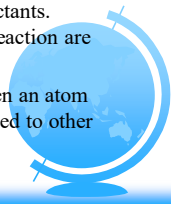
General Information

- A chemical reaction is a process in which one or more substances are converted into new substances that have different physical and chemical properties.
- In a chemical reaction, those substances present before the reaction are called the reactants. Substances produced in a chemical reaction are called the products.
- A chemical reaction takes place when an atom can find a more stable way to be joined to other atoms.



Chemical Equations

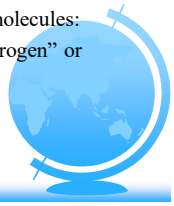
- Scientists represent chemical reactions in chemical equations. Chemical equations can be in words or in formulas.
- In writing equations, many times it is important to know the state of the atom or molecule you are working with.
- To show this, we use the following abbreviations:
  - (l) - liquid (g) - gaseous
    (s) - solid (aq) - aqueous
- Aqueous means dissolved in water.

Diatomic Elements

Some elements cannot exist by themselves, even when they are isolated from any other type of atom.

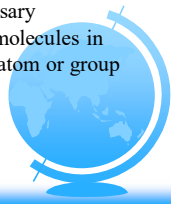
Elements of this nature will combine with atoms of the same element in order to be stable. There are eight elements that form diatomic molecules:

Three Hints: “7 that make a 7 and hydrogen” or “sneeze HNOF ↓“ or “GEN-u-INE”



Balancing Equations

- In all reactions, the Law of Conservation of Matter is adhered to. Therefore, we must have the same number of atoms of each type of element on both sides of the reaction.
- We accomplish this by placing necessary coefficients in front of the atoms or molecules in order to balance the number of each atom or group on each side of the arrow.



Examples

Balance:

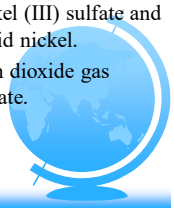
__ $Cu_{(s)}$ + __ $HCl_{(aq)}$ --> __ $CuCl_{2\ (aq)}$ + __ $H_{2\ (g)}$

__ $SrF_{2\ (aq)}$ + __ $Cu_3PO_{3\ (aq)}$ --> __ $CuF_{(aq)}$ + __ $Sr_3(PO_3)_{2\ (s)}$

Balance:

Solid calcium is mixed with aqueous nickel (III) sulfate and makes aqueous calcium sulfate and solid nickel.

Solid copper (II) oxide mixes with carbon dioxide gas (CO_2) to make solid copper (II) carbonate.



Examples

Balance:

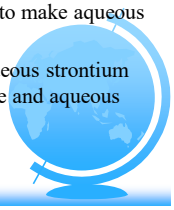
__ $Mg_{(s)}$ + __ $HI_{(aq)}$ --> __ $MgI_{2\ (aq)}$ + __ $H_{2\ (g)}$

__ $NaF_{(aq)}$ + __ $Ag_3P_{(s)}$ --> __ $Na_3P_{(aq)}$ + __ $AgF_{(s)}$

Balance:

Solid calcium is mixed with liquid water to make aqueous calcium oxide and hydrogen gas.

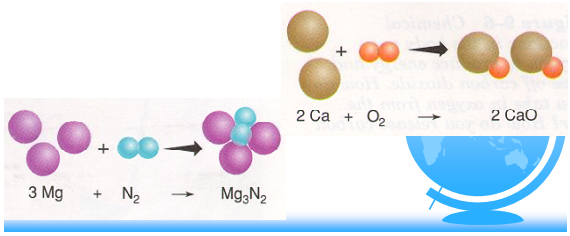
Solid cobalt (III) chloride mixes with aqueous strontium sulfide to make solid cobalt (III) sulfide and aqueous strontium chloride.



Types of Reactions

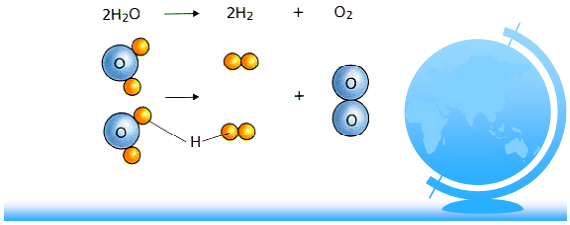
In this chemistry course, we will focus on five basic types of reactions:

1) Synthesis - two or more reactants come together to form one product.



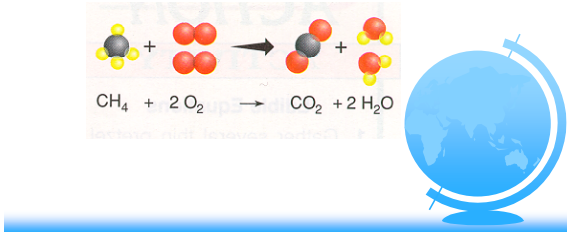
Types of Reactions

2) Decomposition - a single compound is broken down into two or more smaller compounds or elements.



Types of Reactions

3) Combustion - reactions in which a hydrocarbon is combined with O_2 and burned to always form carbon dioxide and water.



Oxidation & Reduction

The process by which a mineral is converted to a pure element is called a reduction:

Ex: $CuCl_2$ (s) ---> Cu (s) + Cl_2 (g)

In a reduction, electrons are gained by an atom or ion.

The process by which the metal is changed back into a cation is called an oxidation:

Ex: 2 Cu (s) + O_2 (g) ---> 2 CuO (s)

In an oxidation, electrons are lost by an atom or ion.

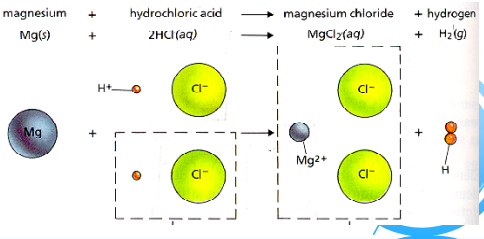
Redox Reactions

When both happen at the same time, it is called a redox reaction

EX: $CuCl_{2\ (aq)} + Mg_{\ (s)}$ ---> $Cu_{\ (s)} + MgCl_{2\ (aq)}$

Types of Reactions

4) Single Replacement - an uncombined element displaces an element that is part of a compound.



Types of Reactions

5) Double Replacement - Atoms or ions from two different compounds replace each other.