

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

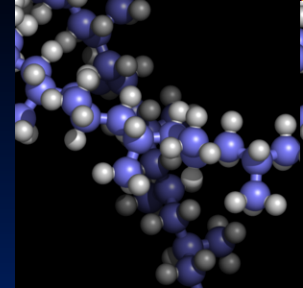
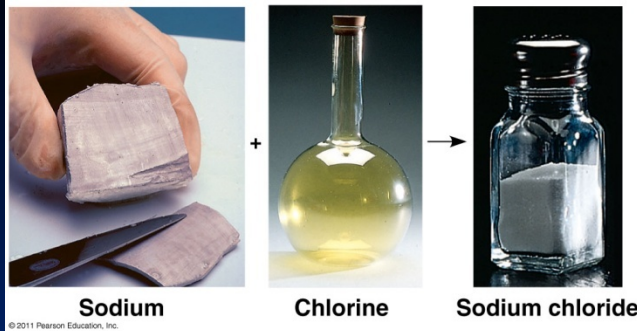
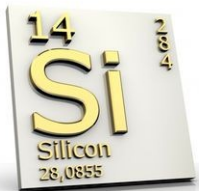
- { Has mass & takes up space
- Affected by gravity
- { Consists of elements and compounds

$$G = \frac{k m_1 m_2}{r^2}$$

Atoms

Energy

- Moves matter
- Potential, kinetic
mgh *$\frac{1}{2}mv^2$*
- Ability to do work
based on position *motion*
- Conversions
- Sound, light, heat



Element → Atom

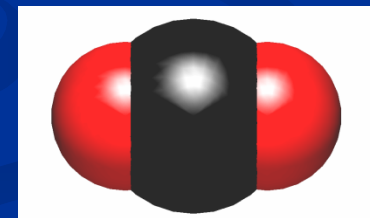
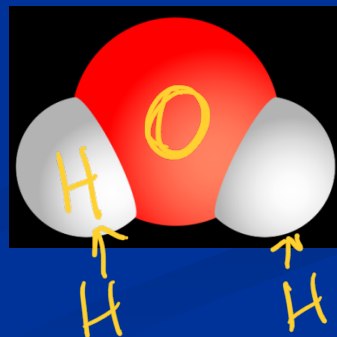
- “pure” substance
- Can't be broken down by “ordinary” means to another substance indivisible
- Ex. hydrogen (H), nitrogen (N), *“atomos”*

Compound

- 2 or more different elements combined in a fixed ratio

Ex. $\boxed{\text{H}_2\text{O}}$, CO_2

$\text{O}_2 \rightarrow \text{element}$ $\text{O}_3 \rightarrow \text{element}$



Elements of Life

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

carbon C hydrogen H
oxygen O nitrogen N

Hint: Remember **CHNOPS**

phosphorus sulfur

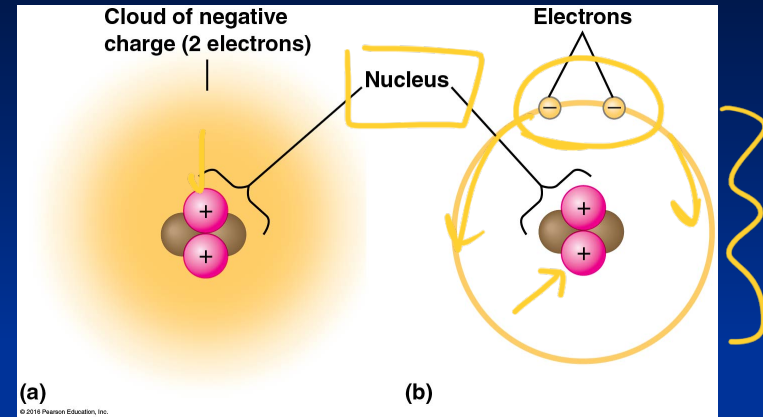
Table 2.1 Elements in the Human Body

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

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

- Atom = smallest unit of matter that retains properties of an element
- Subatomic particles:
atom is mostly empty space

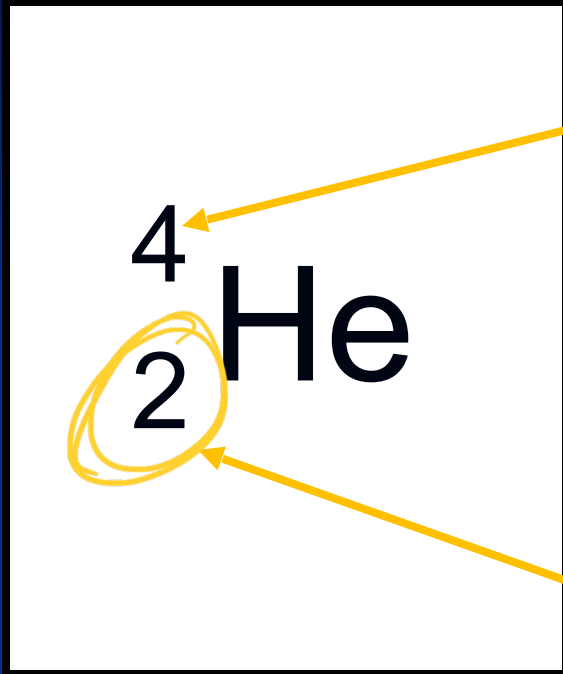


	Mass (dalton or AMU)	Location	Charge
<u>neutron</u>	1	nucleus	0
proton	1	nucleus	+1
electron	negligible $\frac{1}{2000}$	shell	-1

keep positive protons in nucleus

$^{130}_{50}\text{Lu}$ protons 50, neutrons 80, electrons 50

mass number (big)
Mass # (protons + neutrons)



Helium $\left[\begin{array}{l} 200 \\ 80 \end{array} \right] \text{So}$ protons 80
neutrons 120
electrons 80

atomic number
Atomic # (protons or electrons)

He 2 protons

$4 - 2 = 2$ neutrons

2 electrons

in a neutral atom

$$\#p^{\oplus} = \#e^{\ominus}$$