Chemistry
Notes: Moles-- Not the rodent!

The SI unit that measures the amount of a substance is a **mole**

Mole (mol) of a substance is 6.02×10^{23} representative particles of that substance. also known as Avogadro's number, in honor of Amedo Avogadro di Quadrenga (1776-1856)

Representative particle refers to the species present in a substance: usually atoms, molecules or formula units (ions).

Representative Particles and Moles

Substance	Representative particle	Chemical formula	Representative particles in 1.00 mol
atomic nitrogen	atom	N	6.02×10^{23}
nitrogen gas	molecule	N_2	6.02×10^{23}
water	molecule	H_2O	6.02×10^{23}
calcium ion	ion	Ca^{2+}	6.02×10^{23}
calcium fluoride	formula unit	CaF_2	6.02×10^{23}
sucrose	molecule	$C_{12}H_{22}O_{11}$	6.02×10^{23}

*A molecule is the representative particle of diatomic elements and molecular compounds
*The representative particle of ionic compounds is a formula unit

To determine how many atoms are in a mole of a compound you must know how many atoms are in a representative particle of the compound, which is determined from the chemical formula.

Ex. CO_2 has three atoms. therefore a mole of Carbon dioxide contains three times a mole (6.02×10^{23}) of atoms

Gram atomic mass (GAM) is the atomic mass of an element expressed in grams.

Ex. gam of Carbon is 12.0 g.

The GAM of any two elements must contain the same number of atoms

Ex. 12.0 g of carbon atoms with 16.0 g of oxygen, they both contain the same number of atoms.

Gram molecular mass (gmm) of any molecular compound is the mass of 1 mole of that compound.
Gram formula mass (gfm) of any ionic compound is the mass of 1 mole of that compound

The molar mass of any substance is the mass in grams of one mole of the substance

Example:

*Multiplying the number of moles of a substance by its molar mass gives the mass of the substance

Example:

*Dividing the mass of a substance by its molar mass gives the number of moles of that substance

Example:

Standard temperature and pressure (STP)

standard temp. $0^{o}C$ standard pressure 101.3 kPa

Molar volume of a gas is 22.4 L

Example:

Percent Mass / Empirical Formula

The percent composition is the percent by mass of each element in a compound

The percent by mass of any element in a given compound is calculated by dividing the element's mass by the mass of the compound and multiplying by 100%

Example:

Emperical formula gives the lowest whole-number ratio of the atoms of the elements in a compound.