

Chemical Equations

- a method of representing chemical change

reactants → **products**

- three forms of representing chemical change:

1. **word equation**

- uses the names of the reactants and products

2. **chemical equation**

- uses the formula of the reactants and products

3. **balanced chemical equation**

- uses the formula of the reactants and products and shows the ratio in which the reactants combine to produce products

eg. Magnesium metal reacts with oxygen gas to produce solid magnesium oxide.

Write the word equation and the chemical equation for this reaction.

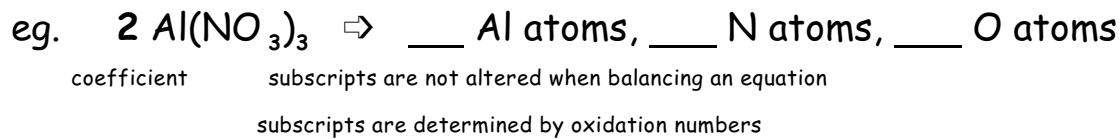
word equation

chemical equation

Problem: the law of **conservation of mass** has been violated. Matter can neither be created nor destroyed but there is one more oxygen atom on the reactants side relative to the products side.

Balanced Chemical Equations

- objective: the number of each type of atom on the reactant side equals the number of each type of atom on the product side
- use whole number coefficients in front of the chemical formulas



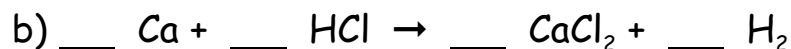
Guidelines for Balancing

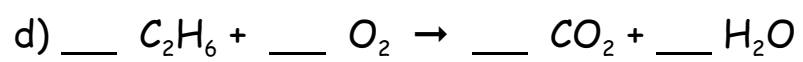
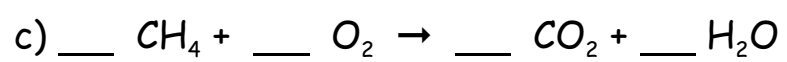
1. Balance elements (esp. O and H) last
2. A radical which appears unchanged on both sides of the equation can be balanced as a unit rather than separating it into individual atoms.
3. A diatomic element will always give an even number of that atom.

Fractions of a

half may be used in this case.

Balance the following chemical equations:





Types of Chemical Equations

- Four types:
1. synthesis (combination)
 2. decomposition
 3. single displacement (replacement)
 4. double displacement

* Always use **oxidation numbers** to balance the charge in the formula when determining the products in a reaction.

1. Synthesis

- direct combination of two substances to produce one new substance

General reaction:



where A and B are elements or compounds and AB is a compound.

eg. solid magnesium reacts with oxygen gas to produce solid magnesium oxide

eg. solid potassium and sulphur react to produce powdered potassium sulphide

2. Decomposition

- opposite of a synthesis
- breaking up of a single compound to form two simpler compounds or elements

General reaction:



where AB is a compound and A and B are elements or compounds

eg. aluminum oxide breaks down to produce solid aluminum and oxygen gas

3. Single Displacement

- an element and a compound react to produce a different element and compound
- involves a more reactive element displacing a less reactive element in a compound

General reaction:



or



Note: Elements that form positive ions displace the positive ion in the compound Elements that form negative ions displace the negative ion in the compound

eg. elemental sodium reacts with copper (II) sulphate to produce elemental copper and sodium sulphate

eg. chlorine gas reacts with solid lithium iodide to produce elemental iodine and lithium chloride

4. Double Displacement

- two binary compounds react to produce two new binary compounds
- ions switch partners

General reaction:



Note: B and D are negative ions and are written second in the compounds

eg. aqueous potassium iodide reacts with aqueous lead (II) nitrate to produce solid lead (II) iodide and potassium nitrate solution