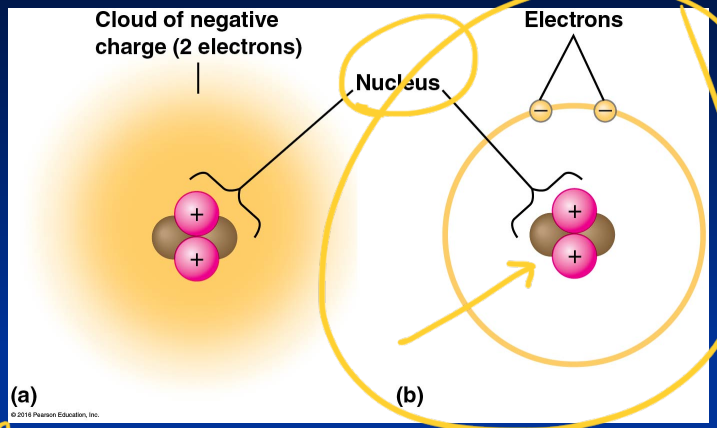
Element	Symbol	Percentage of Body Mass (including water)	
Oxygen H_2O	O	65.0%	96.3%
Carbon	C	18.5%	
Hydrogen	H	9.5%	
Nitrogen	N	3.3%	
Calcium	Ca	1.5%	3.7%
Phosphorus	P	1.0%	
Potassium	K	0.4%	
Sulfur	S	0.3%	
Sodium	Na	0.2%	
Chlorine	Cl	0.2%	
Magnesium	Mg	0.1%	

bone

Trace elements (less than 0.01% of mass): Boron (B), chromium (Cr), cobalt (Co), copper (Cu), fluorine (F), iodine (I), iron (Fe), manganese (Mn), molybdenum (Mo), selenium (Se), silicon (Si), tin (Sn), vanadium (V), zinc (Zn)

II. Atomic Structure

more energy



- **Atom** = smallest unit of matter that retains properties of an element
- **Subatomic particles**:

atom is mostly empty space

	Mass (dalton or AMU)	Location	Charge
neutron	1	nucleus	0
proton	1	nucleus	+1
electron	negligible 1/2000	shell orbit	-1

mass number

Mass # (protons + neutrons)

$^{4}_{2}He$

symbol

Atomic # (protons or electrons)

atomic number

in a neutral atom $p^{\oplus} = e^{\ominus}$

200

$^{200}_{80}Hg$

200-80

80 protons
80 electrons
120 neutrons

180-70
110

→ 180
→ 70

protons 70
electrons 70
neutrons 110