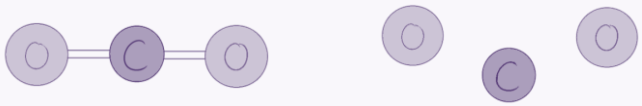
1.1 – The Mole

1.1.1 - Apply the mole concept to substances

A mole is the name given to a certain quantity. It represents 6.02 x 10^{23} particles. This number is also known as Avogadro's constant, symbolised *L*.

$$L = 6.02 \times 10^{23}\ mol^{-1}$$

To apply this concept to substances, we use it like any other constant. If we have 0.250mol of SO_3 then we would have 0.250mol of S atoms, 0.750mol of O atoms and 1mol of atoms all together.



The mole is used because 6.02 x 10^{23} particles of anything weigh a certain amount (the molar mass). Exactly 12g of carbon contains 6.02 x 10^{23} atoms.

1.1.2 - Determine the number of particles and the amount of substance (in moles)

With Avogadro's constant, we can calculate the number of particles present in a given amount of substance.

$$n = \frac{N}{L}$$

where n = number of moles
N = number of particles
L = Avogadro's constant

For example, if we wanted to calculate the number of atoms in 3 moles of Helium, we would do:

$$3mol\ He \times 6.02 \times 10^{23}\ atoms = 1.81 \times 10^{24}\ atoms\ He$$

In reverse, we would do:

$$\frac{1.81 \times 10^{24}\ atoms\ He}{6.02 \times 10^{23}\ atoms} = 3mol\ He$$

You do exactly the same thing if you are asked to calculate the number of ions, molecules, electrons, formula units, etc. For example, if you were asked to find the number of atoms of a certain element in a molecule, then this is what you do:

Find the number of H atoms present in 76.59g of water, H_2O

$$\frac{76.59g\ H_2O}{18.02g\ mol^{-1}H_2O} = 4.25mol\ H_2O$$

Since 1mol of water contains 2mol H:

$$2 \times 4.25mol = 8.50mol\ H$$

$$8.50mol\ H\ \times 6.02 \times 10^{23}\ atoms = 5.12 \times 10^{24} atoms\ H$$

∴ in 76.59g of water, there are 5.12×10^{24} atoms of hydrogen