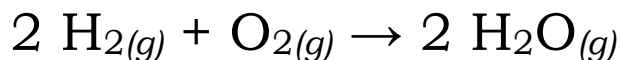# Calculations Involving Reactions

A.K.A Stoichiometry

STOICHIOMETRY:

The relationship between the amount of reactants used in a chemical reaction and the amounts of products produced by the reaction.
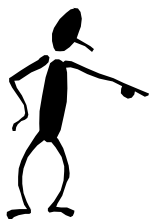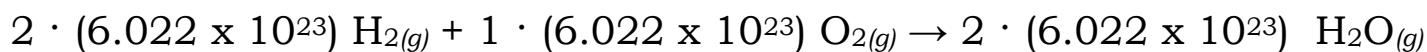
Consider the following chemical reaction:

$$2 \ H_{2(g)} + O_{2(g)} \rightarrow 2 \ H_2O_{(g)}$$

We know that 2 hydrogen molecules react with 1 oxygen molecule to make 2 molecules of water.

We can also write it as:

$$200 \ H_{2(g)} + 100 \ O_{2(g)} \rightarrow 200 \ H_2O_{(g)}$$

or even

$$2 \cdot (6.022 \times 10^{23}) \ H_{2(g)} + 1 \cdot (6.022 \times 10^{23}) \ O_{2(g)} \rightarrow 2 \cdot (6.022 \times 10^{23}) \ H_2O_{(g)}$$
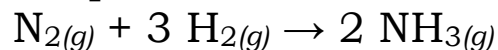
The coefficients can now refer to the amount of molecules, in moles, which are involved in the reaction.

Therefore, the **MOLE RATIO** of $\dfrac{H_2}{O_2} = \dfrac{2}{1}$ is maintained.

For Example:

Consider the equation:
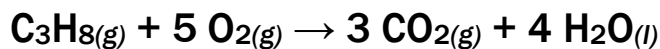$$N_{2(g)} + 3\ H_{2(g)} \rightarrow 2\ NH_{3(g)}$$

a. How many molecules of $N_{2(g)}$ are required to react with 15 molecules of $H_{2(g)}$?

b. How many moles of $NH_{3(g)}$ are produced when 18 mol of $H_{2(g)}$ are reacted?

Stoichiometry Calculations Involving: Moles, Mass, Volume of Gas and Molecules

The combustion of propane, $C_3H_{8(g)}$, proceeds according to the following equation:
$$C_3H_{8(g)} + 5\ O_{2(g)} \rightarrow 3\ CO_{2(g)} + 4\ H_2O_{(l)}$$

a. What mass of $CO_{2(g)}$ is produced by reacting 2.00 mol of $O_{2(g)}$?

b. What mass of $C_3H_{8(g)}$ is required to produce 100.0 g of $H_2O_{(g)}$?

c. If a sample of propane is burned, what mass of $H_2O_{(l)}$ is produced if the reaction also produces 50.0 L of $CO_{2(g)}$ at STP?

d. A propane burner is used in an auditorium as part of a chemistry demonstration. What volume of $O_{2(g)}$ at STP is consumed from the auditorium air if the burner produces 10.0 L of $CO_{2(g)}$ at STP during the demonstration?

e. A sample of porous, gas-bearing rock is crushed and 1.25×10^{-6} g of $C_3H_{8(g)}$ is extracted from the powdered rock. How many molecules of $CO_{2(g)}$ are produced if the gas sample is burned in the presence of an excess of $O_{2(g)}$?