

Answer on Question #54515 – Chemistry – Physical Chemistry

Question:

Calculate ΔH° for the combustion of butane gas (C_4H_{10}), to produce gaseous carbon dioxide and liquid water:

$2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l)$ a. Calculate the standard enthalpy change, for the reaction.

Answer:

The standard enthalpy change is defined as follows:

$\Delta H^\circ = 10\Delta H_f^\circ(H_2O) + 8\Delta H_f^\circ(CO_2) - 2\Delta H_f^\circ(C_4H_{10}) - 13\Delta H_f^\circ(O_2)$, where ΔH_f° - the enthalpy change of formation for corresponding compounds.

$$\Delta H_f^\circ(H_2O) = -286 \text{ kJ/mol}$$

$$\Delta H_f^\circ(CO_2) = -394 \text{ kJ/mol}$$

$$\Delta H_f^\circ(C_4H_{10}) = -125.65 \text{ kJ/mol}$$

$$\Delta H_f^\circ(O_2) = 0 \text{ kJ/mol}$$

Thus,

$$\Delta H^\circ = 10 \times (-286) + 8 \times (-394) - 2 \times (-125.65) - 0 = -5760.7 \text{ kJ/mol}$$