**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).

Example: \[ 2 \text{C}_4\text{H}_{10} + 13 \text{O}_2 \rightarrow 8 \text{CO}_2 + 10 \text{H}_2\text{O} \]

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 \(15 \times 6.5 = 97.5\) cm\(^3\) oxygen.*

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

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

\[
\text{Moles} = \frac{\text{Volume (in dm}^3\text{)}}{24}
\]

Example. *Calculate the moles of carbon dioxide in 480cm\(^3\) of the gas.*

\[
\text{Moles} = \frac{480}{24,000} = 0.002
\]

**Moles in solution**
The concentration of solutions is also expressed in terms of moles.

\[
\text{Concentration (g/dm}^3\text{)} = \frac{\text{Moles}}{\text{Volume (in dm}^3\text{)}}
\]

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 1dm\(^3\) of solution (mol/dm\(^3\)).

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

Examples
1. *Calculate the concentration of a solution containing 2.4g MgSO\(_4\) in 500cm\(^3\) of solution.*

\[
\text{Moles} = \frac{2.4}{120} = 0.02\text{mol}
\]

\[
\text{Concentration} = \frac{0.02\text{mol}}{0.5\text{dm}^3} = 0.04\text{moldm}^{-3}
\]

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

\[
\text{Moles} = \text{Concentration} \times \text{Volume (dm}^3\text{)}
\]

\[
= 0.2 \times 0.1 = 0.02\text{mol}
\]

\[
\text{Mass} = \text{Moles} \times \text{Formula mass}
\]

\[
= 0.02 \times 40 = 0.8\text{g}
\]