Chemistry Topic 4: Chemical calculations

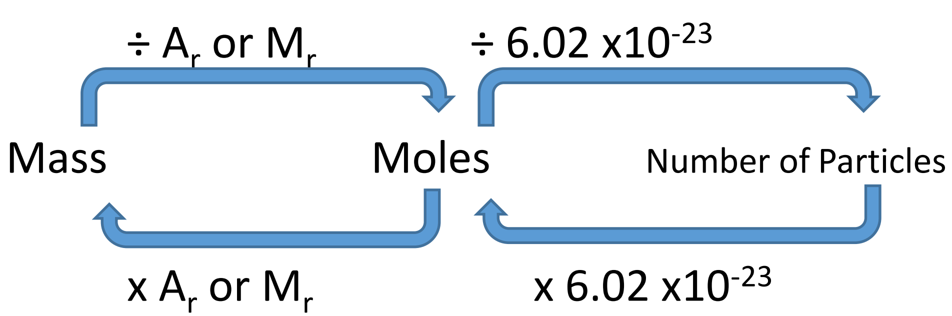
1. Keywords

Conservation of mass	Mass (or atoms) cannot be created or destroyed.
Relative atomic mass (A_r)	Number of neutrons and protons.
Relative formula mass (M_r)	Sum of relative atomic masses
Balanced equation	When the sum of the M_r on the left = the sum of the M_r on the right
Mole	M_r or A_r in grams. Mass of 6.02×10^{23} atoms, molecules or ions.
Limiting reactant (H)	The reactant which runs out first

2. Relative formula mass (M_r)

Steps	Worked example – CO_2
Step 1 – Using the periodic table, determine relative atomic mass (A_r) of each element.	Carbon = 12 Oxygen = 16
Step 2 – Multiply the relative atomic mass by the number of each atom in the molecule.	Carbon = (1 x 12) = 12 Oxygen = (2 x 16) = 32
Step 3 – Add up all the values	12 + 32 = 44

3. Moles



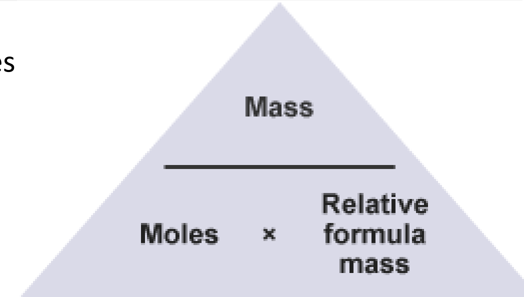
4. Equations and calculations (Higher)

number of moles = mass ÷ relative formula mass

Worked example - Number of moles in 88g of carbon dioxide (CO_2)

Number of moles = 88g ÷ 44 g/mol

Number of moles = 2 moles



5. Masses to balanced equations (Higher)

Worked example – what mass of carbon is need to produce 132g of carbon dioxide. $1\ C + 1\ O_2 \rightarrow 1\ CO_2$

	Carbon (C)	Carbon dioxide (CO_2)
Mass	36g	132g
M_r or A_r	12 g/mol	44 g/mol
Number of moles	3 moles	3 moles
Ratio	1 :	1

6. Concentration

$$\text{concentration (g/dm}^3\text{)} = \frac{\text{amount of solute (g)}}{\text{volume of solution (dm}^3\text{)}}$$

Worked example – What is the concentration of a solution when 50g of sodium hydroxide is dissolved in 200cm³ of water.

Volume in dm³ = $\frac{200cm^3}{1000}$ = 0.2dm³ Concentration = $\frac{50g}{0.2dm^3}$ = 250g/dm³