Fact sheet: moles and Avogadro’s number

In chemistry, a **mole** is a **really big number**. This number (**6.02 x 1023**) comes from the number of atoms in **12 g of carbon-12** (this is the carbon isotope with six protons and six neutrons).

So, we can say that one **mole** of protons has a mass of one gram, and one **mole** of neutrons has a mass of one gram, as protons and neutrons have similar masses.

This means that:

* One **mole** of 1H atoms has a mass of one gram.
* One **mole** of 19F atoms has a mass of 19 g, and two moles have a mass of 38 g.
* One **mole** of NH3 molecules – which has a relative molecular mass (*Mr*) of 17 – has a mass of 17 g, and half a **mole** has a mass of 8.5 g.
* One **mole** of ibuprofen (C13H18O2) has a mass of 206 g, and 0.01 **moles** have a mass of 2.06 g (which is still way more than is in an ibuprofen tablet).

**Moles** allow us to compare the number of atoms or molecules in two or more different substances without writing out long numbers.

Calculating moles

The relationship between moles (mol), mass (g) and *Mr* (g mol-1) can be represented by this equation:

Did you know …?  
The average furry European mole is approximately 100 g. So, a mole of furry European moles would have a mass of: 6.02 x 1022 kg. Similar to the mass of the Moon at 7.35 x 1022 kg. That is one huge ball of fur.

Avogadro’s constant

Remember that we said a **mole** is a **really big number**…

We can use Avogadro’s constant to calculate the number of atoms or molecules from the number of moles or vice versa, using the following relationship:

Did you know…?  
Amedeo Avogadro didn’t calculate the value of the mole, but he was the first to claim that different gases at the same volume and pressure would contain the same number of particles. Sadly, he died before anyone figured out the number that bears his name.