

## Objective 4 Law of Conservation of Mass

Investigate and identify the law of conservation of mass

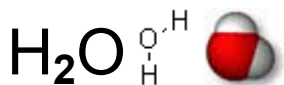
All chemical equations must satisfy the Law of Conservation of Mass, i.e. the mass of the reactants must equal the mass of the products. (∴ There must be the same number of each atom on both sides of the equation) Remember that chemical equations are written:

### **Chemical Equation: a way to represent chemical reactions on paper.**

**Equations must be balanced because: Law of Conservation of Matter:** Atoms can be neither created nor destroyed in an ordinary chemical reaction, so there must be the same number of atoms on both sides of the equation. **The mass of all the reactants (the substances going into a reaction) must equal the mass of the products (the substances produced by the reaction).**

These numbers are found in a chemical equation:

- **Subscripts**



The small numbers to the lower right of chemical symbols. Subscripts represent the number of atoms of each element in the molecule.

- **Coefficients**  $2 \text{C}_2\text{H}_6(\text{g}) + 7 \text{O}_2(\text{g}) \rightarrow 4 \text{CO}_2(\text{g}) + 6 \text{H}_2\text{O}(\text{g})$

The large numbers in front of chemical formulas. Coefficients represent the number of molecules of the substance in the reaction. **Balancing**

#### TIPS:

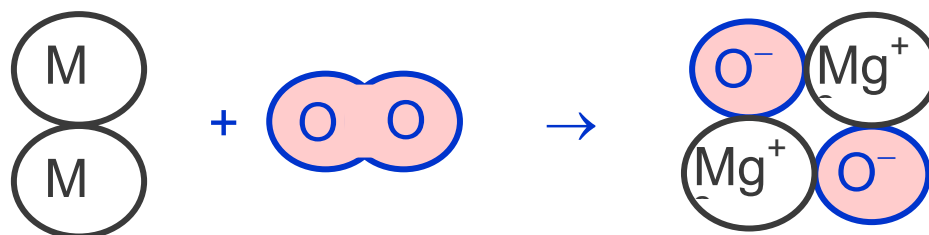
- ✓ **1. Check for Diatomic Molecules -  $\text{H}_2$  -  $\text{N}_2$  -  $\text{O}_2$  -  $\text{F}_2$  -  $\text{Cl}_2$  -  $\text{Br}_2$  -  $\text{I}_2$** 
  - If these elements appear **by themselves** in an equation, they **must** be written with the subscript  $_2$
- ✓ **2. Balance atoms other than Hydrogen and Oxygen**
- ✓ **3. Balance Hydrogen**
- ✓ **5. Balance Oxygen**
- ✓ **6. Recount All Atoms**
- ✓ Balance equations by changing **coefficients never** by changing **subscripts**
  - If the atoms are not balanced at this point, there is a problem somewhere. Work your way back up the steps, **from bottom to top**, until you find the problem, and correct it.

✓ 7. If every coefficient will reduce, rewrite in the simplest whole-number ratio.

An equation is not properly balanced if the coefficients are not written in their lowest whole-number ratio.

## Balancing Equations

A balanced chemical equation has the same type and number of atoms in the reactants as in the products.



*Physical*

1.  $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$
2.  $\text{CO} + \text{O}_2 \rightarrow \text{CO}_2$
3.  $\text{H}_2 + \text{Br}_2 \rightarrow \text{HBr}$
4.  $\text{K} + \text{H}_2\text{O} \rightarrow \text{KOH} + \text{H}_2$
5.  $\text{Zn} + \text{AgCl} \rightarrow \text{ZnCl}_2 + \text{Ag}$
6.  $\text{S}_8 + \text{O}_2 \rightarrow \text{SO}_2$
7.  $\text{KOH} + \text{H}_3\text{PO}_4 \rightarrow \text{K}_3\text{PO}_4 + \text{H}_2\text{O}$

8.  $\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow \text{Fe} + \text{CO}_2$
9.  $\text{Eu} + \text{HF} \rightarrow \text{EuF}_3 + \text{H}_2$
10.  $\text{Al}(\text{OH})_3 + \text{HCl} \rightarrow \text{H}_2\text{O} + \text{AlCl}_3$
11.  $\text{HClO}_4 + \text{Ca}(\text{OH})_2 \rightarrow \text{Ca}(\text{ClO}_4)_2 + \text{H}_2\text{O}$
12.  $\text{Na}_2\text{SO}_4 + \text{AgNO}_3 \rightarrow \text{Ag}_2\text{SO}_4 + \text{NaNO}_3$

1.  $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$  **balanced**
2.  $2 \text{CO} + \text{O}_2 \rightarrow 2 \text{CO}_2$
3.  $\text{H}_2 + \text{Br}_2 \rightarrow 2 \text{HBr}$
4.  $2 \text{K} + 2 \text{H}_2\text{O} \rightarrow 2 \text{KOH} + \text{H}_2$
5.  $\text{Zn} + 2 \text{AgCl} \rightarrow \text{ZnCl}_2 + 2 \text{Ag}$
6.  $\text{S}_8 + 8 \text{O}_2 \rightarrow 8 \text{SO}_2$
7.  $3 \text{KOH} + \text{H}_3\text{PO}_4 \rightarrow \text{K}_3\text{PO}_4 + 3 \text{H}_2\text{O}$
8.  $\text{Fe}_2\text{O}_3 + 3 \text{CO} \rightarrow 2 \text{Fe} + 3 \text{CO}_2$
9.  $2 \text{Eu} + 6 \text{HF} \rightarrow 2 \text{EuF}_3 + 3 \text{H}_2$
10.  $\text{Al}(\text{OH})_3 + 3 \text{HCl} \rightarrow 3 \text{H}_2\text{O} + \text{AlCl}_3$
11.  $2 \text{HClO}_4 + \text{Ca}(\text{OH})_2 \rightarrow \text{Ca}(\text{ClO}_4)_2 + 2 \text{H}_2\text{O}$
12.  $\text{Na}_2\text{SO}_4 + 2 \text{AgNO}_3 \rightarrow \text{Ag}_2\text{SO}_4 + 2 \text{NaNO}_3$