Amount of substance etc.

The **mole** is the **amount of substance** that contains 6.0221415×10^{23} (Avogadro constant/ mol^{-1}) atoms or molecules of the pure substance being measured. For example 1 mole (mol) of potassium will contain N_{A} atoms. 1 mole of water contains N_{A} water molecules. A mole of any substance contains as many atoms or molecules (as specified) as there are atoms in 12g of the carbon isotope ${}^{12}_{6}\text{C}$. (To avoid confusion, always specify the type of particle.)

The **molar mass**, M, of a substance is the mass divided by chemical amount. For pure materials, molar mass, $M =$ molecular weight (or relative atomic or molecular mass) $\times$ g mol^{-1}.

The **concentration** or **molarity** of a solute is $c = \frac{n}{V}$ where $n =$ amount of solute, $V =$ volume of solution. Molarity is usually quoted in mol dm^{-3}. The unit $1\ \text{mol dm}^{-3}$ is commonly denoted 1 M and read as 'molar'.

The **molality**, b, of a solute is the amount of solute divided by the mass of solvent: $b = \frac{n}{m}$. So, molality represents 1 mole of a solute in 1 kg of solvent.

The **mole fraction**, x, of a solute is the amount of solute divided by the total amount in the solution:

$$x = \frac{n}{n_{\text{total}}}.$$

The **mass density** (or just **density**), ρ, of a substance is its mass divided by its volume, that is $\rho = \frac{m}{V}$.

The **mass percentage** is the mass of a substance in a mixture as a percentage of the total mass of the mixture.

The **mass-volume percentage** is the number of grams of solute in 100 millilitres of solution.

The **volume-volume percentage** is the number of millilitres of liquid solute in 100 millilitres of solution.

Parts per million (ppm): mg/kg.

Parts per billion (ppb): μg/kg.

Yield:

$$\% \text{ yield} = \frac{\text{Mass obtained}}{\text{Theoretical yield}} \times 100$$

Gases

The general form of an **equation of state** is $p = f(T, V, n)$ where p = pressure, T is temperature, V = volume, n = amount of substance.

Boyle's Law relates the pressure and volume of a gas when the temperature is fixed: $p_1V_1 = p_2V_2$.

An equivalent form is: $pV = \frac{1}{3}nM\overline{c^2}$, where n = number of molecules, m = mass of a molecule, M $(= mN_A)$ is the molar mass of the molecules, $\overline{c^2}$ = mean square speed.

Charles's Law relates the volume and temperature of a gas at constant pressure: $\frac{V_1}{V_2} = \frac{T_1}{T_2}$.