

Hess's Law Equation

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The law states that the total enthalpy change during a reaction is the same whether the reaction is ~~the~~ made in one step or in several steps.

In other words, if a chemical change takes place by several different routes, the overall enthalpy change is the same, regardless of the route by which the chemical change occurs (provided the initial and final conditions are same.)

Hess's Law allows the enthalpy change (ΔH) for a reaction to be calculated even when it cannot be measured directly. This is accomplished by performing basic algebraic operations based on the chemical equations of reactions using previously determined values for the enthalpies of formation.

Addition of chemical equations leads to a net or overall equation. If enthalpy change is known for each equation, the result will be the enthalpy change for the net equation.

In chemistry "H" represents the enthalpy of a system. Enthalpy refers to the sum of the internal energy of a system plus the product of the system's pressure and volume. The delta (Δ) symbol is used to represent change. Therefore ΔH represents the change in enthalpy of a system in a reaction.

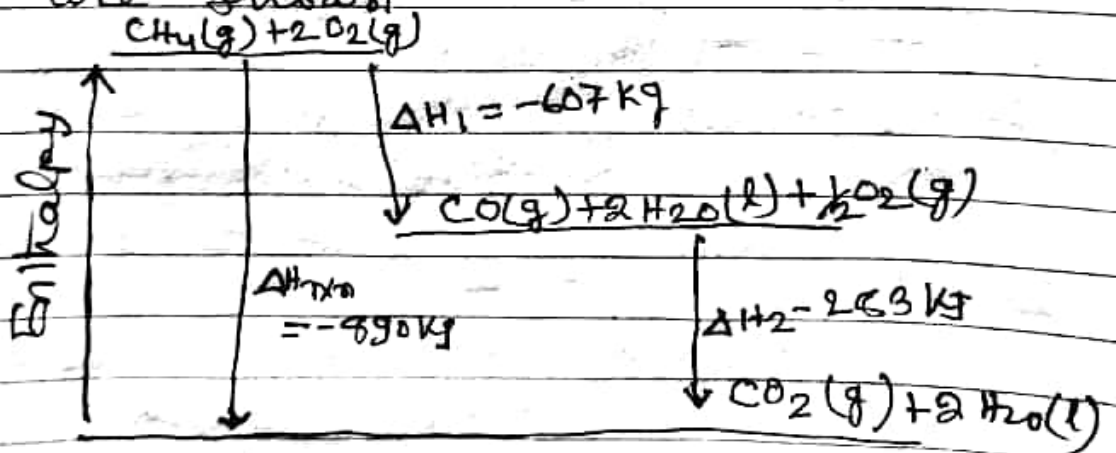
One of the key ideas of looking at state functions like the enthalpy is that the change are the same regardless of the process taken from initial to the final state. This allows us to take advantage of existing data to calculate the enthalpy changes for reactions we may not have been able to perform. This is because even if we cannot directly measure the change in the enthalpy, we can imagine a new process which involves a no. of

Steps that can be measured. The enthalpy change for the overall process is the sum of enthalpy change of the steps in the process, this is known as Hess's Law and is given in the following equation

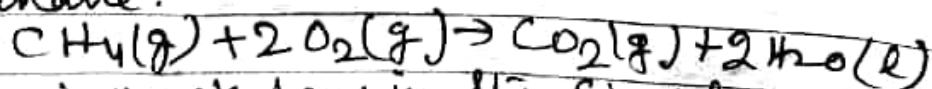
$$\Delta H_{rxn} = \Delta H_1 + \Delta H_2 + \Delta H_3 + \dots$$

Example:-

Consider the energy diagram. The total enthalpy for the grouping of compounds and their amounts are given and their energy differences are shown



The overall reaction is the balanced equation of the ~~combustion~~ Combustion of methane:-



This is Hess's Law in the simplest case

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of just two steps giving an overall reaction. In practice there could be numerous steps to combine to get the overall reaction.