Conversion Factors and the Mole

The mole is a unit of measurement specific to chemists, "a chemists dozen".

- 1 mole = 6.022 x 10^{23} atoms or molecules

The mole needs to be a very large number because atoms and molecules are so small that only a large number can become meaningful

- 6.022 x 10^{23} = 602214179300000000000000

- 1 mol of water is 18.02 mL

- 1 mol of marshmallows would cover the earth to a depth of 18.4 km

- 1 mol of loonies would make a stack the would reach to the sun and back over 4 billion times!

Why the perfect 6.022 x 10^{23} ?????

- Given that 1.6606 x 10^{-24} g = 1 u (where u is an atomic mass unit)

$$6.022 \times 10^{23} \text{ C} \times \frac{12.011 \text{ u C}}{1 \text{ C atom}} \times \frac{1.6606 \times 10^{-24} \text{ g C}}{1 \text{ u C}} = 12.011 \text{ g C}$$

- Therefore the average atomic masses as stated on the periodic table will also give the mass of one mole of the each atom in grams!!

The value of 6.022×10^{23} makes possible the use of average atomic masses to find the mass per mole (i.e. g/mol)

eg H_2O H: 2 x   1.01 =   2.02

      O: 1 x 16.00 = 16.00
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                            18.02 **u/molec** or **g/mol**

The mole is best understood through three equalities (THE THREE GREAT MOLEY TRUTHS!)

   1 mol = 6.022×10^{23} molec or atoms (atoms for one element)

   1 mol = x g (where x depends on the formula)

   1 mol = 22.414 L of a gas at S.T.P.

(standard temperature (0 °C) and pressure (1 atm)

Conversions:

We will use a conversion factor approach to Stoichiometry. A converson factor is a fraction in which the numerator and denominator **must represent the same physical quantity but expressed in different units**. As such, multiplication by a conversion factor is like multiplication by one. The difference is accounted for by the units.

Detemine how many oranges are in an ipod

$$1 \text{ ipod } \times \frac{250 \text{ dollars}}{1 \text{ ipod}} \times \frac{1 \text{ doz oranges}}{6.83 \text{ dollars}} \times \frac{12 \text{ oranges}}{1 \text{ doz oranges}} = 439.24 \text{ oranges}$$

These conversions are often based on the three great moley truths!

Unit Extensions:

- All units must be follow by a formula extension.

- The formula extension tells you what substance you are measuring.

- eg it is not 24.7 g, it is 24.7 g H_2SO_4

Calculators:

- You must use the EE or EXP button for scientific notation numbers (not the 10^x button or the y^x button)

- Do not type a x 10 anywhere in a scientific notation number

The Unit Connection:

mass ➜ g (mg, kg)

volume ➜ l (ml)

amount ➜ mol (mmol or kmol)