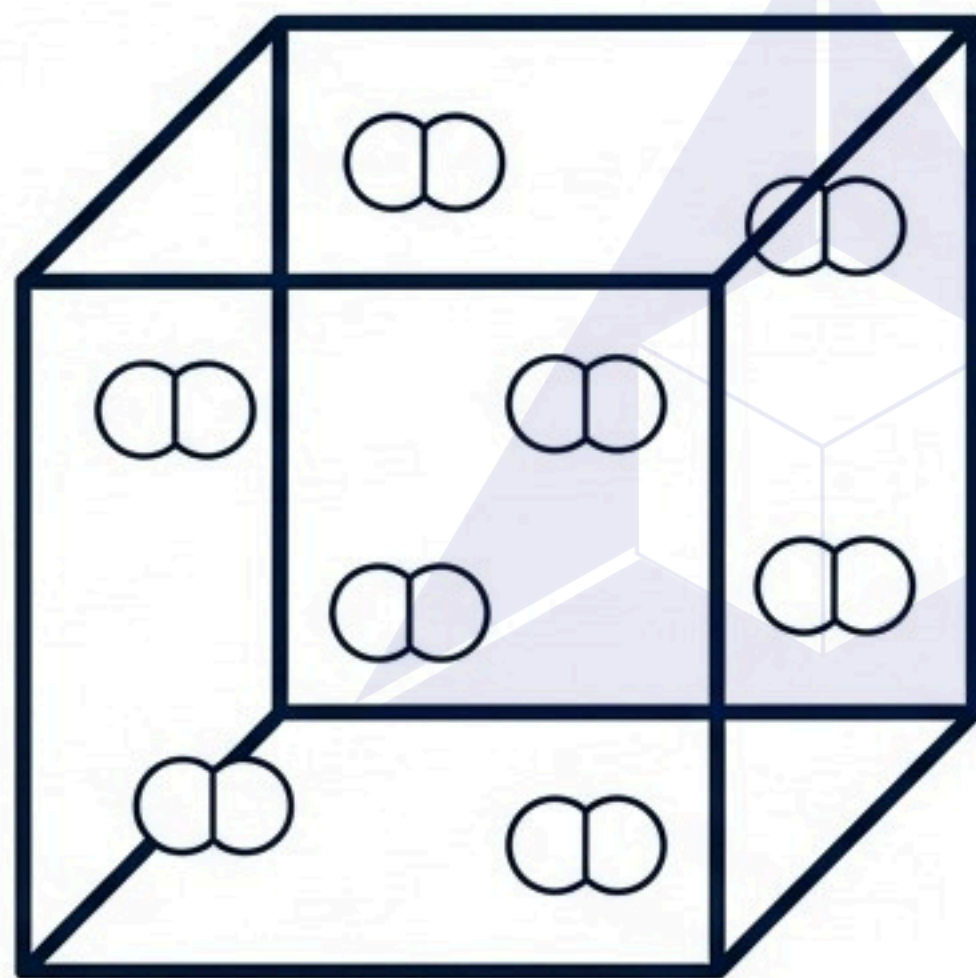
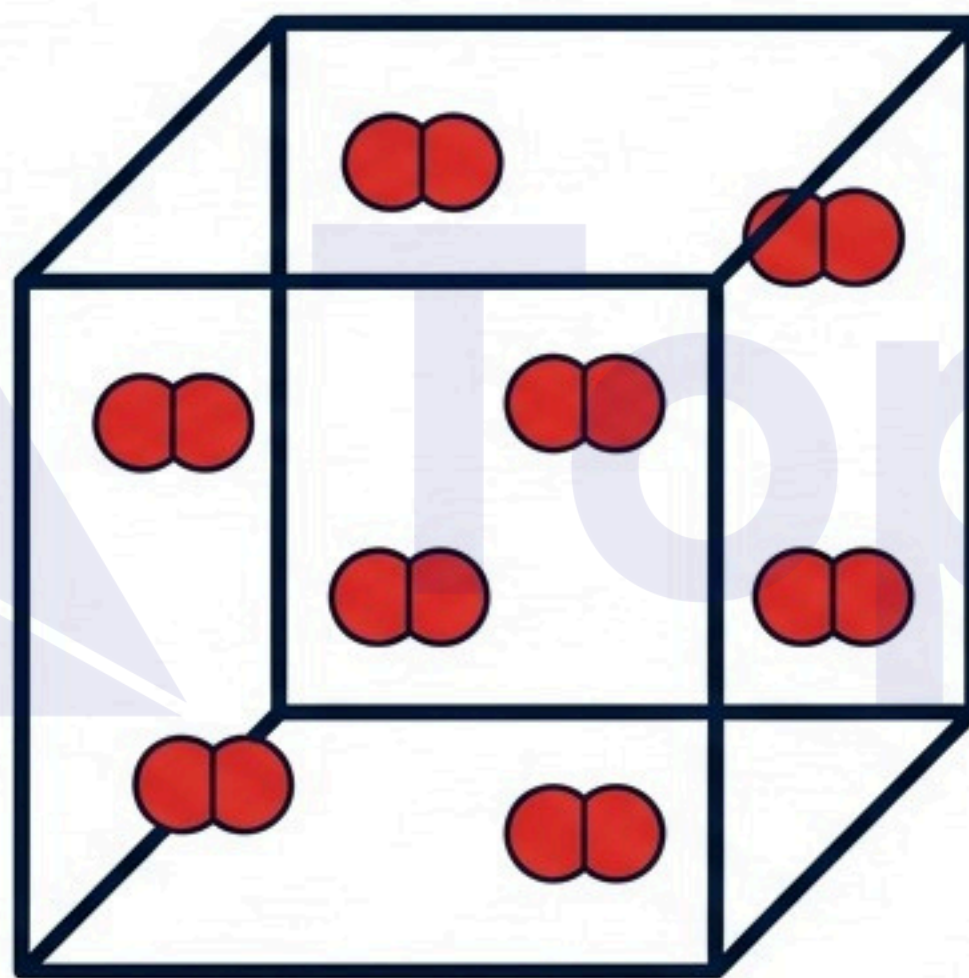


The Geometry of Gases (JEE Chemistry Concept Mastery)

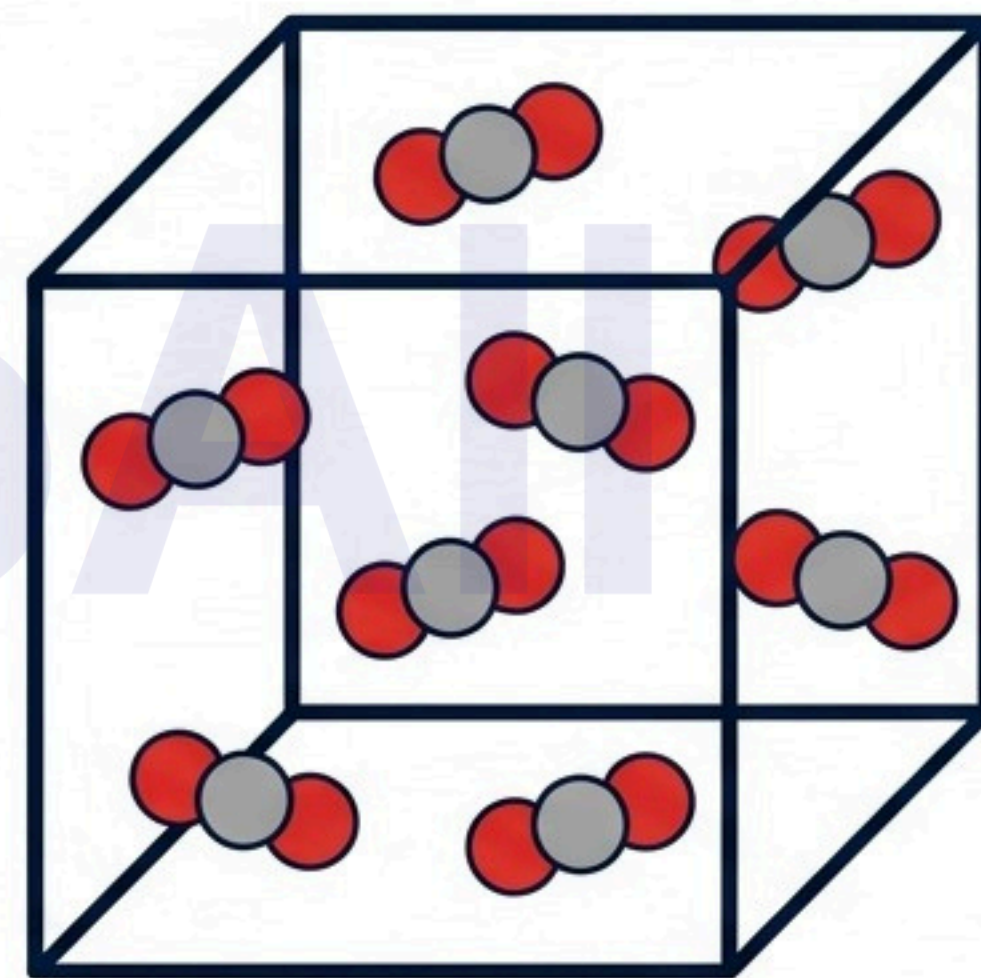
Avogadro's Law



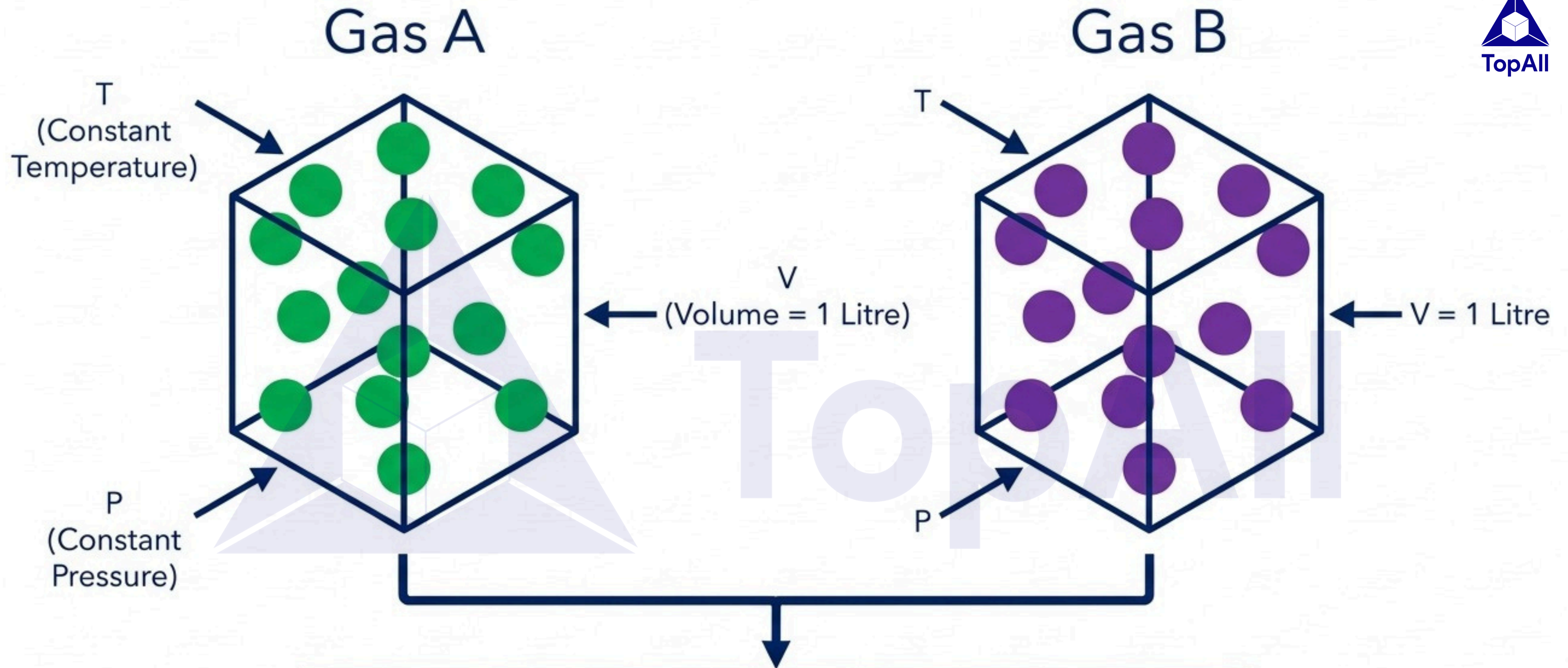
H_2



O_2

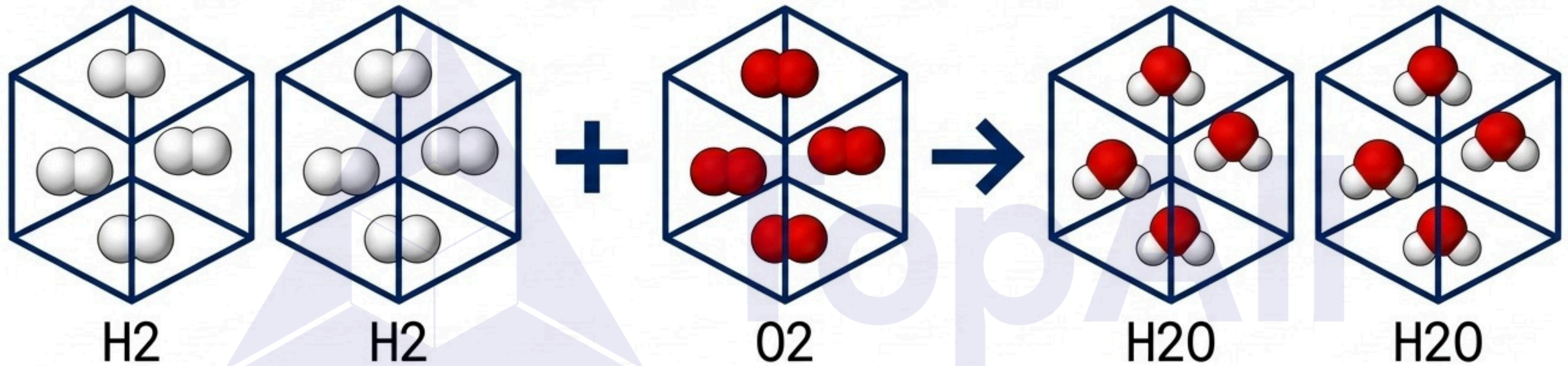


CO_2



If Temperature (T) and Pressure (P) are identical, any two equal volumes of gas contain the exact same number of molecules, regardless of the gas's chemical identity.

The Water Vapour Proof (1811)



2 Volumes H₂ + 1 Volume O₂ → 2 Volumes H₂O

To perfectly split 1 volume of Oxygen into 2 volumes of water, Oxygen must exist as polyatomic molecules (O₂), not single atoms.



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The Mathematical Rule Bank

Core Proportion

$$V \propto N \text{ (at constant } T, P)$$

Equation State

$$\frac{V_1}{N_1} = \frac{V_2}{N_2}$$

The Avogadro Deduction

$$V_1 = V_2 \Rightarrow N_1 = N_2$$

(Where V = Volume, N = Number of Molecules)

Since Moles (n) $\propto$ Molecules (N),
Avogadro's Law also means:
Equal Volumes = Equal Moles ($n_1 = n_2$).

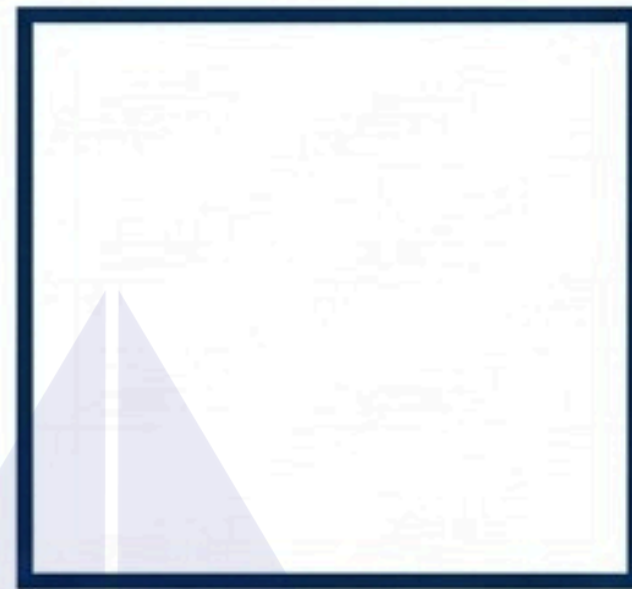
JEE Trap Alert

The Mass & Atom Illusion

	1 Liter of O ₂ gas	(both at STP)	1 Liter of He gas
Volume	1L	= ✓	1L
Molecules	N	= ✓	N
Moles	n	= ✓	n
Mass	32g	≠ ✗	4g
Total Atoms	2N	≠ ✗	N

Equal volume guarantees equal MOLECULES. It does NOT guarantee equal MASS or equal ATOMS. Check atomicity and molar mass!

Mini Application



100 mL NH_3



100 mL CO_2

Which container has more molecules? Which has more mass?

Step 1 - Molecule Count: By Avogadro's Law, $V_A = V_B \Rightarrow \text{Molecules}_A = \text{Molecules}_B$. (Count is **Identical**).

Step 2 - Mass Calculation: $n \times \text{Molar Mass}$.

- NH_3 Molar Mass = 17 g/mol.
- CO_2 Molar Mass = 44 g/mol.

Step 3 - Conclusion: CO_2 is heavier per molecule. Therefore, Container B has **more mass**.



- **The Rule**: Equal Gas Volume Fixes Molecule Count ($V_1 = V_2 \Rightarrow N_1 = N_2$).
- **The Condition**: Only holds true if Temperature (T) and Pressure (P) remain constant.
- **The Implication**: Moles (n) are also equal if volumes are equal. Chemical identity of the gas is irrelevant.
- **The Defense**: Never assume equal volume means equal mass or equal total atoms. Always multiply moles by molar mass or atomicity to find those values.



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