

Some Basic Concepts of Chemistry: one-page cheat sheet

NEET Chemistry · Unit 1 · Physical Chemistry

1 • Matter & measurement

Pure element	(one kind of atom) or compound (fixed mass ratio)
Mixture	variable composition, separated physically
SI base	m, kg, s, A, K, mol, cd
Temp.	$K = ^\circ C + 273.15$, $^\circ F = \frac{9}{5} ^\circ C + 32$
Precision	closeness of repeated readings
Accuracy	closeness to the true value

Trap · Milk and blood are **heterogeneous** (colloids); dry, dust-free air is **homogeneous**. Mass is constant, weight is not.

2 • Significant figures

Digits	Counted?	Example
Non-zero, trapped zeros	always	2.18, 2.008
Leading zeros	never	0.0034 $\rightarrow$ 2
Trailing, with point	yes	4.200 $\rightarrow$ 4
Trailing, no point	no	2500 $\rightarrow$ 2
Exact counts	∞	20 apples

+ and - keep the **least decimal places**: $18.0 + 12.11 = 30.1$

* and $\div$ keep the **least sig. figures**: $2.5 \times 1.25 = 3.1$

3 • Laws of chemical combination

Law	By	Idea
Mass conservation	Lavoisier	mass is conserved
Definite proportions	Proust	fixed mass % in a compound
Multiple proportions	Dalton	simple ratio of B masses
Gaseous volumes	Gay-Lussac	simple volume ratios
Avogadro's law	Avogadro	equal V , equal molecules

Example CO , CO_2 : for 12 g C, O is 16 g and 32 g (1 : 2)

Trap · Dalton's theory explains the first three laws but **not** Gay-Lussac's law.

4 • The mole

$$n = \frac{w}{M} = \frac{N}{N_A} = \frac{V_{\text{STP}}}{22.4 \text{ L}}$$

Constants $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$; 1 amu = $1.66 \times 10^{-24} \text{ g}$

Molar vol. 22.4 L (273 K, 1 atm); 22.7 L (273 K, 1 bar)

1 particle mass = $M/N_A \text{ g}$

Atoms $n \times N_A \times \text{atomicity}$

Avg. mass $\sum(\text{abundance \%} \times \text{isotopic mass})/100$

Trap · "Maximum atoms": compare $(\text{mass}/M) \times \text{atomicity}$. 1 g Li = 0.143 mol atoms; 1 g O_2 = 0.0625 mol atoms.

5 • Empirical & molecular formula

$$\text{MF} = (\text{EF})_x, \quad x = \frac{\text{molar mass}}{\text{EF mass}}, \quad M = 2 \times \text{V.D.}$$

Step 1 divide each mass % by its atomic mass

Step 2 divide all by the smallest value

Step 3 fractions: $1.5 \rightarrow \times 2$, $1.33 \rightarrow \times 3$

Mass % (element in 1 mol/ M) $\times 100$

6 • Limiting reagent

Method convert to moles, then compare n /coefficient for each reactant

Limiting the **smaller** ratio; it fixes the yield

% yield (actual/theoretical) $\times 100$

Purity pure mass = sample $\times$ purity/100

Trap · Limiting reagent is **not** the one with fewer grams or moles. Divide by the coefficient first.

7 • Concentration terms

Term	Formula	Changes with T
Mass %	$w_{\text{solute}}/w_{\text{soln}} \times 100$	no
Mole fraction	$\chi_A = n_A/(n_A + n_B)$	no
ppm	$w_{\text{solute}}/w_{\text{soln}} \times 10^6$	no
Molality m	$n_{\text{solute}}/\text{kg solvent}$	no
Molarity M	$n_{\text{solute}}/\text{L solution}$	yes

Heating increases volume, so only M falls.

8 • Shortcuts

Dilution $M_1 V_1 = M_2 V_2$

Mixing $M = (M_1 V_1 + M_2 V_2)/(V_1 + V_2)$

M from % $M = \% w/w \times d \times 10/M_B$

m from M $m = \frac{1000 M}{1000 d - M M_B}, d \text{ in g mL}^{-1}$

Seen in NEET 2024

X: 32% A, 20% B, rest C (A = 64, B = 40, C = 32).

$$\frac{32}{64} : \frac{20}{40} : \frac{48}{32} = 0.5 : 0.5 : 1.5 = 1 : 1 : 3$$

Empirical formula: ABC_3 .

Seen in NEET 2023

Mass of CO_2 from heating 20 g of 20% pure limestone (CaCO_3).

$$\frac{20 \times 20}{100} = 4 \text{ g}, \quad \frac{4}{100} = 0.04 \text{ mol}, \quad 0.04 \times 44 = 1.76 \text{ g}$$

Use the **pure** mass (4 g), not 20 g.

Six traps to remember

- Milk and blood are heterogeneous; dry air is homogeneous.
- Trailing zeros without a decimal point are **not** significant.
- Dalton's theory could not explain the law of **gaseous volumes**.

- For maximum atoms, multiply moles by **atomicity**.
- Limiting reagent: compare n / coefficient, not grams or moles.
- Only molarity changes with temperature; molality, mole fraction and mass % do not.