

## Methane combustion

METHANE CHEMISTRY: the combustion reaction

What chemical reaction takes place when the methane?

The simplest chemical reaction involving methane is combustion.

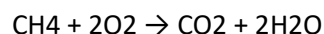
This is a chemical reaction involving the oxidation of a fuel by a comburent (which is generally represented by the oxygen present in the air), with development heat and electromagnetic radiation, including often also light radiation.

The methane molecule is composed of a carbon atom and 4 Hydrogen atoms. Its formula is CH<sub>4</sub>. When the CNG it burns, the C-H bonds break, and the atoms of C and H form new bonds with oxygen: there is therefore a reaction oxidation which results in CO<sub>2</sub> (carbon dioxide), H<sub>2</sub>O (water) and releases heat.

What products are obtained from the combustion of methane?

Burning a methane molecule in the presence of oxygen (precisely two O<sub>2</sub> oxygen molecules for each molecule of methane) a carbon dioxide (CO<sub>2</sub>) molecule is formed, commonly called carbon dioxide, two molecules of water (H<sub>2</sub>O) and heat is released which is due to the breakage of the bonds between carbon and hydrogen that make up methane.

The balanced reaction of methane combustion is as follows:



the chemical equation informs us that any quantity of methane and oxygen will react will be found to react

having finished that the quantity of moles of methane reacted will be half of the quantity in moles of oxygen reacted and also that will be equal to the quantity in moles of carbon dioxide produced and also that it will be half the amount of moles of water produced.

It should therefore be noted that, thanks to the stoichiometric coefficients, it is

it is sufficient to know any of the values, in moles, of substance reacted or produced to easily know the value, in moles, of all other substances reacted or produced.

Referring to simple values: each mole of methane (16 grams) reacts with two moles of oxygen ( $2 \times 32 = 64$  grams) forming a mole of carbon dioxide (44 grams) and two moles of water ( $2 \times 18 = 36$  grams).

Note that the total reacted mass (80 g) is equal to the mass total produced (Lavoisier 's law), casually also the number of reacted moles (3) is equal to the number of moles produced (3), however in general for chemical reactions it will be found that the mass will be always conserved while the number of moles may increase or to decrease. In quantitative or total chemical reactions (not in those of equilibrium) the reaction ends when at least one of the reagents has run out of that reagent is said to be "in defect "or which is the limiting reagent, the others are called excess reagents.