The Structure of Matter

CHEMICAL BONDING AND NAMING

The Danger of Dihydrogen Monoxide

- Colorless and odorless
- Found in caustic chemicals such as sulfuric acid, Nitroglycerine and Ethyl Alcohol.
- Can cause death by suffocation
- Contained in many explosives and corrosives

The Danger of Dihydrogen Monoxide

Dihydrogen – H_2

Monoxide – O

$$H_2O$$

How do compounds and molecules form?

What is a compound?

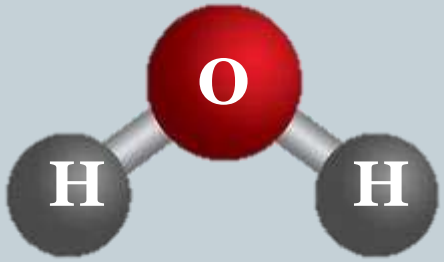
Chemical Bonds: The forces that hold atoms and ions together. (Interactions between the protons and electrons). Atoms bond so that they may have a stable outer energy level.

Chemical Structure: the arrangement of the atoms in a substance

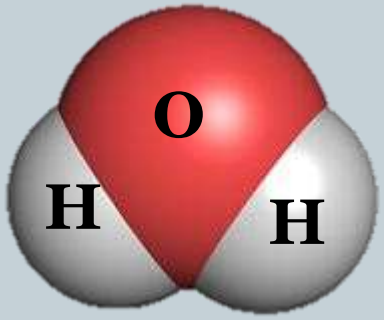
Bond Length: the average distance between the nuclei of two bonded atoms

Bond Angle: the angle formed by two bonds of the same atom

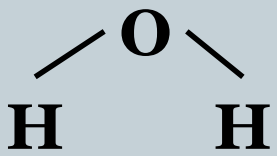
Structural Models



Ball and Stick



Space Filling



Structural

Structural Models

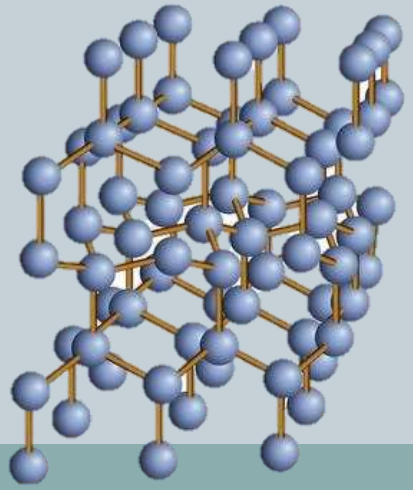
We often see the straight, solid bar, but the bond is more like a spring.

Chemical Structure

Network Structure: strong solids

high boiling/melting points

it takes a great deal of energy to break these bonds



The 2 types of Bonds

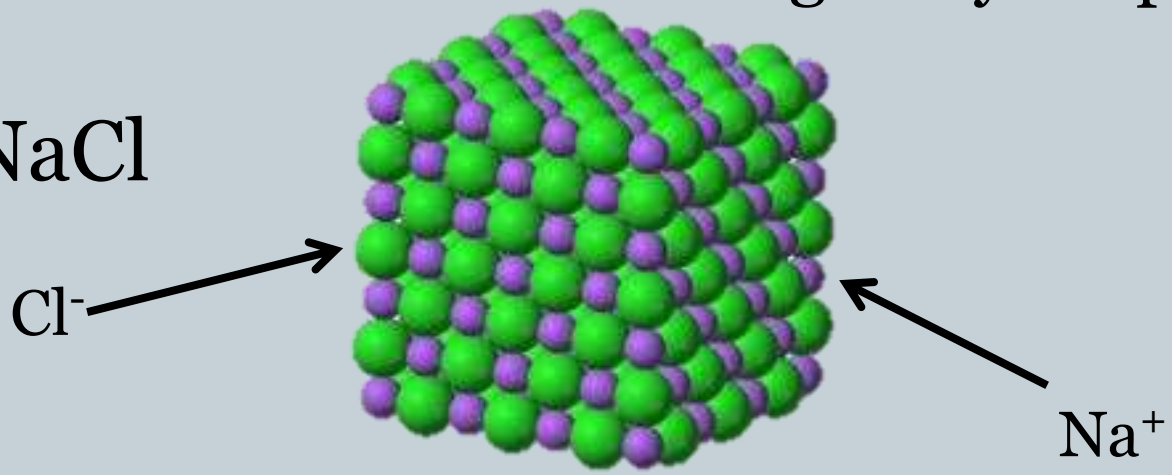
Ionic Bond: the bonding of positively charged ions (cations) and negatively charge ions (anions).

- Metal / non-metal
- Formed by the transfer of electrons
- Network of bonded ions
- Good Conductivity
- Generally Solid at room temp
- High Melting and boiling points

Chemical Structure of an Ionic Compound

Bonded Ions: Ions that form regularly shaped crystals

NaCl



The 2 types of Bonds

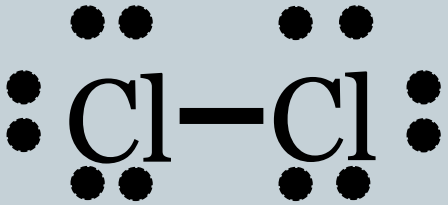
Covalent Bond: the atoms in a covalent bond share electrons.

- Non-metal / non-metal
- Formed by the sharing of electrons
- poor Conductivity
- Solid, liquid, or gas at room temp
- Low Melting and boiling points

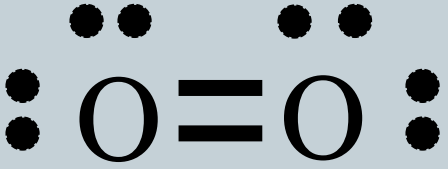
Covalent bond Structure

Non-Polar
Covalent Bonds

Cl_2



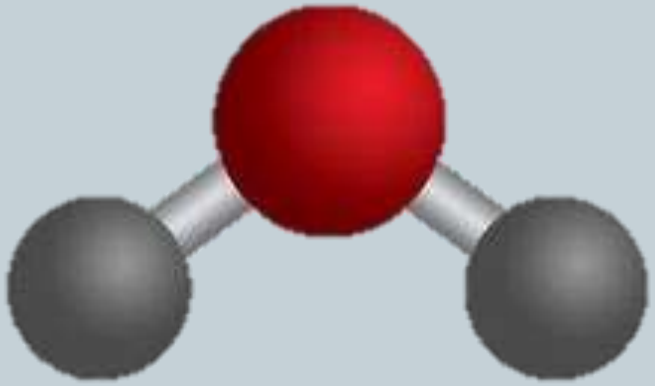
O_2



N_2

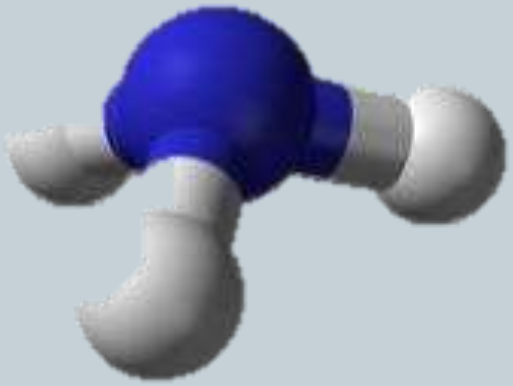
Polar Covalent Bonds

Water is polarized!!



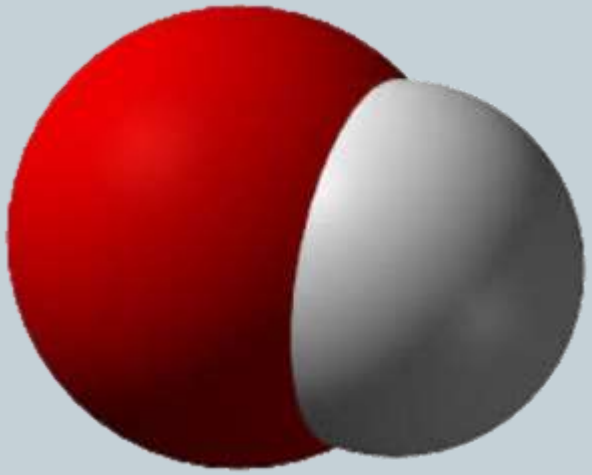
Polyatomic Ions

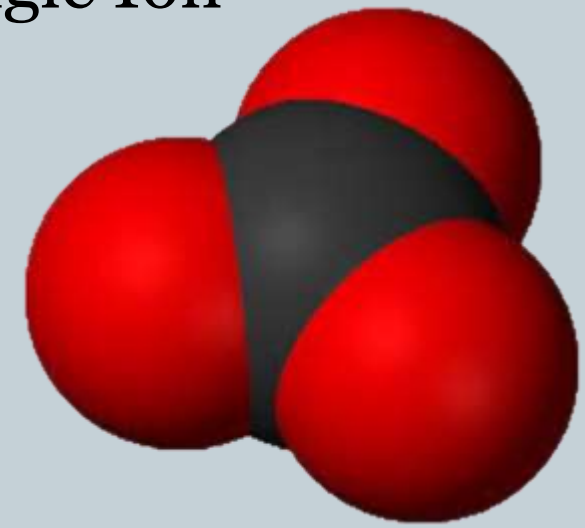
Polyatomic Ions: Multi-atom molecules (covalent bonds) that act as a single Ion



Amonia, NH_4^+

Hydroxide, OH^-





Carbonate, CO_3^{2-}

Naming Compounds: Ionic

The name of an ionic compound is simply the names of the elements that it consists of!!

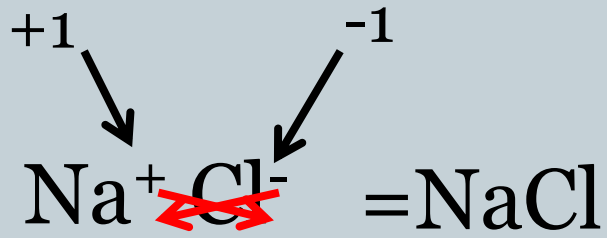
In general the Cation is named first

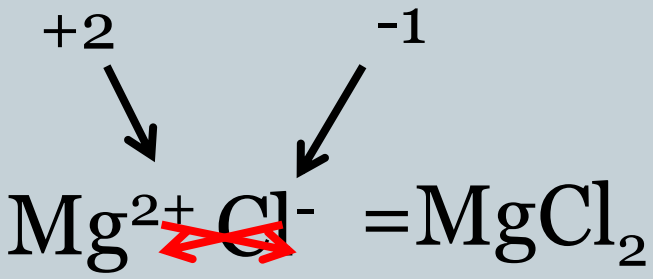
NaCl: Sodium Chloride

$MgCl_2$: Magnesium Chloride

Naming Compounds: Ionic

- Ionic Compounds must have a total net charge of 0!!





Naming Compounds: Covalent

Numerical Prefixes tell how many atoms of each element there are in the molecule.

N_2O_4=Dinitrogen tetroxide

H_2O=Dihydrogen Monoxide (Water)

Common Prefixes Use in Chemical Nomenclature

Prefix	Meaning
Mono-	1
Di-	2
Tri	3
Tetra-	4
Penta-	5
Hexa-	6
Hepta-	7
Octa-	8
Nona-	9
Deca-	10

Naming Compounds: Covalent

Formulas are determined by empirical formulas.

Empirical Formula: the composition of a compound in terms of the relative numbers and kinds of atoms in the simplest ratio.

Important Types of Compounds

- Organic Compound: covalently bonded compound containing carbon.
  - Glucose: $C_6H_{12}O_6$

- Polymers: a molecule that is a long chain mad eup of smaller molecules
  - Polyethylene: C_2H_4 is repeated