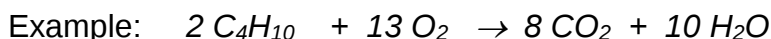


Moles of gas

One mole of any gas has approximately the same volume as any other gas at a particular temperature and pressure. (This is **Avogadro's Law**).



What volume of oxygen is needed to react with 15 cm^3 of butane under room conditions?

From the equation, 1 mole of butane reacts with 6.5 moles of oxygen.

Therefore, 1 volume of butane needs 6.5 volumes oxygen.

Therefore, 15 cm^3 of butane needs $15 \times 6.5 = 97.5 \text{ cm}^3$ oxygen.

At room temperature and 1Atm this is 24 dm^3 (24000 cm^3). (At 0°C and 1Atm this is 22.4 dm^3).

So the number of moles of a gas at room temperature can be found from the formula.

$\text{Moles} = \frac{\text{Volume (in dm}^3\text{)}}{24}$
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Example. Calculate the moles of carbon dioxide in 480 cm^3 of the gas.

$$\text{Moles} = 480 / 24,000 = 0.02$$

Moles in solution

The concentration of solutions is also expressed in terms of moles.

$\text{Concentration} = \frac{\text{Moles}}{\text{Volume (in dm}^3\text{)}}$
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The concentration of a solution can be stated as the mass of solute per cubic decimeter of solution (g/dm^3) or the amount in moles of a solute present in 1 dm^3 of solution (mol/dm^3).

To make a solution of 1 mol dm^{-3} concentration, 1 mol of substance is dissolved and the solution made up to a total volume of 1 dm^3 .

Examples

1. Calculate the concentration of a solution containing 2.4 g MgSO_4 in 500 cm^3 of solution.

$$\begin{aligned}\text{Moles} &= 2.4 / 120 = 0.02 \text{ mol} \\ \text{Concentration} &= 0.02 \text{ mol} / 0.5 \text{ dm}^3 = 0.04 \text{ mol dm}^{-3}\end{aligned}$$

2. Calculate the mass of NaOH required to make 100 cm^3 of a 0.2 mol dm^{-3} solution.

$$\begin{aligned}\text{Moles} &= \text{Concentration} \times \text{Volume (dm}^3\text{)} \\ &= 0.2 \times 0.1 = 0.02 \text{ mol}\end{aligned}$$

$$\begin{aligned}\text{Mass} &= \text{Moles} \times \text{Formula mass} \\ &= 0.02 \times 40 = 0.8 \text{ g}\end{aligned}$$