FREE NOTES · NCERT + JEE/NEET LEVEL

# Some Basic Concepts of Chemistry

Matter aur uska classification, SI units, significant figures, chemical combination ke laws, Dalton ki theory, atomic aur molecular mass, mole concept, percentage composition, empirical formula, stoichiometry, limiting reagent aur concentration terms.

01 Matter & measurement
02 Scientific notation & significant figures
03 Chemical combination ke laws
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## 01 Matter & measurement

- **Matter:** jiska mass ho aur jagah ghere. States: solid, liquid, gas.
- **Pure substances** (elements, compounds; fixed composition) vs **mixtures** (homogeneous: hawa, cheeni ka ghol; heterogeneous: ret + namak).
- **SI base units:** metre (m), kilogram (kg), second (s), kelvin (K), ampere (A), mole (mol), candela (cd).
- Density = mass/volume; T(K) = t(°C) + 273.15; °F = (9/5)°C + 32.

**PRECISION VS ACCURACY**

**Precision** = baar baar ki readings aapas me kitni paas. **Accuracy** = readings asli value ke kitni paas. Asli value 2.00 ho aur readings 1.95, 1.93, 1.94 aayein to precise hain par accurate nahi.

## 02 Scientific notation & significant figures

Number ko $N \times 10^n$ ($1 \le N < 10$) me likho: $0.00016 = 1.6 \times 10^{-4}$.

- Saare non-zero digits gine jaate: 285 cm ⇒ 3.
- Non-zero digits ke beech ke zeros gine jaate: 2.005 ⇒ 4.
- Shuru ke zeros nahi gine jaate: 0.0034 ⇒ 2.
- Aakhri zeros tab gine jaate jab decimal ho: 0.200 ⇒ 3; 100 ⇒ 1 (confusing), 100. ⇒ 3.
- Exact numbers (gini hui cheezein, defined values) ke infinite significant figures.

**CALCULATION KE RULES**

**Jodna/ghatana:** answer me utne **decimal places** jitne sabse kam precise number me (12.11 + 18.0 + 1.012 = 31.1). **Guna/bhaag:** utne **significant figures** jitne sabse kam wale number me (2.5 × 1.25 = 3.1). Rounding: hatane wala digit 5 ho aur pichla digit even ho to waisa hi chhodo (6.35 → 6.4, 6.25 → 6.2).

## 03 Chemical combination ke laws

| Law | Kya kehta | Kisne diya |
|---|---|---|
| Conservation of mass | Matter na banta na mit-ta | Lavoisier |
| Definite proportions | Ek compound me hamesha same elements same mass ratio me | Proust |
| Multiple proportions | Do elements ek se zyada compounds banayein to ek element ke fixed mass se judne wale doosre ke mass simple whole-number ratio me ($H_2O$ aur $H_2O_2$: O ka ratio 1:2) | Dalton |
| Gay Lussac's law of gaseous volumes | Gases simple volume ratio me judti (same T, p): $H_2 + Cl_2 \rightarrow 2HCl$, 1:1:2 | Gay Lussac |
| Avogadro's law | Same T, p pe barabar volume ki gases me barabar molecules | Avogadro |

**Dalton's atomic theory:** matter atoms se bana jo toot nahi sakte; ek element ke atoms ek jaise; atoms fixed ratio me judke compound banate; reaction me atoms sirf jagah badalte. (Gaseous volumes wala law explain nahi kar paayi.)

## 04 Atomic & molecular mass

- **1 amu (u)** = ek C-12 atom ke mass ka 1/12 = $1.66056 \times 10^{-24}$ g.
- **Average atomic mass** isotopes ki abundance se: Cl = (35 × 75.77 + 37 × 24.23)/100 ≈ 35.5 u.
- **Molecular mass** = atomic masses ka jod: $H_2O$ = 18 u, $C_{12}H_{22}O_{11}$ = 342 u.
- Ionic compounds ke liye **formula mass**: NaCl = 58.5 u.

## 05 Mole concept

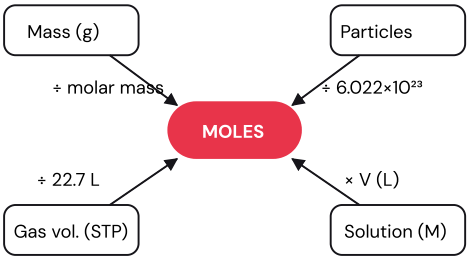
1 mole = utne particles jitne exactly 12 g C-12 me atoms = **$6.022 \times 10^{23}$** (Avogadro constant $N_A$).

$n = \text{mass} / \text{molar mass}$

$n = \text{particles ki ginti} / N_A$

$n = \text{STP pe gas ka volume} / 22.7\ \text{L}$

Molar mass g/mol me = molecular mass u me ($H_2O$: 18 g/mol). STP (273.15 K, 1 bar) pe molar volume 22.7 L (1 atm wali purani convention me 22.4 L).




Sab kuch moles ke through badalta

## 06 Percentage composition & empirical formula

Element ka mass % = (1 mol me element ka mass / molar mass) × 100. $H_2O$ me: H = 2.016/18.02 × 100 = 11.19%.

**EMPIRICAL FORMULA KE STEPS**

1. % ko gram maan lo (100 g me).
2. Har ek ko atomic mass se bhaag do ⇒ moles.
3. Sabse chhote se bhaag do ⇒ simple ratio (zaroorat ho to guna karke poore number banao).
4. Molecular formula = n × empirical formula, n = molar mass / empirical formula mass.

## 07 Stoichiometry & limiting reagent

Balanced equation mole ratio deta: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ matlab 1 mol $CH_4$ ko 2 mol $O_2$ chahiye (16 g ke saath 64 g) aur 1 mol $CO_2$ + 2 mol $H_2O$ milta.

**LIMITING REAGENT**

Wo reactant jo sabse pehle khatam hota aur product ki matra tay karta. Tareeka: har reactant ke moles ko uske coefficient se bhaag do; sabse chhoti value wala limiting reagent.

## 08 Concentration terms

| Term | Formula |
|---|---|
| Mass % | solute ka mass / solution ka mass × 100 |
| Mole fraction | $x_A = n_A/(n_A + n_B)$ |
| Molarity (M) | solute ke moles / solution ke litre |
| Molality (m) | solute ke moles / solvent ke kg |
| Dilution | $M_1V_1 = M_2V_2$ |

## 09 JEE Extra + Tricks

**JEE LEVEL**

- Equivalent concept: equivalents = moles × n-factor; N = M × n-factor. Acid ka n-factor = replace hone wale $H^+$, base = $OH^-$, oxidant/reductant = per molecule electrons.
- $H_2O_2$ ki volume strength = 11.2 × molarity (STP); oleum % = 100 + (100 g ke liye paani ki matra).
- POAC (atom conservation): element ke atoms conserved; stoichiometry me balancing ki zaroorat kam.
- Limiting reagent trick: har reactant ke moles ko coefficient se bhaag do; sabse chhota limit karta.
- Molality temperature se independent; molarity badalti (volume badalta).
- % w/w aur density se molarity: M = (10 × d × %)/(molar mass).

## 10 Solved numericals

**Q1.** 9 g paani me kitne molecules?

n = 9/18 = 0.5 mol ⇒ 0.5 × 6.022 × $10^{23}$ = **$3.011 \times 10^{23}$**.

**Q2.** Compound me 4.07% H, 24.27% C, 71.65% Cl; molar mass 98.96 g. Formulas nikalo.

Moles: H 4.04, C 2.02, Cl 2.02 ⇒ ratio 2:1:1 ⇒ empirical $CH_2Cl$ (49.48) ⇒ n = 2 ⇒ **$C_2H_4Cl_2$**.

**Q3.** 3 mol $H_2$ aur 2 mol $N_2$ react ($N_2 + 3H_2 \rightarrow 2NH_3$). Limiting reagent aur kitna $NH_3$?

$H_2$: 3/3 = 1; $N_2$: 2/1 = 2 ⇒ $H_2$ limiting ⇒ **2 mol $NH_3$**.

**Q4.** 4 g NaOH ghol ke 250 mL solution banaya. Molarity?

n = 4/40 = 0.1 mol ⇒ M = 0.1/0.25 = **0.4 M**.

## 11 Mistakes & practice

- Shuru ke zeros ko significant ginna.
- Molarity me seedha mL daal dena (litre me badlo).
- Kam gram wale reactant ko limiting maan lena (moles ÷ coefficient compare karo).
- Empirical aur molecular formula me confusion.

1. 0.0025 me significant figures?
2. $CO_2$ ke ek molecule ka mass?
3. STP pe 2 mol $O_2$ ka volume (bar convention)?
4. CO aur $CO_2$ kaun sa law dikhate?
5. Glucose ka empirical formula?

**ANSWERS**

1) 2 · 2) $44/(6.022 \times 10^{23}) = 7.3 \times 10^{-23}$ g · 3) 45.4 L · 4) Multiple proportions · 5) $CH_2O$

## 12 Quick revision: exam se 5 minute pehle

**MEASUREMENT**

- 7 SI base units.
- Shuru ke zeros significant nahi.
- +/− me decimals; ×/÷ me sig figs.

**MOLE**

- $N_A = 6.022 \times 10^{23}$.
- $n = m/M = N/N_A = V/22.7$.
- $1\ u = 1.66 \times 10^{-24}$ g.

**LAWS**

- Lavoisier, Proust, Dalton.
- Gay Lussac: volume ratios.
- Avogadro: barabar V, barabar N.

**CALCULATIONS**

- Empirical: % → moles → ratio.
- Limiting: sabse chhota moles/coeff.
- $M_1V_1 = M_2V_2$.

Koi doubt? padhaiadda.netlify.app pe AI Doubt Solver se poocho, ya is chapter ka mock test do.