Balancing Equations and Conservation of Mass

Conservation of Matter

Mass is neither created nor destroyed during a chemical reaction.

Power of 10: Law of Conservation of Matter

Law of Conservation of Mass

Conservation of Mass/Matter

- **Matter is conserved** → ***TYPE*** of atoms does not change
    - Nothing is created, nothing is destroyed

- **Mass is conserved** → ***AMOUNT*** of atoms cannot change
    - Nothing is created, nothing is destroyed

In a Chemical Reaction …

- elements can combine to form new substances
- substances can be broken down into simpler substances
- atoms are **re-arranged**, they are NOT created or destroyed

Reactants → Products

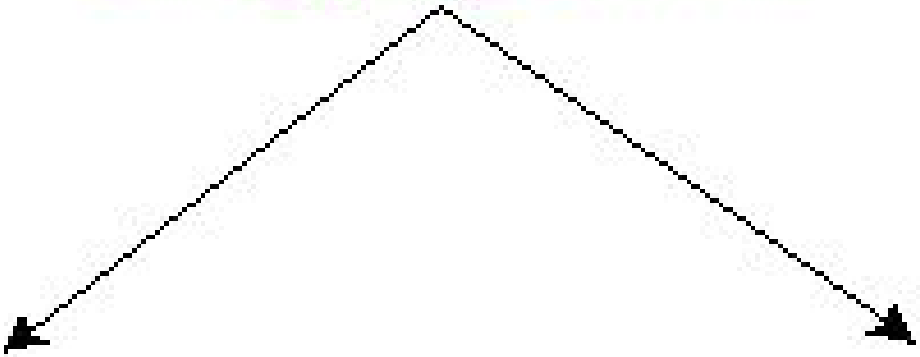
Mass of **Reactants** = Mass of **Products**

Balancing Equations

To show conservation of mass → **Balance equations**

- Make sure there are the **same number** of each type of **atom** in the products **and** in the reactants

coefficients



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

reactants

products

Balancing Equations

When there is no subscript or coefficient, it is understood the subscript or coefficient is **1**

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

let's look at it this way

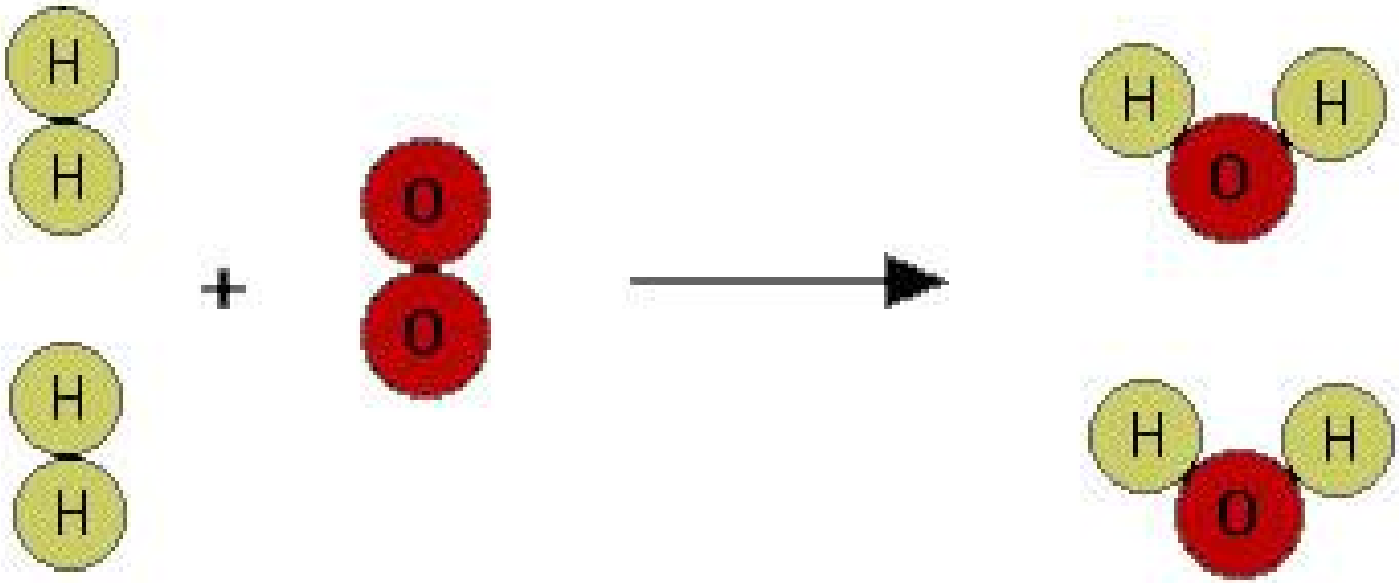
$$C_1H_4 + 2O_2 \rightarrow C_1O_2 + 2H_2O_1$$

1 C → **1** C

4 H → **4** H

4 O → **4** O

$2H_2 + O_2 \longrightarrow 2\,H_2O$

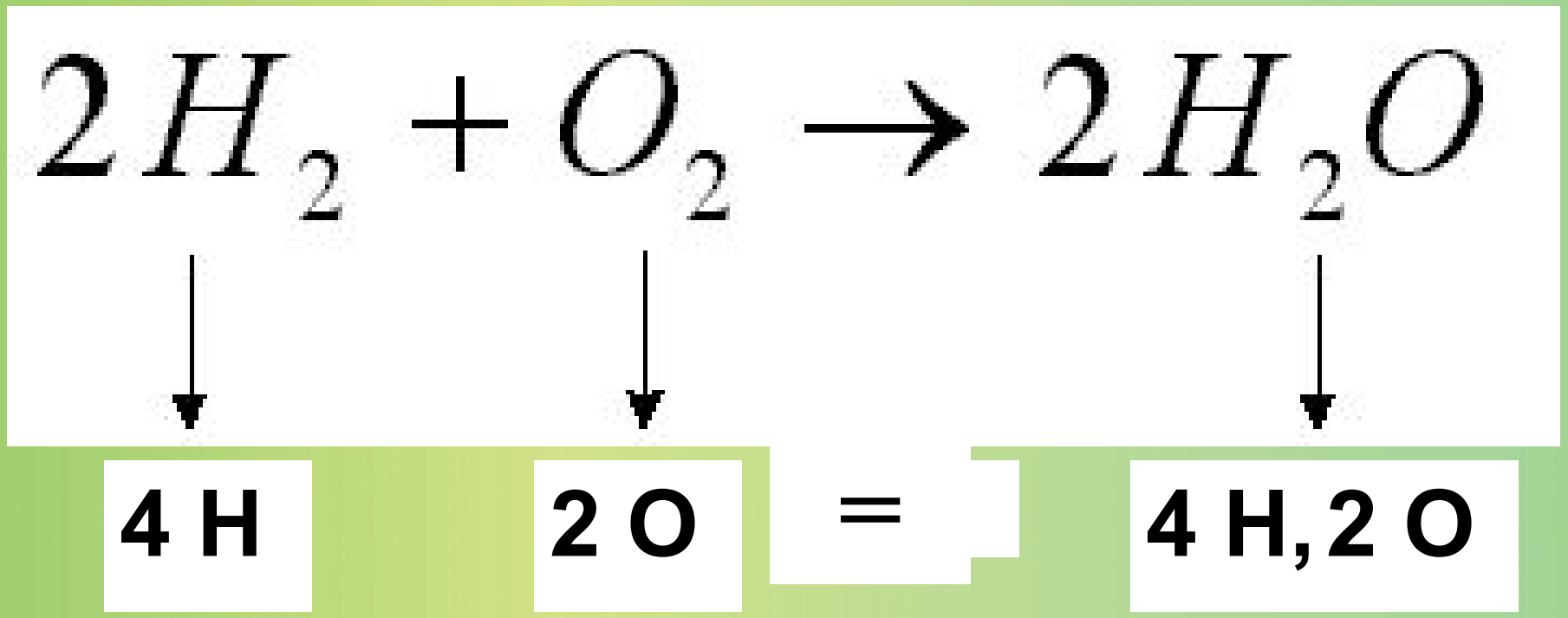


4 hydrogen atoms
+ 2 oxygen atoms

4 hydrogen atoms
+ 2 oxygen atoms

Let’s look at some equations ……

are they balanced? Not balanced?


$2H_2 + O_2 \rightarrow 2H_2O$
4 H
2 O
=
4 H,2 O

$$CH_4 + O_2 \rightarrow CO_2 + H_2O$$

C =	**1**			**C =**	**1**
H =	**4**	**≠**		**H =**	**2**
O =	**2**			**O =**	**3**

$$CH_4 + O_2 \rightarrow CO_2 + 2H_2O$$

C =	**1**		**C =**	**1**
H =	**4**	**≠**	**H =**	**4**
O =	**2**		**O =**	**4**

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

C =	**1**			**C =**	**1**
H =	**4**	**=**		**H =**	**4**
O =	**4**			**O =**	**4**

Quick Check - Counting Atoms

- **$2CuO_2$**
  Copper - 2
  Oxygen - 4
- **$2NH_4$**
  Nitrogen - 2
  Hydrogen - 8
- **$3S_2O_2$**
  Sulfur - 6
  Oxygen - 6
- **$4Mg_2O_4H_2$**
  Magnesium – 8
  Oxygen – 16
  Hydrogen - 8
- **$2NaN_3HO$**
  Sodium – 2
  Nitrogen – 6
  Hydrogen – 2
  Oxygen - 2

Balanced or Not Balanced?

- $Cu + O_2 \longrightarrow CuO$ Not Balanced
- $2Cu + O \longrightarrow 2CuO$ Not Balanced
- $S + O_2 \longrightarrow SO_2$ Balanced
- $Mg + O_2 \longrightarrow MgO$ Not Balanced
- $2Mg + O_2 \longrightarrow 2MgO$ Balanced