Balancing Reactions

2 Cracker Squares + 1 Marshmallow + 3 Chocolate Squares ⟶ 1 S'more

2 Cq + 1 Mm + 3 Ch ⟶ 1 Cq_2MmCh_3

Outcome:

S2-2-05 Investigate the Law of Conservation of Mass, and recognize that mass is conserved in chemical reactions.

S2-2-06 Balance chemical equations.

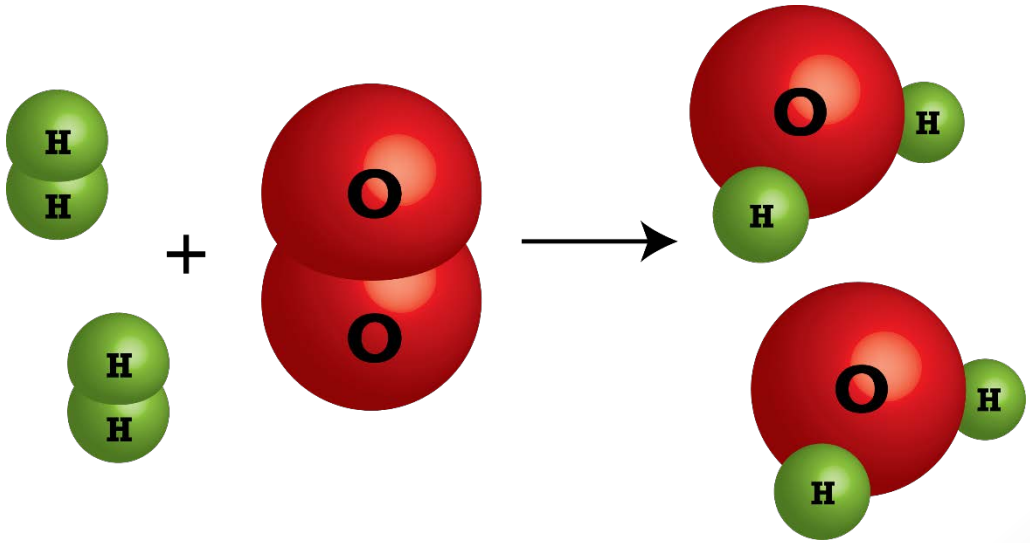
Chemical Reactions

Under certain conditions, elements and/or compounds can be mixed to create a **CHEMICAL CHANGE** (**REACTION**).

- In any chemical change **NEW SUBSTANCES** with **NEW PROPERTIES** are **PRODUCED**.
- Are different than a **PHYSICAL** change.

A chemical reaction involves the breaking and making of **BONDS**

Remember that bonds result from the giving and taking of **ELECTRONS** (ionic) or the sharing of **ELECTRONS** (covalent)



Chemical Equations

A chemical **EQUATION** describes the **PROCESS** specific **SUBSTANCES** undergo to produce **NEW SUBSTANCES**.

ALL EQUATIONS come in the general form of:

REACTANTS → PRODUCTS

- The arrow separates the reactants from the products. (the → means "**PRODUCES**")
- The reactants go on the **LEFT** side of the arrow, The products on the **RIGHT** side of the arrow

Ex) $H_2 + O_2 \rightarrow H_20$

Chemical Equations

There are two types of chemical equations:

- **WORD** equations

  Ex. ***oxygen and hydrogen produces water***

  OR

  oxygen + hydrogen → water

- **BALANCED CHEMICAL** equations

  Ex. $O_2 + 2\ H_2 \rightarrow 2\ H_2O$

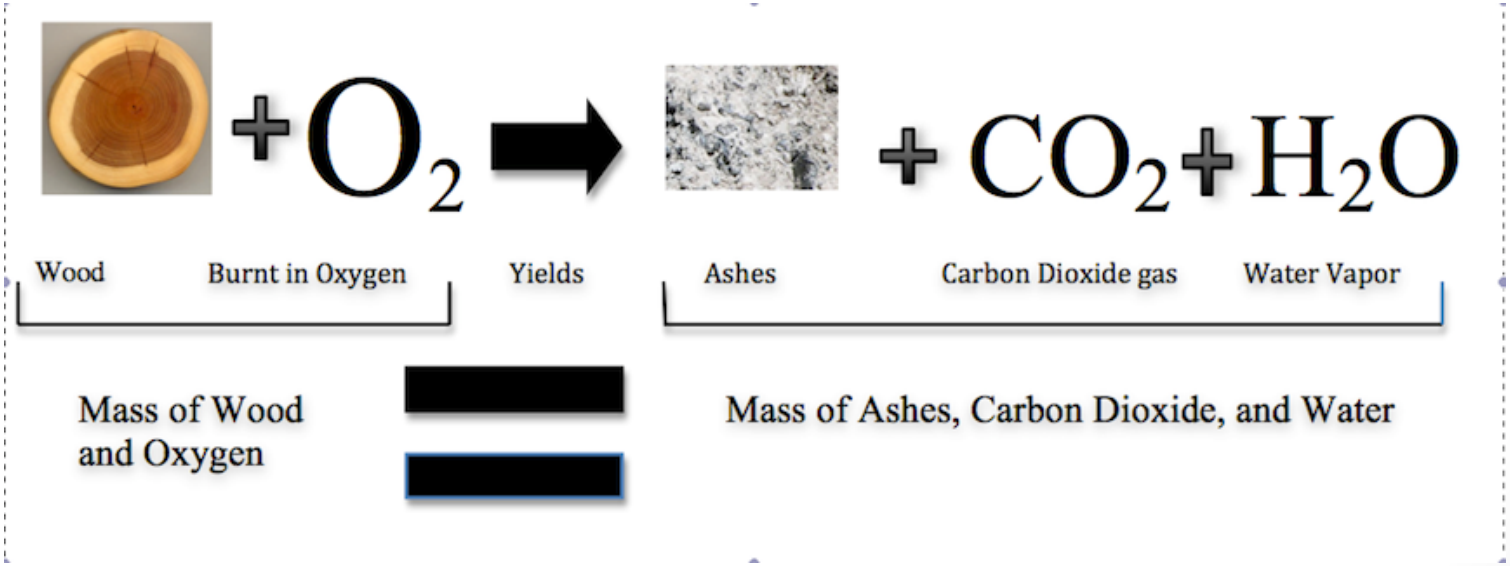
→ chemical equations that are **NOT BALANCED** are referred to as **SKELETON** equations

Law of Conservation of Mass:

The law of conservation of mass states:

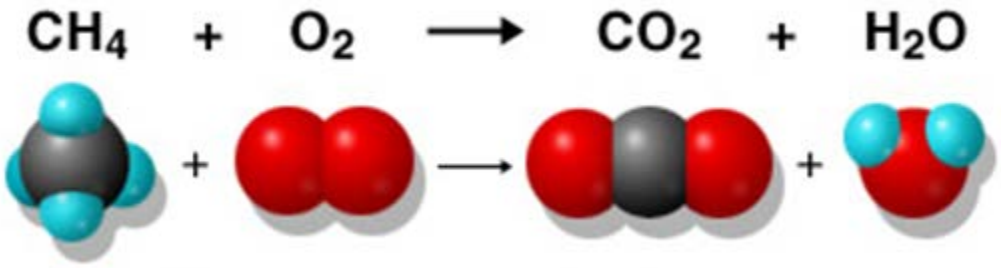
Matter cannot be created nor destroyed

Ie.)The **TOTAL MASS** of the **REACTANTS** is ***equal*** to the **TOTAL MASS** of the **PRODUCTS** in a chemical reaction.



Law of Conservation of Mass:

Consider the following reaction



Reactants		Products
1 C atom	=	1 C atom
4 H atoms	≠	2 H atoms
2 O atoms	≠	3 O atoms

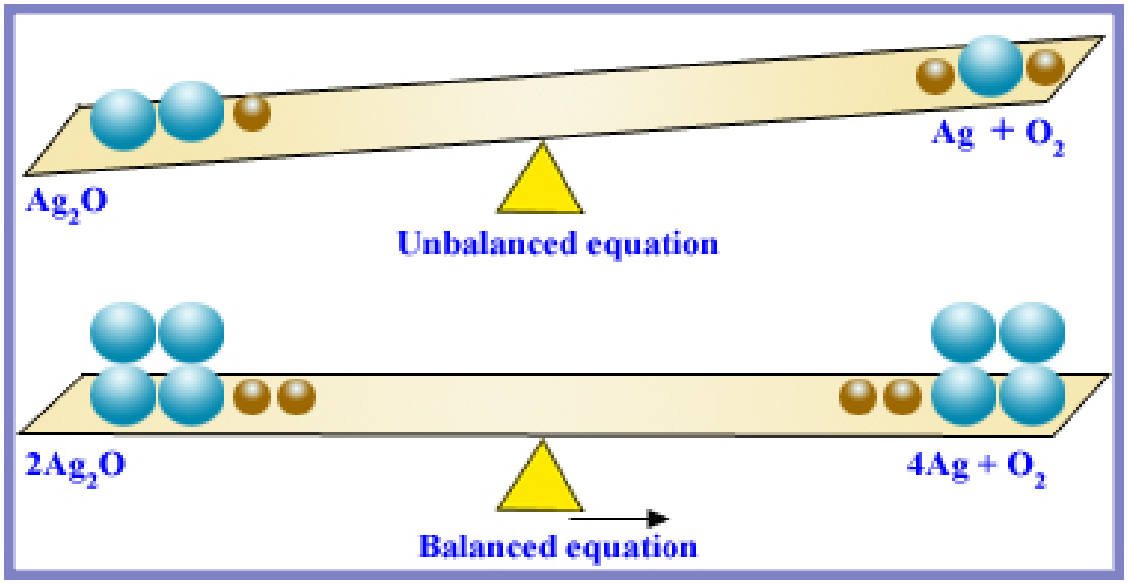
In this example, mass would have **CHANGED**, since there is a different amount of **ATOMS** on the **PRODUCTS** side….

To keep the mass constant, the same number of **ATOMS** ***of each kind of element*** must appear on each side of the equation.

→ **BALANCING!**

What is balancing?

If the mass of the reactants and products are equal, the mass would be considered “balanced”.



To balance reactions, we use coefficients…

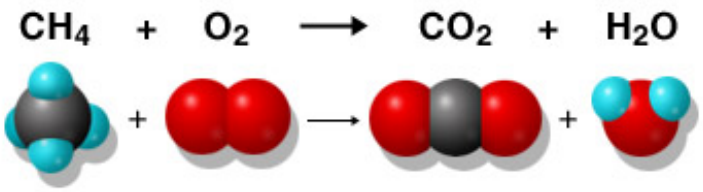
- **LARGE NUMBERS** placed in **FRONT** of chemical formulas to indicate the **TOTAL** number of **MOLECULES**

Ex) 2 H_2O

→indicates there are **TWO** molecules of water.

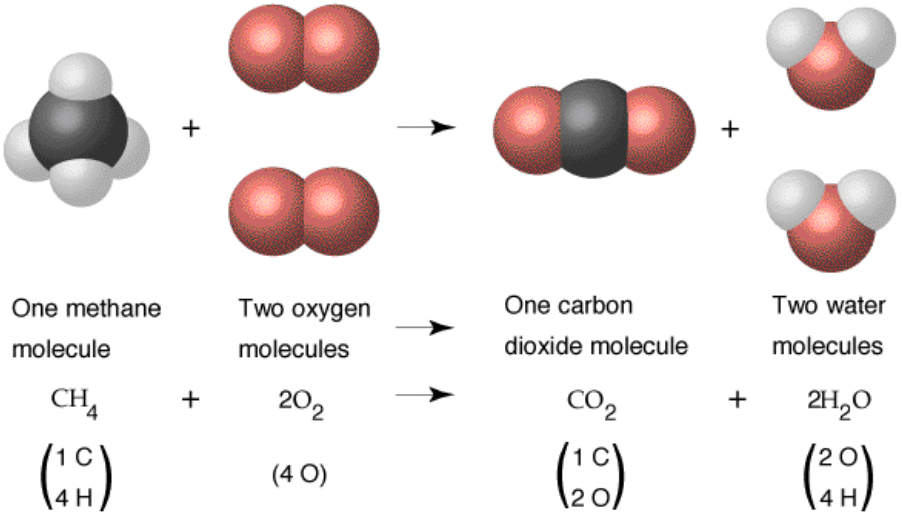
What is balancing?

Using the example from before…



Reactants		Products
1 C atom	=	1 C atom
4 H atoms	≠	2 H atoms
2 O atoms	≠	3 O atoms

By adding **COEFFICIENTS** in front of the oxygen and the water, we can balance the reaction:



Steps to Balancing Equations:

Step 1:
Determine the **REACTANTS** and **PRODUCTS** (can be tricky in word problems).

Example:
"Sodium metal combines with chlorine gas to produce sodium chloride"

Reactants → ***Sodium & Chlorine***
Products → ***Sodium chloride***

Steps to Balancing Equations:

$Na^+ Cl^-$

Step 2:

ASSEMBLE the parts of the chemical **EQUATION**, **REACTANTS** on the **LEFT**, **PRODUCTS** on the **RIGHT**, separated by an **ARROW**.

$$Na + Cl_2 \rightarrow NaCl$$

All compounds must be **NEUTRAL** (**NO CHARGE**)

Elemental gases (**DIATOMIC** molecules) must be written as such.

L HOFBrINCl

Steps to Balancing Equations:

Step 3:

- Make a **LIST** of the atoms composing **REACTANTS** and **PRODUCTS**. Both lists need to be the **SAME**!!!
- **COUNT** the number of **ATOMS** of each **ELEMENT**, and enter in the list.
- Change the **COEFFICIENTS** in the equation so you have the **SAME AMOUNT** of each **ELEMENT** on each **SIDE**.

Reacts Prods

$$\_2\_\ Na + \_\_\_\ Cl_2 \rightarrow \_2\_\ NaCl$$

Reacts	Prods
Na 1 x 2 = 2	Na 1 x 2 = 2
Cl 2	Cl 1 x 2 = 2

You must balance the equation using **WHOLE NUMBERS ONLY**. No **FRACTIONS** or **DECIMALS** allowed.

Result:

Try these ones…

$N_2 + 3H_2 \rightarrow 2NH_3$ ✓

$Mn + 2CuCl \rightarrow MnCl_2 + 2Cu$

$2H_2 + O_2 \rightarrow 2H_2O$

$3BaCl_2 + Al_2(SO_4)_3 \rightarrow 3BaSO_4 + 2AlCl_3$

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$