Chemical reaction: conversion of substances into different substances (by rearranging atoms)

Reactants: substances present before reaction
Products: substances present after reaction

Chemical equation: represents a reaction on paper

Reactants → Products $A + B \longrightarrow C + D + E$

Phase labels: show the phase of reactants or products

(s): solid

(l): liquid only for pure liquids. ex. $H_2O(\ell)$

(g): gas

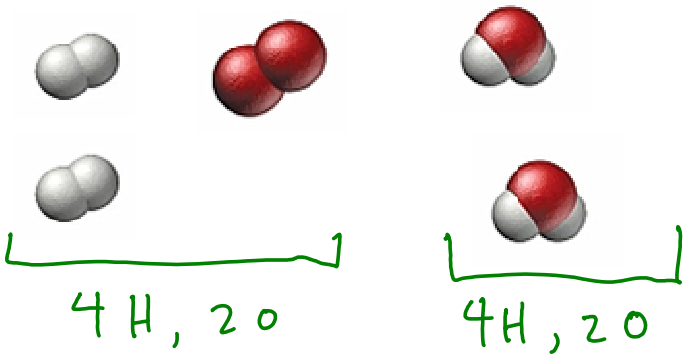
(aq): aqueous: dissolved in water

NaCl (ionic) ionic cpds (s) when pure

NaCl (aq) = saltwater

Law of conservation of mass: mass neither created nor destroyed

2 H_2 + ___ O_2 → 2 H_2O



4 H, 2 O 4H, 2 O = balanced

Tips for balancing:

1. Leave elemental substances for last:

___ CH_4 + 2 O_2 → ___ CO_2 + 2 H_2O

C : 1 C : 1
H : 4 H : ~~2~~ 4
O : ~~2~~ 4 O : ~~3~~ 4

2. In an even/odd issue, try doubling all other coefficients

2 ~~(1)~~ C_4H_{10} + 13 O_2 → 8 ~~4~~ CO_2 + 10 ~~5~~ H_2O

C : ~~4~~ 8 C : ~~1~~ ~~4~~ 8
H : ~~10~~ 20 H : ~~2~~ ~~10~~ 20
O : ~~2~~ 26 O : ~~3~~ ~~1~~ ~~13~~ 26

Always make sure all coefficients are reduced to the simplest whole numbers!

3. If an element appears in one compound on each side, balance that element first, making the least common multiple on both sides (2b on prelab)

$$4\ H_3PO_3 \rightarrow 3\ H_3PO_4 + \_\_\ PH_3$$

4. If polyatomic ions are identical on both sides, group them when counting

$$\_\_\ Na_2SO_4 + \_\_\ Ca(NO_3)_2 \rightarrow 2\ NaNO_3 + \_\_\ CaSO_4$$

Use the chemical equations worksheet to practice writing and balancing chemical equations.

Solid sodium and liquid water combine to create sodium hydroxide solution and hydrogen gas.

$$2\ Na(s) + 2H_2O(\ell) \rightarrow 2\ NaOH(aq) + H_2(g)$$

Na x 2 | Na x 2
H x 4 | H x 4
O x 2 | O x 2

Other reaction types

1. **Combustion reaction** (fire or flame are produced)

carbon-containing compound + $O_2 \rightarrow CO_2 + H_2O$

complete combustion

Write a balanced chemical equation for the complete combustion of propane, C_3H_8.

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

O : IO

2. **Decomposition reaction**: 1 reactant decomposes into 2 or more products

$2H_2O_2(aq) \rightarrow 2H_2O + O_2$ (slow)

catalysts speed up reactions but are not consumed by the reaction - they are common in decomposition reactions

$2H_2O_2(aq) \xrightarrow[(cat)]{KI} 2H_2O + O_2$ (fast)

Other reaction types

3. **Single-displacement reaction**: 1 element is replaced by another

   (an element + a compound → another element + another compound)

   $2\ Al(s) + Fe_2O_3(s) \rightarrow 2\ Fe(l) + Al_2O_3(s)$

   element cpd element cpd

   $2\ Na(s) + 2H_2O(l) \rightarrow 2\ NaOH(aq) + H_2(g)$

4. **Synthesis reaction**: 2 or more reactants form 1 product

   Write the synthesis reaction that silver and oxygen will undergo.

   Ag^+ / O^{2-}

   $4Ag + O_2 \longrightarrow 2Ag_2O$

Review: reaction types

- Double displacement

  $AB + CD \longrightarrow AD + CB$

- Combustion

  $\_C_xH_y + \_O_2 \longrightarrow \_CO_2 + \_H_2O$

- Decomposition

  $AB \longrightarrow A + B$

- Single displacement

  $A + BC \longrightarrow B + AC$

- Synthesis

  $A + B \longrightarrow AB$