Answer on Question #59670, Chemistry / General Chemistry

How to differentiate between standard enthalpy of formation and standard enthalpy of combustion?

Solution:

Standard heat of formation is called thermal effect formation of the reaction of one mole of a substance from simple substances, its components are resistant to standard conditions.

For example, the standard enthalpy of formation of 1 mole of methane from carbon and hydrogen is equal to the heat of reaction:

C (solid) + $2H_2$ (g) = CH_4 (g) + 74.9 kJ / mol.

The standard enthalpy of formation is indicated ΔH_f^O. Here, the subscript f indicates formation, and ^{O} - that refers to a standard value of the substance.

The enthalpy of formation of simple substances is assumed to be zero, and a value of zero enthalpy of formation refers to the state of aggregation, stable at T = 298 K. For example, iodine in the crystalline state ΔHI_2 (solid) = 0 kJ / mol, and the liquid iodine ΔHI2 (l) = 22 kJ / mol. Enthalpy of formation of simple substances at standard conditions are their main energy characteristics.

The thermal effect of any reaction is the difference between the sum of the heats of formation of all the products and the sum of the heats of formation of all the reagents in the reaction (a consequence of Hess's law):

ΔH^O reaction = $\Sigma\Delta H_f^O$ (products) - $\Sigma\Delta H_f^O$ (reagents)

The standard enthalpy of combustion – Δhcomb is the thermal effect of the combustion reaction of one mole of a substance in oxygen to form oxides in high oxidation states. The heat of combustion of non-combustible materials shall be equal to zero.

The difference between the combustion enthalpy and enthalpy of formation the substance is as follows: These values are of different chemical reactions, enthalpies, enthalpy of combustion - refers to a reagent in the reaction with oxygen, and enthalpy of formation - in response to the product of its formation.

Example:

The enthalpy of formation of carbon monoxide is determined by the reaction:

2C sol g + O_2 = 2CO g; ΔH ° = -220 kJ / mol

ΔH ° CO = ΔH ° / nCO = -220 kJ / mol 2 = -110 kJ / mol

and the enthalpy of combustion of the same material - the reaction of:

2CO + O2 = 2CO2 g g; ΔH ° = -220 kJ / mol

ΔH ° c CO = ΔH ° / nCO = -566 kJ / mol 2 = -283 kJ / mol

The enthalpy of reaction can be calculated not only on the enthalpies of formation of the reactants and the reaction products, and the enthalpy of combustion for substances involved in the reaction. In accordance with the law of Hess reaction enthalpy equal to the difference between the sum of the enthalpies of combustion reactants and the sum of the enthalpies of the combustion reaction products.