# Counting Atoms and Balancing Equations

# Chemical Formula

- Chemical Formula – shorthand notation to represent a compound; indicates how many of each type of atom

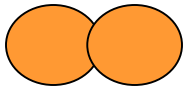
ex. $H_2O$

# Counting Atoms: Subscripts and Coefficients

**Subscript** –#atoms of the element it is to right of.
(indicates a chemical bond)

$O_2$

How many atoms are in the following compound?



$Na_2SO_4$

First identify how many elements you have.
Then list them.

Na= 2
S= 1
O= 4

(if there is no subscript written, it means it is 1)

# Coefficient (# of compounds)

**Coefficient** – the # in **FRONT** of the formula applies to **<u>ALL</u>** elements (tells you HOW much)

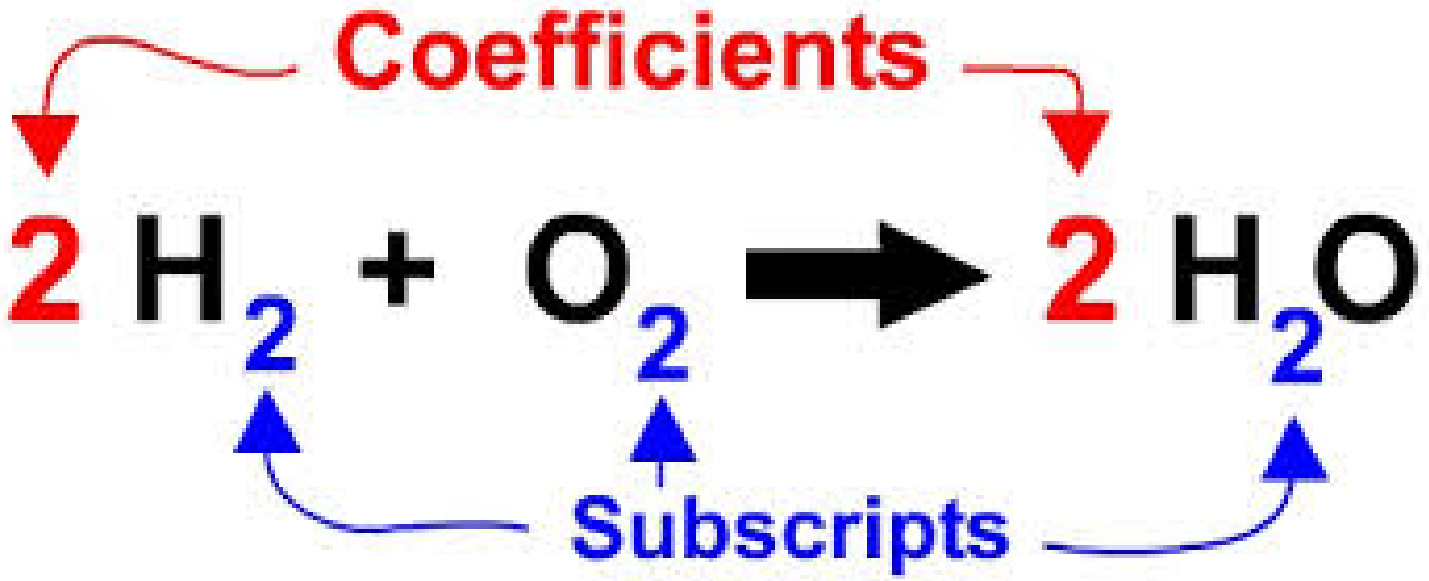
How many atoms are in the following compound?

3NaCl

There are 3 NaCl compounds ex. NaCl
NaCl
NaCl

First identify how many elements you have.
Then list them.

Na= 3
Cl= 3


Coefficients
2 H2 + O2 → 2 H2O
Subscripts

# When Counting Atoms in a Chemical Formula, **Forget** the Word Add…

- When formulas contain **both coefficients and subscripts --- MULTIPLY** the coefficient by the subscript to count the total # atoms.
- Ex.

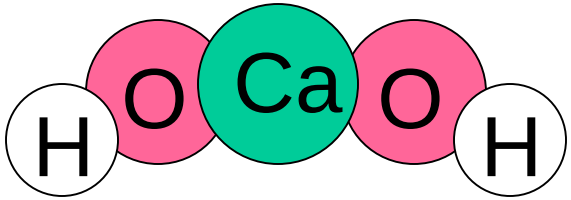
  $2H_2O$ –

  H= 2 x 2= 4 atoms

  O= 2 x 1 = 2 atoms

# Brackets

Molecules may also have brackets to indicate numbers of atoms. E.g. $Ca(OH)_2$

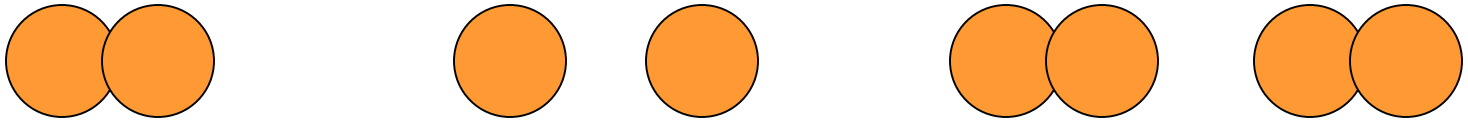



Notice that the OH is a group

The 2 refers to both H and O it is **<u>distributed</u>** to all elements in the brackets.

# How molecules are symbolized

$Cl_2$ 2Cl $2Cl_2$



- How many of each atom are in the following?
  - a) NaOH Na = 1, O = 1, H = 1
  - b) $Ca(OH)_2$ Ca = 1, O = 2, H = 2
  - c) $3Ca(OH)_2$ Ca = 3, O = 6, H = 6

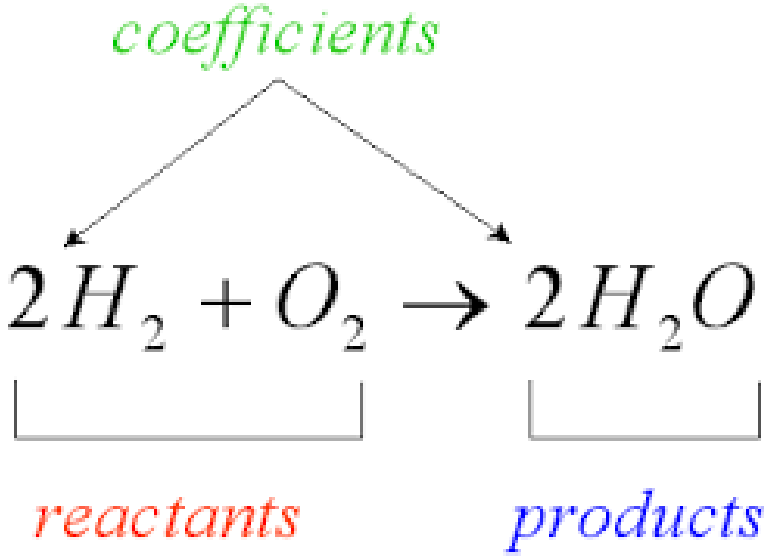
# Chemical Equations

1. A **chemical equation** is the symbolic representation of a **chemical reaction** where the elements or compounds that **react** are on the left-hand side and the elements or compounds **produced** are on the right-hand side.

Ex. $NaOH + HCl \longrightarrow NaCl + H_2O$

**REACTANTS** **PRODUCTS**

- The **plus sign** sign separates the formulas of two or more reactants or products from one another.




- The **arrow** , called the **yield** sign separates the reactants and products.

# Law Conservation Mass

- Matter can neither be created or destroyed…
- Thus, atoms are only ***rearranged*** in a chemical reaction.
- Thus, the number of a particular atom **MUST** be the same on both sides of a chemical equation.

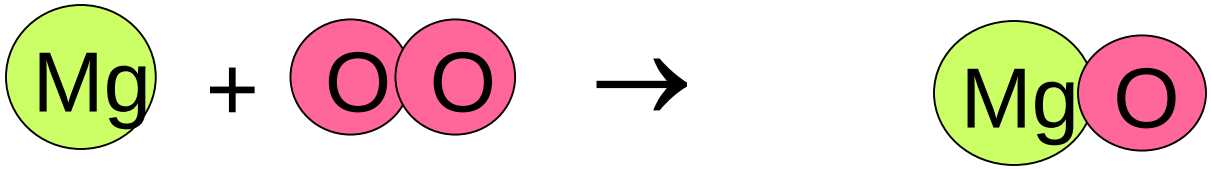
# Mass Must be Conserved!

- http://www.neok12.com/php/watch.php?v=zX567d4e457d737d75667b0a&t=Law-of-Conservation

- Where does the mass go when you “burn fat”?
- https://www.youtube.com/watch?v=C8ialLlcdcw&app=desktop

# Balancing equations: MgO

- Example: Magnesium + Oxygen
- $Mg + O_2 \rightarrow MgO$




- However, this is not balanced
- Left: Mg = 1, O = 2
- Right: Mg = 1, O = 1

# Practice # 1

$H_2 + O_2 \longrightarrow 2H_2O$

| | |
|---|---|
| H-2 | H-4 |
| O-2 | O-2 |
| Is this balanced? | No |

# Practice # 2

$2H_2 + O_2 \longrightarrow 2H_2O$

| | |
|---|---|
| H-4 | H-4 |
| O-2 | O-2 |
| Is this balanced? | Yes |

# Practice #3

$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$

| | |
|---|---|
| Fe- | Fe- |
| H- | H- |
| O- | O- |

Is this balanced?

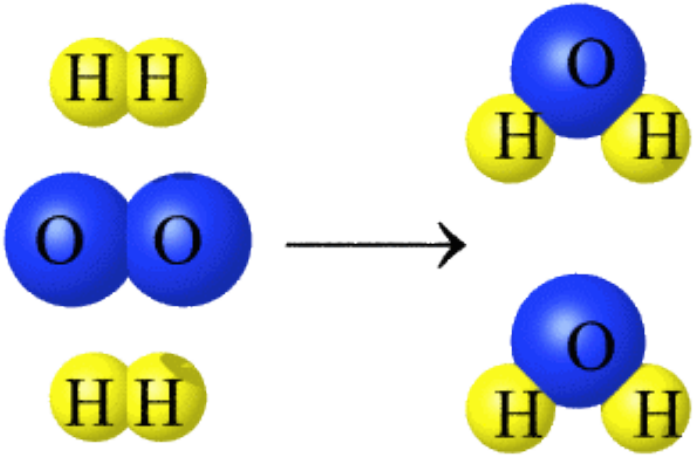
# Review

Matter is not destroyed or created

Atoms are rearranged in chemical reactions

Chemical equations represent chemical reactions

You have to have the same number of each type of atom on the left and right hand side of a chemical equation



Why do we need to balance chemical equations? The Law of Conservation of Mass of course and cool chemical reactions.

http://www.buzzfeed.com/jessicamisener/extremely-freaky-chemical-physical-reaction-gifs