

Stoichiometry Summary Sheet for Ethiopian Entrance Exam

1. Key Definitions

- Mole (mol): 6.022×10^{23} particles (atoms, molecules, etc.)
- Molar mass: Mass of 1 mole of a substance (g/mol)
- Limiting Reactant: The reactant that runs out first in a chemical reaction
- Stoichiometry: The calculation of reactants and products in a chemical reaction

2. Basic Formulas

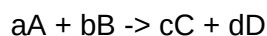
a) Moles from Mass:

$$\text{Moles} = \text{Mass (g)} / \text{Molar Mass (g/mol)}$$

b) Mass from Moles:

$$\text{Mass} = \text{Moles} \times \text{Molar Mass}$$

c) Mole Ratio (from balanced equation):



d) Volume of Gas at STP:

$$\text{Volume} = \text{Moles} \times 22.4 \text{ L/mol (only for gases at STP)}$$

3. Steps in Solving Stoichiometry Problems

1. Write the balanced chemical equation.
2. Convert given masses to moles.
3. Use mole ratio to determine unknown substance.
4. Convert moles to grams or volume if needed.

4. Common Molar Masses (g/mol)

- $H_2 = 2$ - $N_2 = 28$ - $O_2 = 32$
- $NH_3 = 17$ - $H_2O = 18$ - $CO_2 = 44$
- $CH_4 = 16$ - $NaCl = 58.5$

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5. Example Problems

Example 1:

How many grams of NH_3 are produced when 10 g of H_2 reacts with 18 g of N_2 ?

Balanced equation: $3\text{H}_2 + \text{N}_2 \rightarrow 2\text{NH}_3$

Step 1: Moles of $\text{H}_2 = 10 / 2 = 5 \text{ mol}$

Step 2: Moles of $\text{N}_2 = 18 / 28$ approximately 0.64 mol

Step 3: Limiting reactant is N_2

Step 4: NH_3 produced = $0.64 \text{ mol} \times 2 = 1.28 \text{ mol}$

Step 5: Mass = $1.28 \times 17 = 21.8 \text{ g NH}_3$

Example 2:

How many grams of NH_3 are formed from 6 g H_2 and 28 g N_2 ?

H_2 : $6 / 2 = 3 \text{ mol}$; N_2 : $28 / 28 = 1 \text{ mol}$ -> Perfect ratio

$\text{NH}_3 = 2 \text{ mol}$ -> $2 \times 17 = 34 \text{ g NH}_3$

6. Keywords Often Used in Exams

- "How much" -> mass
- "How many moles" -> moles
- "Produced" or "formed" -> product
- "Reacted" -> reactant
- "Limiting reagent" -> which one runs out first