

5.4 Reaction Enthalpy ($\Delta_r H$)

Calculating the energy changes that accompany chemical reactions.

Meta Strip

Chemistry Class 11

Exam Revision Series

CORE CONCEPT

What Is Reaction Enthalpy?

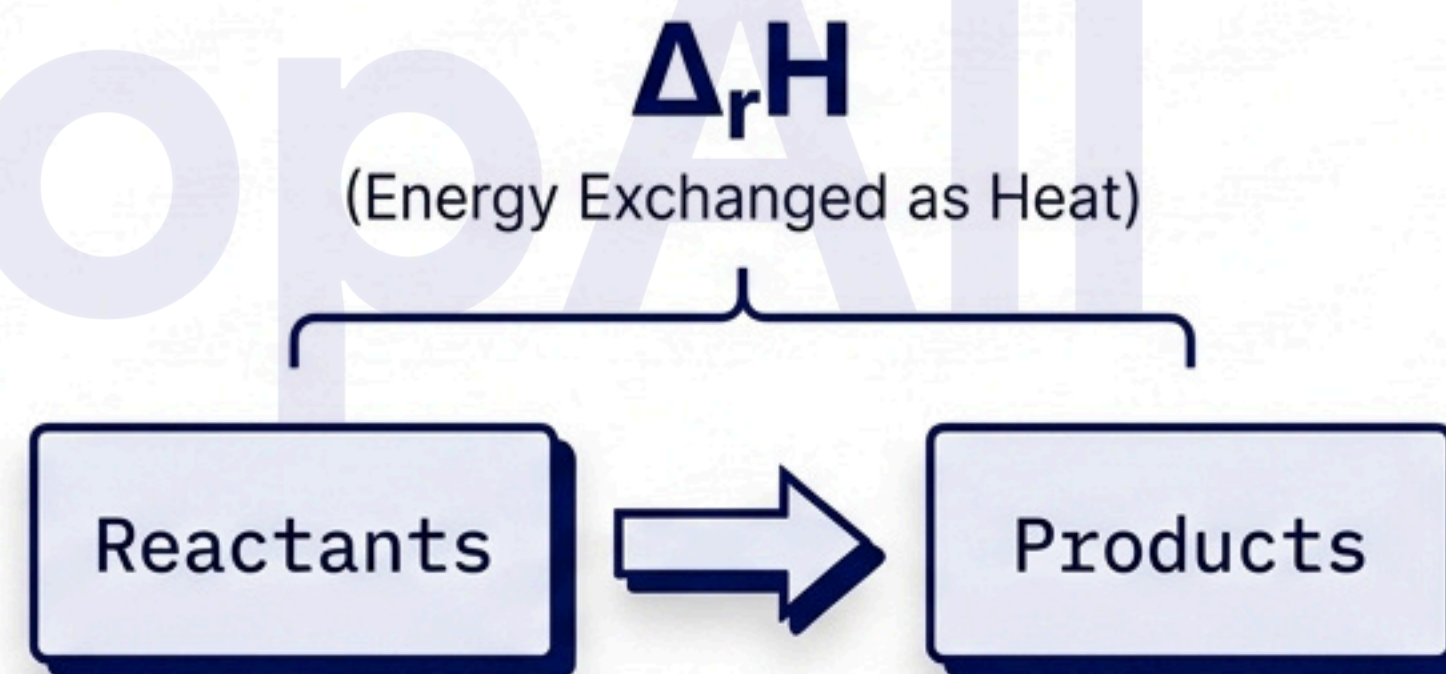
Concept Definition

In every chemical reaction, reactants are converted into products.

The total enthalpy change accompanying this specific transformation is called the Reaction Enthalpy.

Symbol: $\Delta_r H$

Hero Visual



MATHEMATICAL DEFINITION

The General Expression

The total enthalpy change
of the reaction.

Sigma (Summation) — The total
sum of all components.

$$\Delta_r H = \sum a_i H_{\text{products}} - \sum b_i H_{\text{reactants}}$$

Final state minus Initial state.



To find the heat of a reaction, sum up the enthalpies of everything you created, and subtract the enthalpies of everything you started with.



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$$E=mc^2$$



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Key Highlights

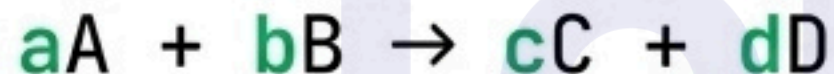
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The Logic of Stoichiometric Coefficients

Enthalpy is an extensive property (it depends on the amount of substance). We must account for the exact number of moles in the balanced equation.

Generic Equation



Mapped Formula Pill

$$\Delta_r H = [c \text{ Hm}(C) + d \text{ Hm}(D)] - [a \text{ Hm}(A) + b \text{ Hm}(B)]$$

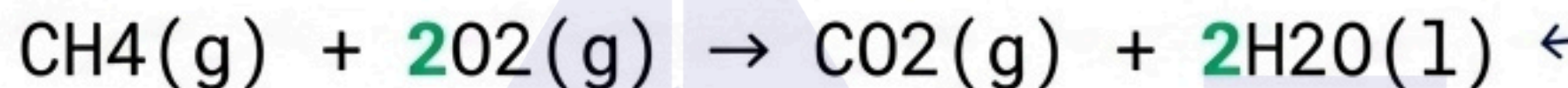
a_i Stoichiometric coefficients
of the Products.

b_i Stoichiometric coefficients
of the Reactants.

Hm Molar enthalpy of the
specific substance.

Example: Methane Combustion

Step 1: The Balanced Equation



Notice the stoichiometric "2" in front of O₂ and H₂O.

Step 2: Applying the Formula

$$\Delta_r H = \text{Sum}(\text{Products}) - \text{Sum}(\text{Reactants})$$

Step 3: The Final Expansion

$$\Delta_r H = [\text{Hm}(\text{CO}_2, \text{g}) + 2\text{Hm}(\text{H}_2\text{O}, \text{l})] - [\text{Hm}(\text{CH}_4, \text{g}) + 2\text{Hm}(\text{O}_2, \text{g})]$$



Takeaway Badge

The multiplier inside the formula matches the balanced mole count perfectly!

Linking Chemistry with Heat Effects



The Core Math

Reaction Enthalpy ($\Delta_r H$) is always calculated as the sum of product enthalpies minus the sum of reactant enthalpies.



The Scale Factor

Because enthalpy is an extensive property, you must multiply molar enthalpies by their exact stoichiometric coefficients from the balanced equation.



Industrial Relevance

Crucial for planning the specific heating or cooling required to safely maintain industrial chemical reactions at constant temperatures.



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