Chemical formulas & Mole Concepts

1. Types of chemical formulas:

Empencal formula	:	Simplest whole-number ratio of atoms
Molecular formula	:	Actual number of atoms in one molecule
Structural formula	:	How atoms are arranged
Ionic formula	:	Shows ions and their charges

Pro tip: If you know the emperical formula & molar mass, you can find the molecular formula:

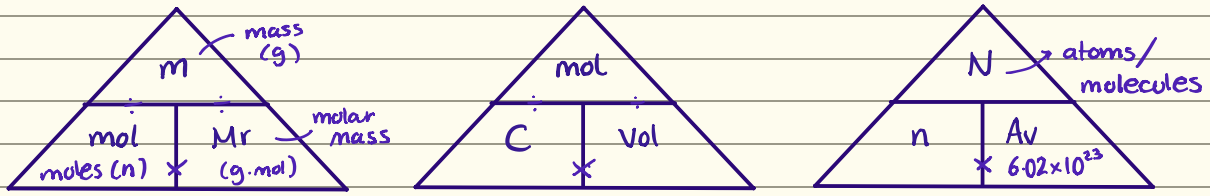
$$n = \frac{\text{Molecular Mass}}{\text{Empencal mass}}$$

Then multiply subscrips by n

2. The Mole Concept

Avogadros number.

→ A mole is the amount of substance that contains 6.022×10^{23} particles



3. Molar volume (for Gases)

At room temperature and pressure (RTP) : 1mol of any gas = $24 dm^3$

Pro tip: Always check Conditions !! Use $22.4 dm^3$ at STP (273K, 1atm)

4. Mass, Moles, and Particles

Mass ⟷ Moles ⟷ Particles

Convert using :

- Divide / multiply by Molar mass (M)
- Multiply / divide by Avogadros number

Quick Tips:

- Always used balanced equations before doing mole Calculations
- Convert cm – dm by dividing by 1000
- Keep units Consistent throughout !

Stoichiometry & Calculations

Using balanced chemical equations to calculate amounts of reactants & products

The General Steps:

1. Write & balance the equation
2. Find moles of known substance
3. Use the mole ratio to find moles of unknown
4. Convert to mass, volume, or concentration if needed

Percentage Composition:

$$\% \text{ By mass} = \frac{\text{mass of element}}{\text{molar mass of compound}} \times 100$$

Empencal Formula from Data:

1. Find moles of each element
2. Divide by the smallest value
3. Round to whole numbers

eg: C = 12g H = 2g O = 16g

→ 1 : 2 : 1 CH_2O

Limiting + Excess Reactants

The limiting reactant is used first and determines how much product forms

Steps:
1- Find moles of each reactant
2- Compare with equation ratio
3- The smaller ratio = limiting reactant

Tip: Always identify the limiting reactant before calculating yield.

Percentage Yield

$$\text{Yield \%} = \frac{\text{actual yield}}{\text{Theorehcal}} \times 100$$

less than 100% means product lost or side reactions occured

Atom economy

$$\text{Atom economy (\%)} = \frac{\text{mass of desired product}}{\text{total mass of products}} \times 100$$

Pro tip:

High atom economy = greener, more efficient process

Final Exam tips:

- Always check your units (dm^3, mol, g).
- Write balanced equations before any calculation.
- Show all working clearly - easy marks
- Think of stoichiometry as a recipe: the coefficients tell you the "ingredients" ratio