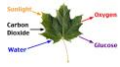
## Why is chemistry important?




Chemistry is related to Biology because all the processes that go on in our world and in your body are a result of chemical reactions.

- photosynthesis
- digestion
- metabolism

**Biochemistry**: chemistry of living organisms

## Everything around us is made up of matter .

Matter: anything that has mass and volume

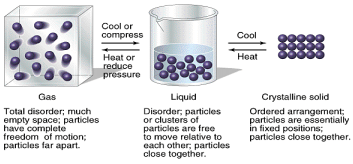
Mass: amount of matter in an object

Volume: amount of space and object takes up

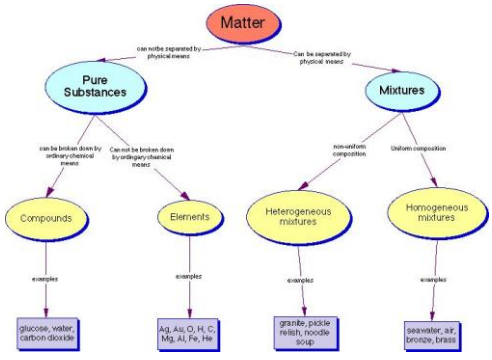
Weight: force of gravity on mass

## States of matter

1. Solid
2. Liquid
3. Gas




## Classification of Matter



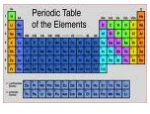

## Classification of matter

**I. Pure substances**: a substance that is identical throughout

A. **Element**: composed on only one type of atom
Ex: Na, Pb, Cl, etc …….

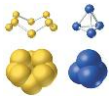
- represented by symbols (from Latin)

| Ex: | lead | Pb | plumbus |
|---|---|---|---|
| | Sodium | Na | natrium |
| | Iron | Fe | ferrum |




B. **Compound**: two or more elements chemically combined in a definite proportion

Ex: $H_2O$, $H_2O_2$
$CO_2$, CO
$O_2$, $O_3$



II. **Mixture**:
two or more substances (element or compound) mixed but not chemically combined, can be separated

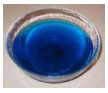
Ex: salt water – boil off water and collect salt

Ex of mixtures: salad dressing, rocks, sand, water, blood, earth's atmosphere

## Two types Mixtures

A. **Solution**: mixture where substances are equally distributed and appear as one substance

Components of a solution



**Solute**: substance being dissolved

**Solvent**: substance doing dissolving
ex: ice tea mix in water
ex: 0.85% NaCl in plasma (water component of blood)

**Aqueous solution**: water is UNIVERSAL SOLVENT

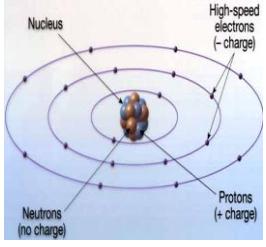
## Structure of the Atom

**Atom**: basic unit of matter, pure substance

Subatomic structure

1. **Protons** – positive, inside nucleus
2. **Neutrons**- neutral, inside nucleus
3. **Electrons**- negative, outside nucleus

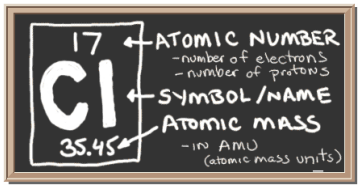
**Atomic number = protons**
**Protons = Electrons**
**Atomic mass = protons + neutrons**




## Identifying Elements

**Symbol**: letter or letters that represent element

**Atomic Number**: identifies element




**Isotopes**: different form of the same element due to different number of **neutrons**

- most radioactive (elements with unstable nuclei which break down and emit particles)

Ex: $C_{12}$, $C_{13}$, $C_{14}$
6 protons 6 protons 6 protons
6 neutrons 7 neutrons 8 neutrons

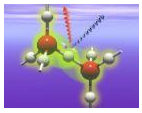

## Uses of Isotopes

- Study age of fossils and rocks ($C_{14}$)
- Radiation therapy
- Medical tests:

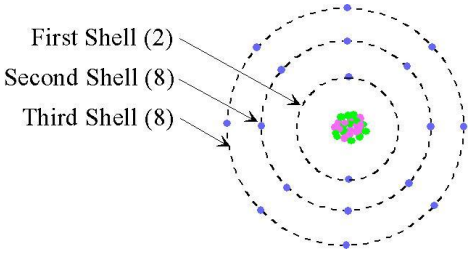
# Bonding

**Chemical bond**: process if joining atoms in a compound

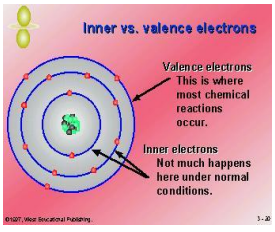
- Electrons are subatomic particles involved in bond
- Goal of bond: to complete outer shell and become stable
- To form a compound, electrons:
  - gain
  - lose
  - share



# Bonding Basics




# Bonding Basics




- Atoms try to fill valence shell (orbital) to become stable
- H and He: need 2 valence electrons
- All other atoms: need 8 valence electrons
- **Metals lose electrons**
- **Non metals gain electrons**

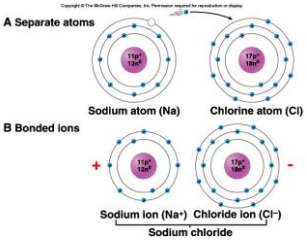
# Result of Bonding

**Compound**: two or more elements chemically joined in a definite proportion

$Na + Cl = NaCl$


$H_2 + O_2 = 2H_2O$


# Types of Bonds

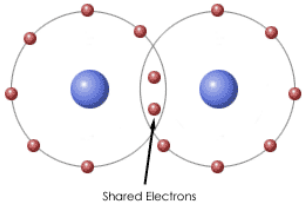



1. **Ionic**:
   transfer of electron between metal and non metal
   - metal gives electrons to non metal
   - i**ons** (charged atoms) formed

     Ex: NaCl, $MgBr_2$
   - strong magnetic attraction keeps compound together

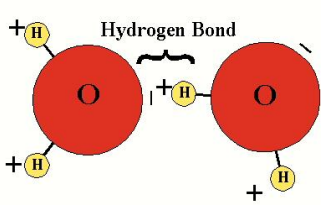
# Types of Bonds

2. **Covalent**:
   two non metals share electrons
   - called **molecules**
     ex: H2O, CO2
   - interparticular forces keep atoms together



## Types of Bonds

3. **Hydrogen**:
   weak chemical attraction between polar molecules



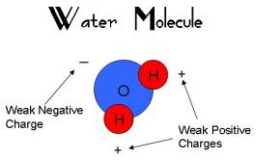

**WHENEVER BOND IS FORMED A CHEMICAL CHANGE TAKES PLACE**

**Chemical reaction (change):**
process in which a chemical change occurs due to bonding

Ex: decaying of apples digestion of food
burning of coal decomposition of plants
rusting of iron

**EVERYTHING THAT OCCURS IN LIVING ORGANISMS IS A RESULT OF CHEMICAL REACTIONS.**

## Properties of Water

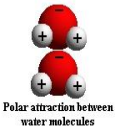



1. **Polar molecule** (polarity)
   Will carry or dissolve other substances in it which are vital for life.

   - **Hydrophilic**: substances that dissolve rapidly in water
   - **Hydrophobic**: substances that are insoluble in water

**Cohesion/Adhesion**

- **Cohesion**: attraction of water to water
- **Adhesion**: attraction of water to other materials
  - oxygen end: negative charge
  - hydrogen end: positive charge


Polar attraction between water molecules

3. **Surface Tension**: cohesion of water molecules at its surface

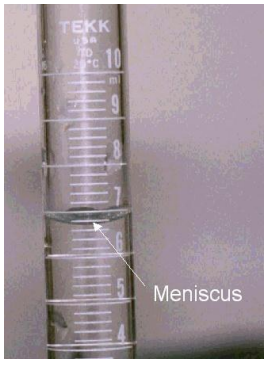
   - Water pulls itself into a bead

4. **Capillary Action**
   adhesion of water molecules to other substances

   Ex: meniscus

   plants pull water into themselves

   water "climbing" up a straw



**5. Stores heat efficiently**

- retains its heat longer than many other substances

- this property keeps temperature constant in order support life on land and in water

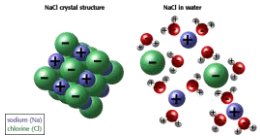
## IONS AND LIVING CELLS

**Salt** is a very important polar molecule.

- When mixed with water, the ionic bonds are broken and the Na and Cl ions separate

- The charged ends of each ion are attracted to the polar ends of water

- This is very important because ions such as Na, Cl, K, and Ca are involved in many reactions inside the cell



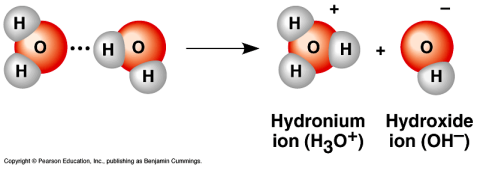

### Ionization

Process of water (non-ionic) being converted into ions

**Result:**

Separate H+ and OH- ions

H+ combines with water to make H3O+ ion






**pH:** number of H ions in a solution

**Acid**: any compound that releases H ions into water

ex: hydrochloric acid in water

HCl → H+ + Cl-

**Base**: compound that releases OH- ions into water

ex: NaOH → Na+ + OH-

- **Neutralization reaction**: production of $H_2O$ from mixture of strong acid and base

| | | | |
|---|---|---|---|
| neutral | H | = | OH |
| acidic | H | > | OH |
| basic, alkaline | H | < | OH |

**Buffer**

Solution which resists changes in pH

Important in maintaining pH in organisms

## The pH scale

**Acid**: below ph 7 (more H ions)

**Base**: above pH 7 (more OH ions)

IMPORTANCE OF PH:

- most reactions in organisms can only occur with enzymes
- enzymes very pH specific