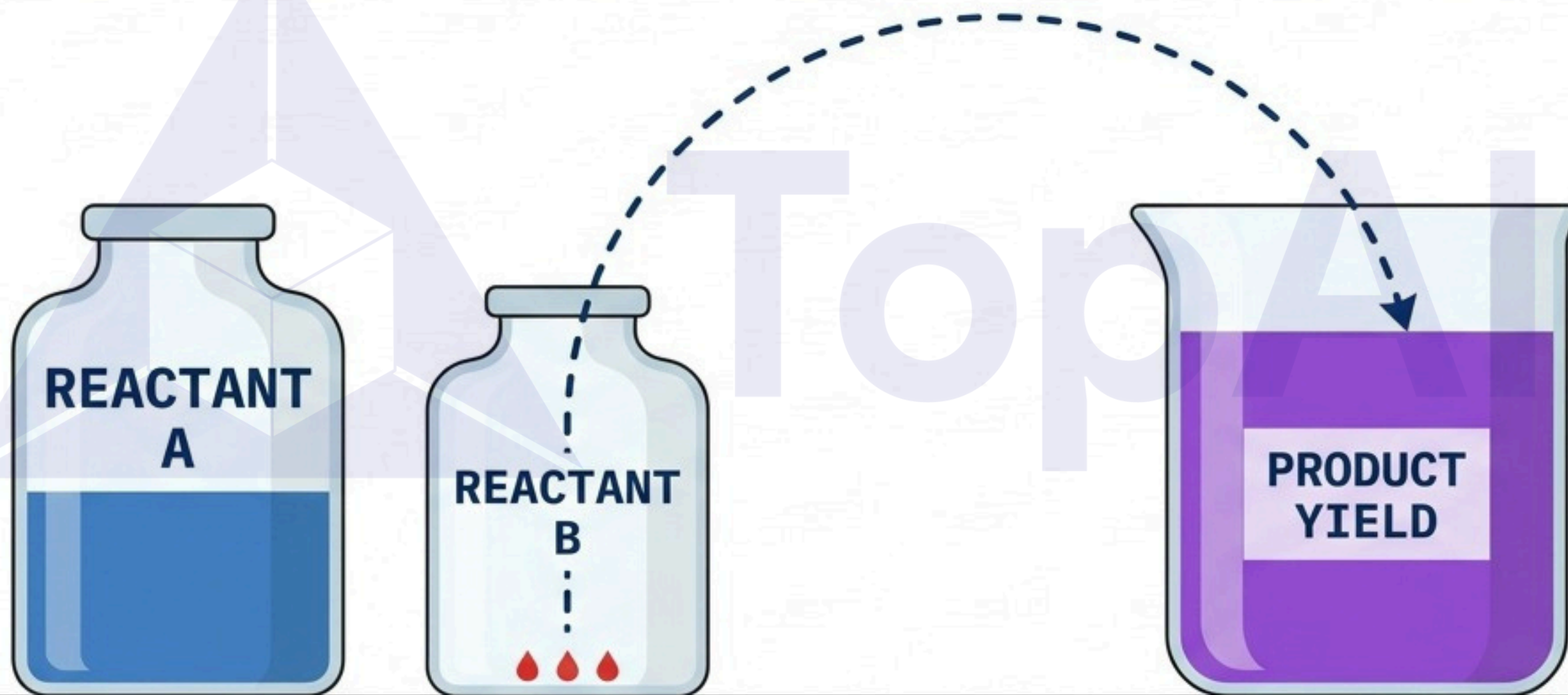


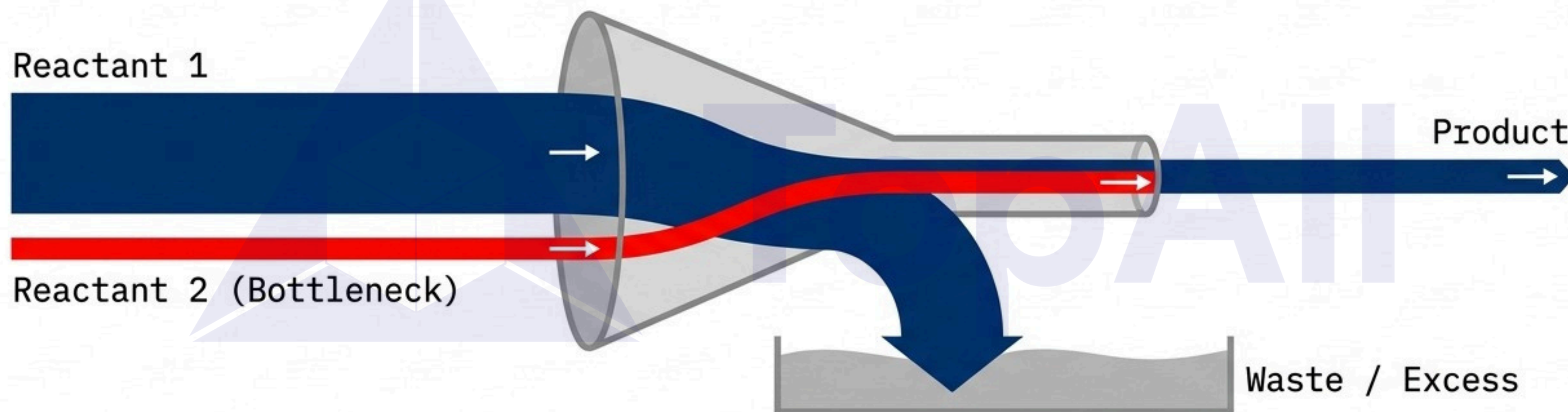
LIMITING REAGENT

Mastering Stoichiometry & Reaction Yields for JEE



What is a Limiting Reagent?

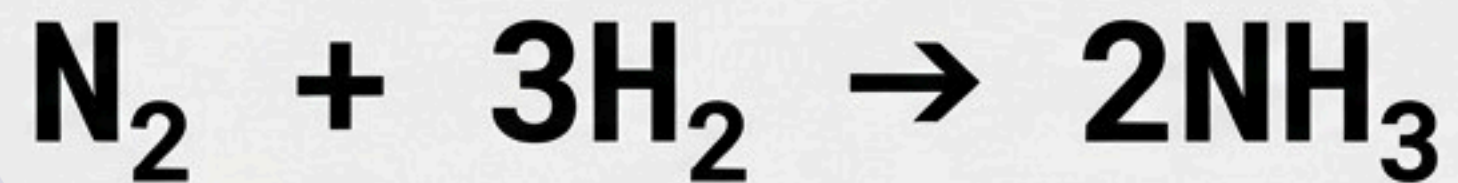
In a chemical reaction, reactants are rarely present in the exact stoichiometric amounts required. The reaction proceeds until one reactant is completely consumed. This exhaustion halts the reaction, leaving the other reactant(s) in excess.



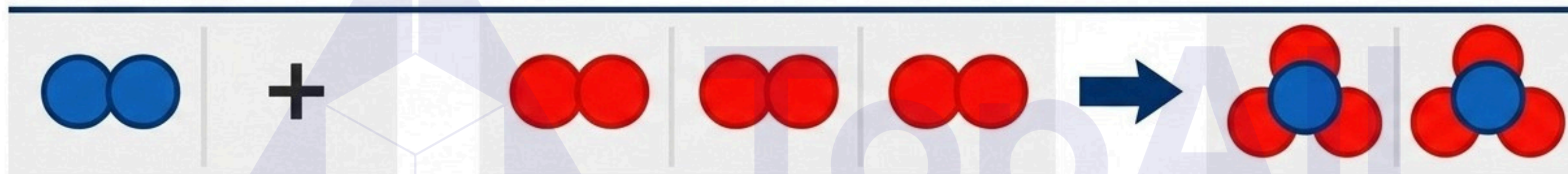
The Bottleneck Principle:

The reactant that gets consumed first limits the amount of product formed. It dictates the entire stoichiometry of the reaction.

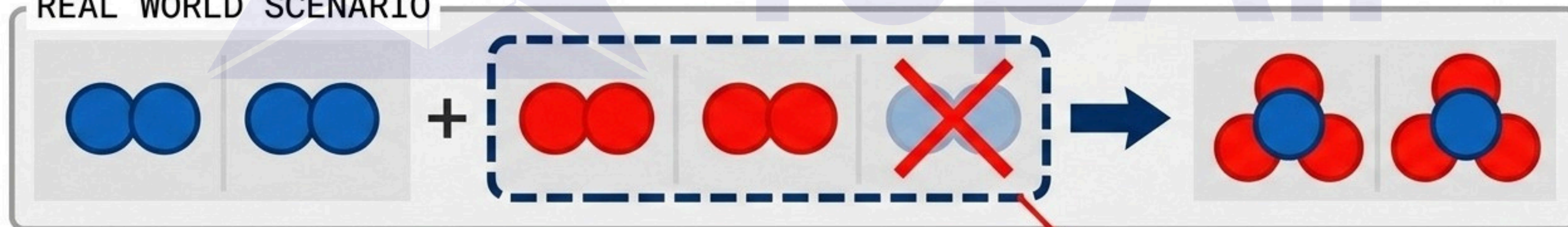
The Stoichiometric Map



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- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



The Ultimate JEE Shortcut Rule

To instantly identify the limiting reagent without writing out lengthy cross-multiplications, use the limiting ratio (LR).

STEP 1: Balance the chemical equation.

STEP 2: Calculate available moles (n) for each reactant.

STEP 3: Calculate the Limiting Ratio (LR) for each:

$$\text{LR} = \frac{\text{available moles (n)}}{\text{stoichiometric coefficient}}$$

STEP 4: Compare LR values.

SMALLER VALUE = LIMITING REAGENT

Common Examination Pitfall



WARNING: The reactant with the smaller mass is **NOT** automatically the limiting reagent! Atoms have different weights. **You must compare molecules to molecules (moles).**

THE TRAP

Comparing 50g of N_2 vs 10g of H_2 . 10g is less than 50g, so H_2 is limiting.

THE TRUTH

Molar mass changes everything.

$$50\text{g } \text{N}_2 \div 28\text{g/mol} \approx 1.78 \text{ moles}$$

$$10\text{g } \text{H}_2 \div 2\text{g/mol} = 5.0 \text{ moles}$$

You actually have more particles of Hydrogen! You must use the Formula Card rule to find the true limiting factor.

Mini Application: Haber Process

Problem: 50.0 kg N₂ and 10.0 kg H₂ are mixed to produce NH₃. Identify the limiting reagent.

Eq:	N ₂	+	3H ₂	→	2NH ₃										
Moles N ₂	=	$\frac{50,000\text{g}}{28.02 \text{ g}\cdot\text{mol}^{-1}}$			=	$1.786 \times 10^3 \text{ mol}$									
Moles H ₂	=	$\frac{10,000\text{g}}{2.016 \text{ g}\cdot\text{mol}^{-1}}$			=	$4.960 \times 10^3 \text{ mol}$									

(Applying the Rule)						
Ratio N ₂	=	$\frac{1.786 \times 10^3}{1}$	=	1.786×10^3		
Ratio H ₂	=	$\frac{4.960 \times 10^3}{3}$	=	1.653×10^3		

$$1.653 < 1.786$$

Therefore, H₂ is the
Limiting Reagent.

Revision & Golden Rule



- [✓] Always balance the chemical equation first.**
- [✓] Convert everything to moles; never calculate limits using raw mass or volume.**
- [✓] Divide by stoichiometric coefficients to find the limiting ratio.**

THE GOLDEN RULE: Once identified, the Limiting Reagent acts as the sole baseline for all further calculations. The theoretical amount of product formed is based exclusively on the moles of the limiting reagent. Excess reactants are ignored for yield calculations.



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