

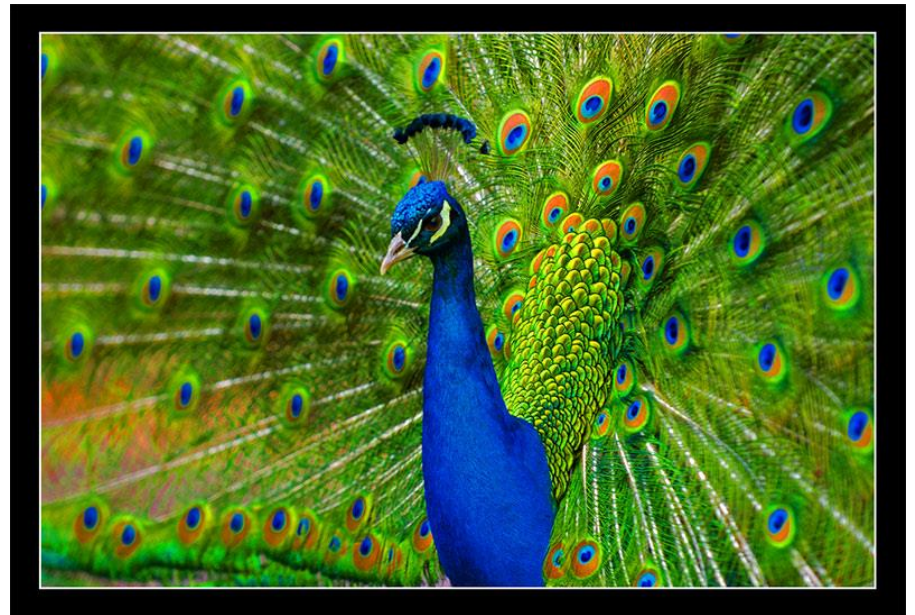


The Nature of Matter

Chapter 2-1

What is matter?

- Anything that takes up space
- Anything that has mass
- Amount of matter determines mass of the object



Properties of Matter

- Physical properties: can be observed without changing the substance
 - Brown and orange with blue and black spots
 - Less dense than water
 - soft
 - iridescent



Properties of matter, cont.

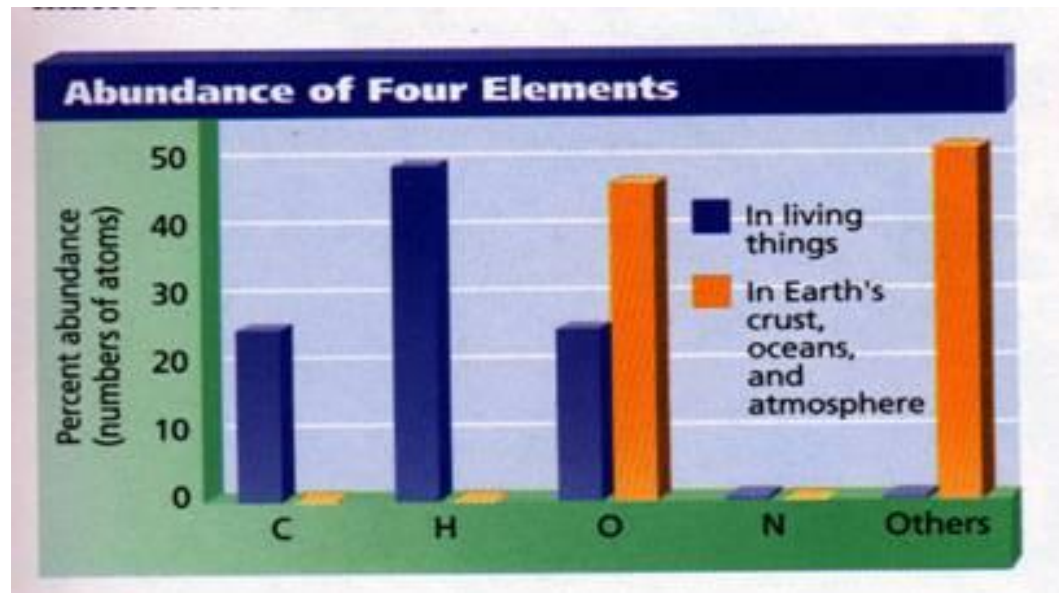
- Chemical properties: describes how a substance reacts with other substances
 - Granite does not react with other substances
 - Copper will react with oxygen to form copper oxide



What is matter made of?

■ Elements

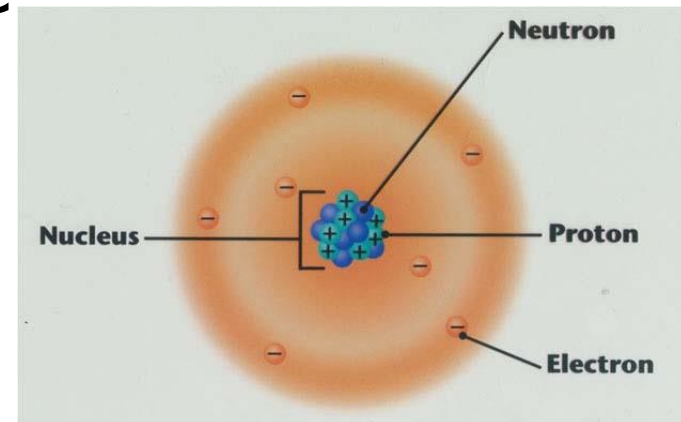
- purest form of a substance
- Characteristic set of physical and chemical properties



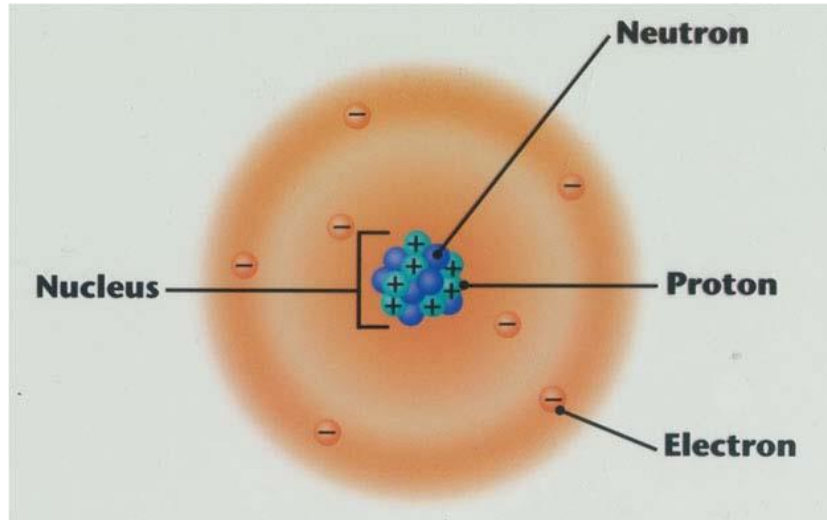
What are elements made of?

■ Atoms

- Smallest unit of an element
- Contains all the properties of an element
- 92 different types of atoms occur in nature
- Arranged on the periodic table

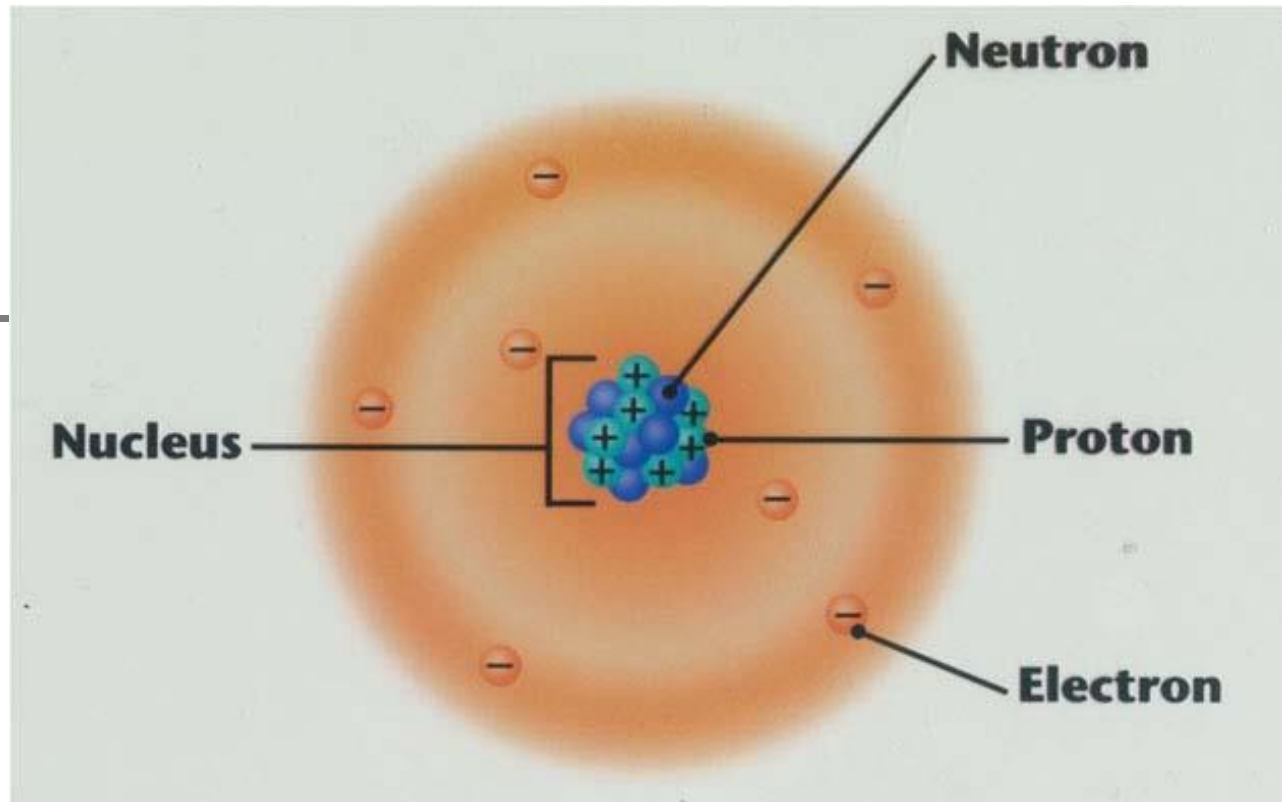


Parts of an atom



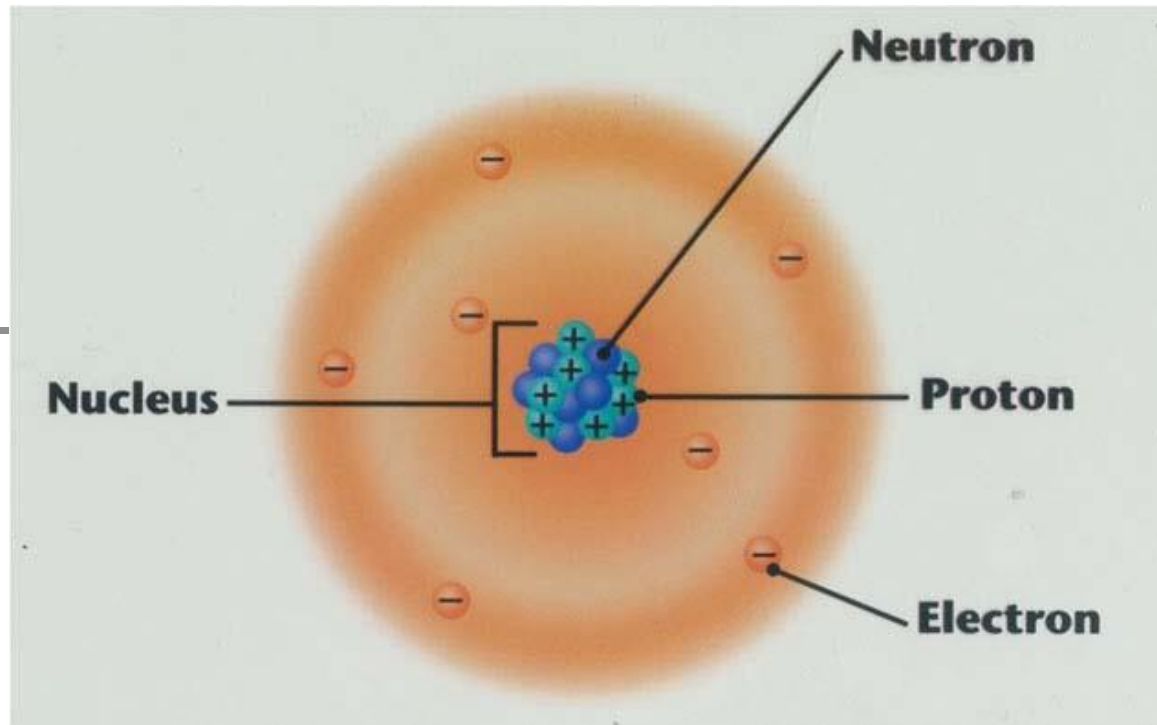
■ Proton

- Found in the nucleus
- Positive charge (+)
- Mass = 1 amu (atomic mass unit)



■ Neutron

- Found in the nucleus
- No charge (0)
- Mass = 1 amu



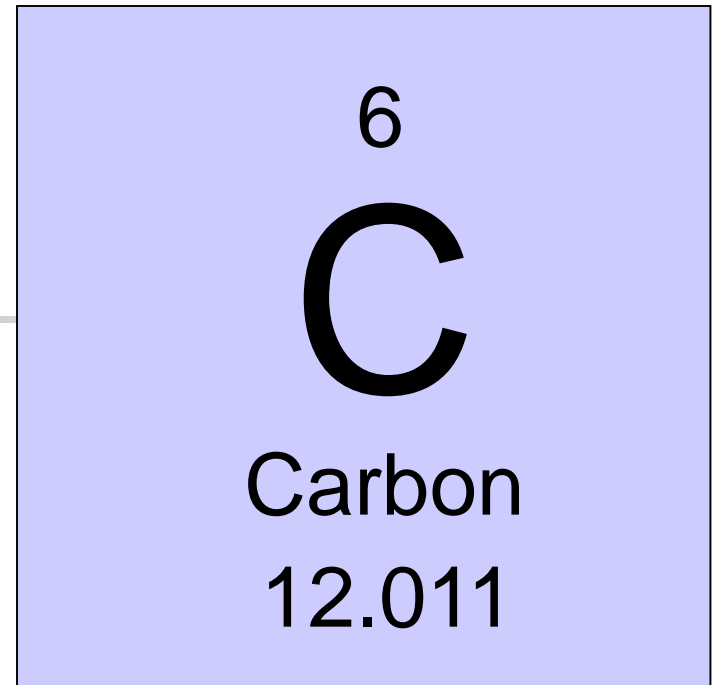
■ Electron

- Zoom all around the outside of the nucleus
- Negative Charge (-)
- Mass = $1/1000$ of a proton



Atomic Number

- Number of Protons
- An atom is neutral
- Equal number of protons and electrons
- Carbon (6): 6 protons, 6 electrons





Atomic Mass

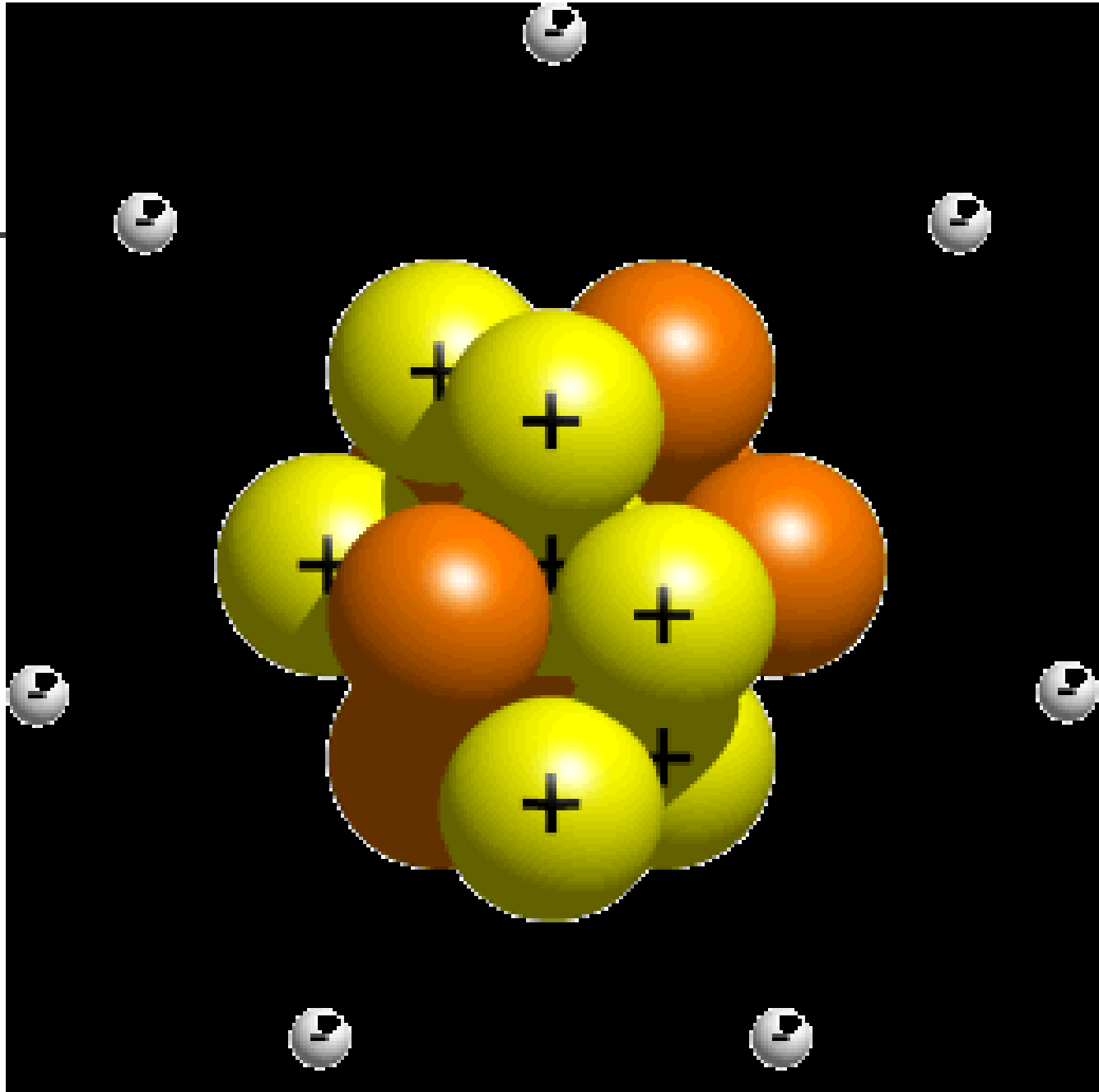
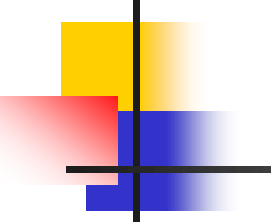
- Mass = protons + neutrons
- Carbon: Atomic # 6 (6 protons)

$$\text{Mass} = 12$$

$$\text{Mass} - \text{Atomic Number} = \text{Neutrons}$$

$$12 - 6 = 6$$

6 protons, 6 electrons, 6 neutrons





Periodic Table

6

C

Carbon

12.011

16

S

Sulfur

32.066



Periodic Table

54

Xe

Xenon

131.29

83

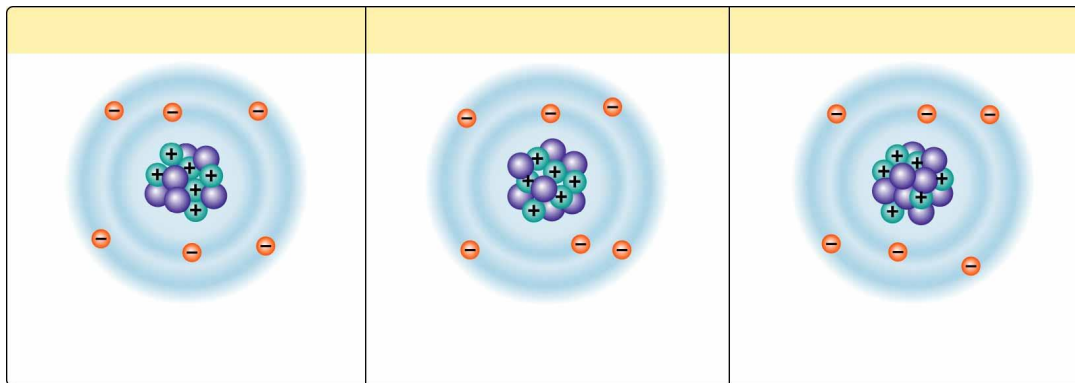
Bi

Bismuth

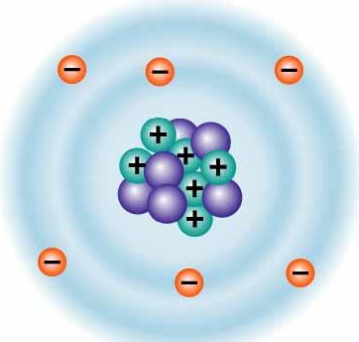
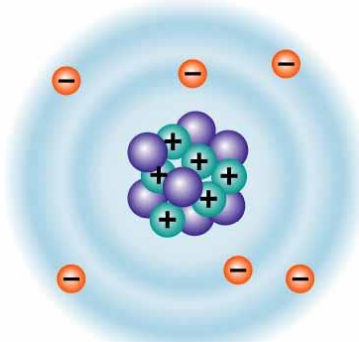
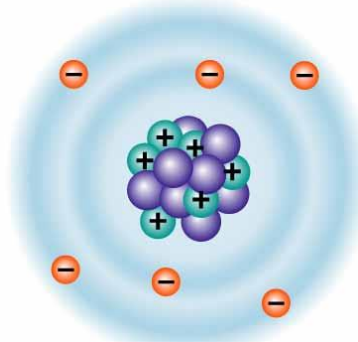
208.980

Isotopes

- Atoms of the same element with different number of neutrons
- Same number of protons
- Same number of electrons so they have the same chemical properties



Carbon Isotopes

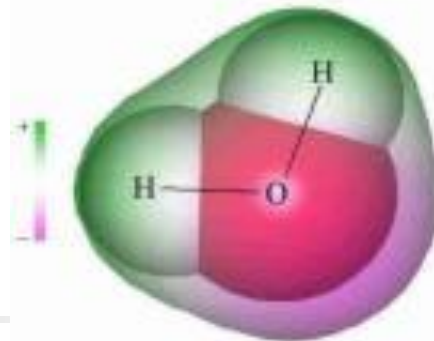
Nonradioactive carbon-12	Nonradioactive carbon-13	Radioactive carbon-14
 <p data-bbox="388 1011 575 1125">6 electrons 6 protons 6 neutrons</p>	 <p data-bbox="948 1011 1136 1125">6 electrons 6 protons 7 neutrons</p>	 <p data-bbox="1501 1011 1688 1125">6 electrons 6 protons 8 neutrons</p>



Radioactive Isotopes

- Nuclei break down at a constant rate
- Give off radiation
- Used to date rocks and fossils
- Used to treat cancer
- Used to kill bacteria
- Used as “tracers” which follow movement of substances in organisms

Chemical Compounds



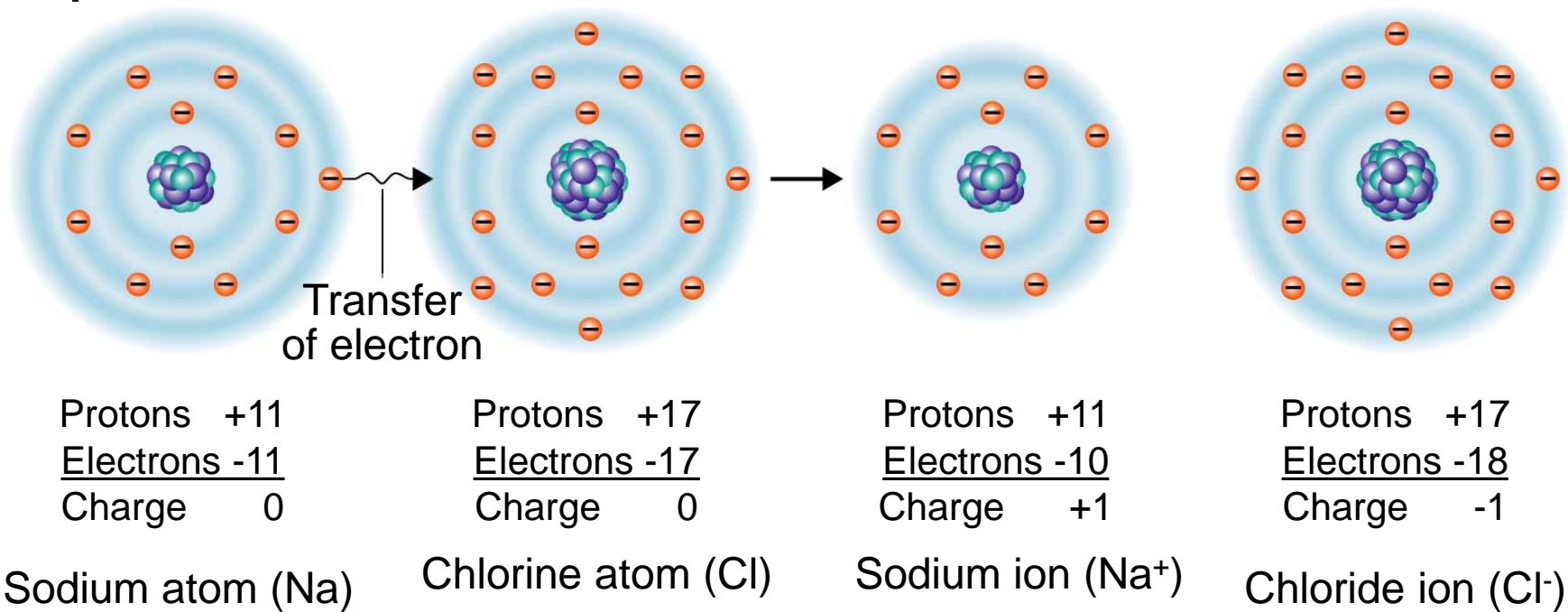
- Two or more elements chemically combined
- Always in definite proportions
- H_2O = 2 atoms of hydrogen bonded to 1 atom of oxygen
- Chemical properties of elements are different than those of the compound



Ionic Bond

- One or more electrons are transferred from one atom to another
- Atom that loses the electron becomes a positive ion
- Atom that gains the electron becomes a negative ion
- Positive and negative ions are strongly attracted to each other

Ionic bond

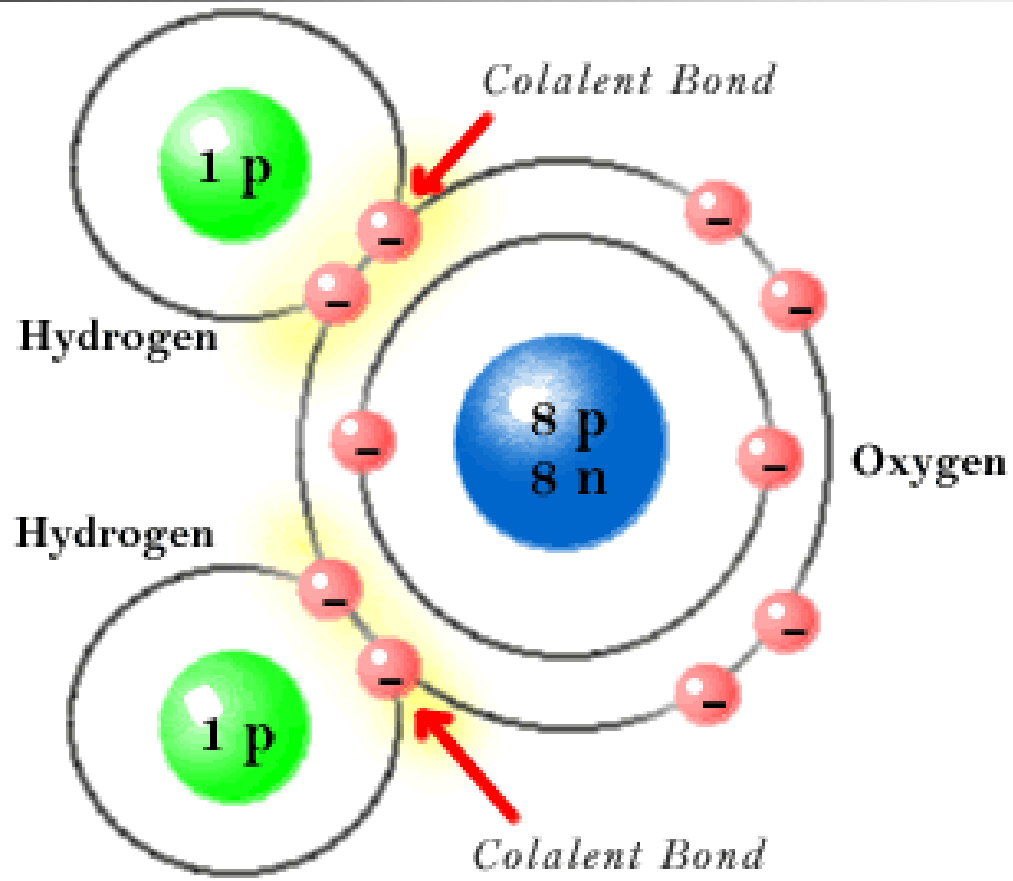




Covalent Bond

- 2 or more electrons are shared between 2 atoms
- 1 shared pair = single bond
- 2 shared pairs = double bond
- 3 shared pairs = triple bond
- Smallest unit is a molecule

Covalent Bond



Bohr Model of H_2O

Van der Waals Forces

- Atoms do not share electrons equally
- Molecules have regions of positive or negative charge
- Slight attraction between oppositely charged regions of nearby molecules.

