

Chemical Reactions

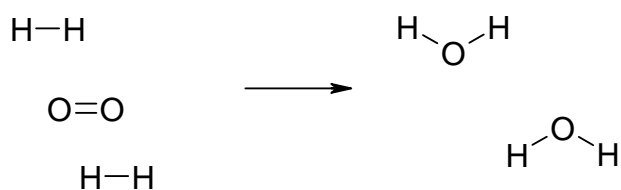
CHM 1020

Chemical Equations

Chemical change involves a reorganization of the atoms in one or more substances.

The **Hindenburg** Reaction

- Reactants are on left, products to the right.
- Arrow indicates the change



A chemical equation

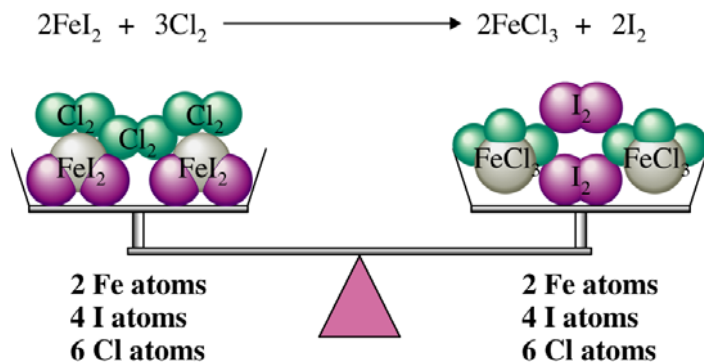
- Notice that the formula for the molecules is unchanged.
- To indicate that more than one molecule is required, use coefficients (**shown in blue**).
- The equation is balanced.



The Rules

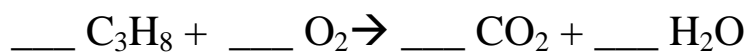
- Change only the coefficients to balance the chemical equation.
- Balance one element at a time.
- Continue to balance the other elements in the same manner.
- Adjust coefficients to the lowest whole number common multiple.
- Check your answers.

Example



Balancing Combustion Reactions

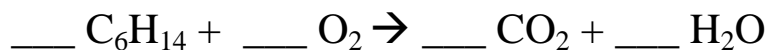
- Balance carbon first
- Hydrogen second
- Oxygen last
- Multiply by 2 if you need to.



More Balancing and Things to Avoid



- Coefficients should always have the lowest whole number ratio.
- Never Change the subscripts. 8 CO₂ is not the same as C₈O₁₆.



Go to <http://www.wfu.edu/~ylwong/balanceeq/balanceq.html> for a fun tutorial

Quantifying Chemical Reactions

Microscopic world	Macroscopic world
amu	grams
atoms or molecules	moles
1 carbon atom = 12 amu	1 mole of carbon = 12 grams
1 water molecule = 18 amu	1 mole of water = 18 grams

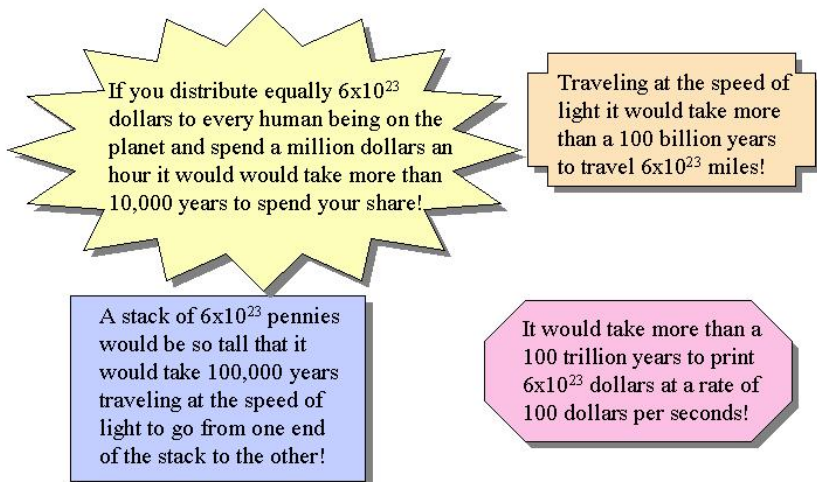
The mole (6.02×10^{23})

- A macroscopic version of the molecule defined so we can use the periodic table for the macroscopic and microscopic world.
- Defined as the number of atoms in exactly 12.0 g of carbon-12 isotope.



- This number is called **Avogadro's Number** after the Italian physicist Amedeo Avogadro (1776-1856).

How Big is a Mole



Formula Weight

- The sum of the atomic weights of all the atoms in the molecular formula, whether ionic or molecular.
- Expressed in amu/molecule or grams/mole.
- Also called molecular weight, molar mass .

A silly problem

- How many molecules are in one drop (0.0500 g) of water?

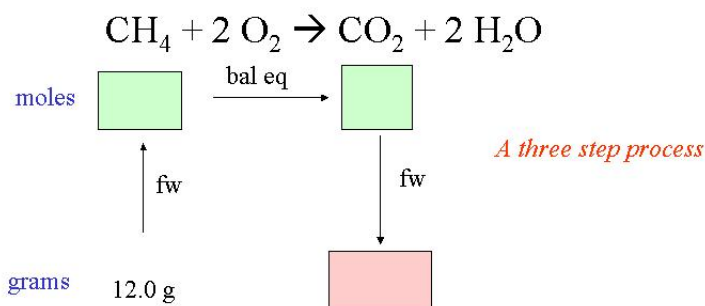
Weight relationships in reactions

•**Stoichiometry** - Study of the mass relationship between reactants and product in chemical reactions.

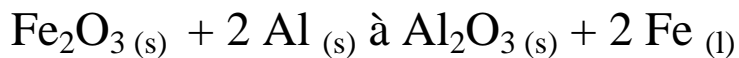
Always start with a balanced chemical equation!

1. Convert grams of A to moles of A. (Use FW)
2. Convert moles of A to moles of B. (Use Eq.)
3. Convert moles of B to grams of B. (Use FW)

How many grams of CO_2 are produced from the combustion of 12 grams of CH_4 ?



How much Al is required to react with 55.0 g of Fe_2O_3 ? (Thermite)



Describing phases

- (s) solid
- (l) liquid
- (g) gas
- (aq) aqueous (dissolved in water)

Reactions in Water (Aqueous)

- In water, when ionic compounds dissolve, they dissociate into their anions and cations.
- It is the polarity of water that allows them to do this.
- Some compounds are soluble and others are not.
- Water is very stable

Ionic compounds in water

