CHAPTER 1 QUANTITATIVE CHEMISTRY
(IB TOPIC 1) SUMMARY

Introduction

- 1 dm^3 = 1 litre = 1 x $10^{-3}m^3$ = 1 x 10^3 cm^3 = 1000 ml
- Amount of substance, *n*, is measured in moles (mol).
- 1 mol of a chemical species contains the same number of particles as there are atoms in exactly 12 g of C-12 ($^{12}_{6}C$) isotope.
- 1 mol of any substance contains 6.02 × 10^{23} particles; 6.02 × 10^{23} mol^{-1} is called Avogadro's Constant (*L* or N_A)
- A_r, the relative atomic mass of an element is the ratio of the mass of an atom of the element to the mass of one atom of C-12; A_r has no units.
- M_r, the relative molecular mass also has no units.
- *M*, the molar mass is the mass of one mole of any chemical species and has the units g mol^{-1}.

The amount of substance, *n* in moles = $\frac{mass\,(g)}{molar\ mass\,(g\ mol^{-1})}$;

$n = \frac{V\,(dm^3)}{V_m\,(dm^3\ mol^{-1})}$.

Number of Particles	⇔ Avogadro Constant (6.02×10^{23} mol^{-1})	Amount in moles	⇔ Molar mass	Mass in grams

- Use Avogadro Constant to convert between amount and number of particles.
- Use molar mass of substance to convert between amount in moles and mass in grams.
- Empirical formula gives the simplest whole number ratio of atoms in a compound.
- Molecular formula gives the actual number of atoms of each element in the molecule of a compound.

If a molecular formula is given, percentage composition can be calculated.

If the percentage composition is given:

- Consider 100 g of sample, the % of each element becomes its mass.
- Convert the mass of each element to its amount in moles.
- Determine simplest whole number ratio – this is its empirical formula.
- Molecular formula is a whole-number multiple of the empirical formula.
- Substances react by amounts based on a balanced chemical equation.

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If masses are given, convert these to amounts of substances.

- In stoichiometric problems, apply mole ratios as specified in the balanced chemical equation.
- The % yield indicates how efficient a reaction is (given by: $\frac{\text{experimental yield}}{\text{theoretical yield}} \times 100\%$).
- STP for gases is standard temperature (0°C or 273 K) and pressure (1 atmosphere or 101.325 kPa).
- Molar volume, V_m, of any gas at STP = 22.4 dm^3.

In a balanced chemical equation, coefficients stand for the amount of substance. For gases, these also refer to volumes of gases.

Concentration, $c = \frac{\text{amount n (mol)}}{\text{Vol solution (dm}^3\text{)}} = \frac{n}{V} \text{ mol dm}^{-3}$.

n = cV; volume must be in dm^3.

On dilution, the amount of solute does not change but the volume increases and the concentration decreases

Amount $n = \frac{m\,(g)}{M\,(g\,mol^{-1})}$.

For a reaction aA + bB $\rightarrow$ products, where a and b are coefficients, then $\frac{1}{a} n_A = \frac{1}{b} n_B$.

Percentage yield = $\frac{\text{experimental yield}}{\text{theoretical yield}} \times 100\%$.

(There are many worked examples given in the chapter)