

Chapter Two: The Chemistry of Life

Lesson 2.1: The Nature of Matter

Atom: the basic unit of matter

- Started with the Greek philosopher Democritus
 - He called the smallest fragment of any substance an atom
 - *Atomos* which means unable to be cut
- Made up of subatomic particles:
 - Protons:
 - Similar mass to the neutrons
 - Positively charged
 - Found in the nucleus – center of the atom
 - Neutrons:
 - Similar mass to the proton
 - Neutrally charged
 - Found in the nucleus – center of the atom
 - Electrons:
 - Incredibly smaller compared to proton and neutron
 - Negatively charged
 - Space surrounding the nucleus – electron cloud
 - Atoms have equal numbers of protons and electrons. This makes the atom electrically neutral.

Element: a pure substance that consists entirely of one type of atom

- Written with either 1 or 2 letters to resemble the symbol
- Atomic number: the number of protons in the nucleus of the atom

Number letters	element	Symbol	Atomic Number	Protons	Neutrons	Electrons
1 st letter only	Carbon	C	6	6	6	6
1 st and 2 nd letter	Helium	He	2	2	2	2
1 st and 3 rd letter	Chromium	Cr	24	24	28	24
Greek letter	Sodium	Na (Natrium)	11	11	12	11

99% of living things are composed of 6 elements:

- | | | |
|------------|-------------|---------------|
| 1. Calcium | 2. Carbon | 3. Hydrogen |
| 4. Oxygen | 5. Nitrogen | 6. Phosphorus |

Isotopes: atoms of the same element that differ in the number of neutrons

- Mass number: the total number of protons and neutrons in the nucleus of the atom
- Atomic mass: the weighted average of all naturally occurring isotopes of a particular element on Earth
- Isotopes have different masses, but their chemical properties are the same

Isotope	Protons	Neutrons	Electrons
Carbon-12 nonradioactive	6	6	6
Carbon-13 nonradioactive	6	7	6
Carbon-14 radioactive	6	8	6

Radioactivity:

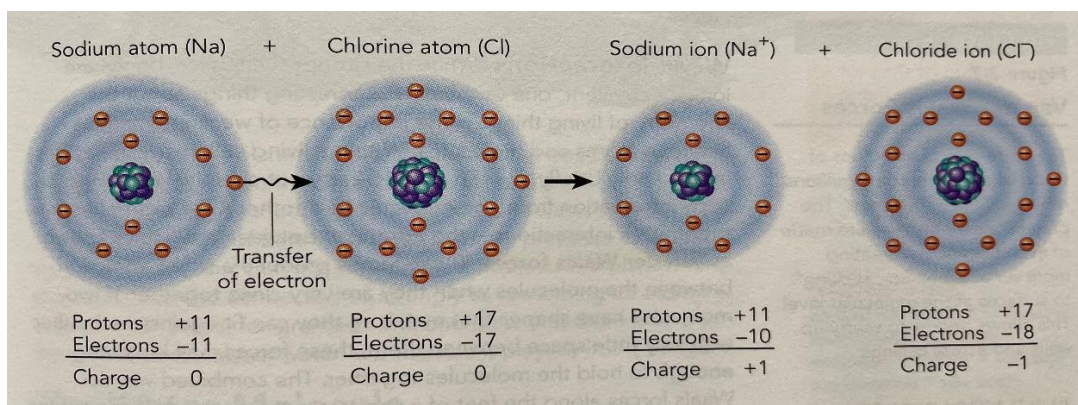
- Used to date rocks in the Earth
- Used to detect cancer
- Used for medical procedures as tracers for movement in the body (Barium)

Compound: a substance formed by the chemical combination of two or more elements in definite proportions

- Written as a chemical formula
 - Salt is NaCl or sodium chloride
 - Water is H₂O or dihydrogen monoxide

Chemical bonds: electrons that hold the elements together

- Held together with valence electrons – outer shell electrons in an atom
- **Ionic bond:** formed when one or more electrons are transferred from one atom to another
 - A neutral atom that loses an electron becomes positively charged called a positive **ion**
 - A neutral atom that gains an electron becomes negatively charged called a negative **ion**



- **Covalent bond:** formed when two atoms share electrons between both atoms
 - 2 electrons shared = single bond
 - 4 electrons shared = double bond
 - 6 electrons shared = triple bond
 - **Molecule:** the structure that forms when atoms are held together by covalent bonds