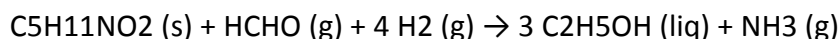


Answer on the question #47842, Chemistry, Physical Chemistry

Question:

At 298 K the standard enthalpy of combustion of solid L-valine (C₅H₁₁NO₂ (s)) to give CO₂ (g), H₂O (liq) and N₂ (g) is $\Delta_{\text{comb}}H^\circ = -2911$ kJ/mol. Calculate $\Delta_r H^\circ$ and $\Delta_r U^\circ$ at 298 K for the following reaction.

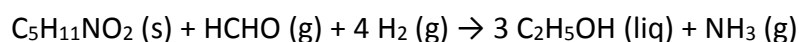


Solution:

According to the Hibbs law:

$$\Delta H_r = \sum_i^N \Delta H_{\text{comb},i}$$

For the reaction



$$\Delta H_r = \Delta H_{\text{valine}} + \Delta H_{\text{HCHO}} + 4\Delta H_{\text{H}_2} - 3\Delta H_{\text{C}_2\text{H}_5\text{OH}} - \Delta H_{\text{NH}_3}$$

$$\Delta H_r = -2911 - 570.78 - 285.83 * 4 + 1368.34 * 3 + 382.85 = -137 \frac{\text{kJ}}{\text{mol}}$$

The combustion enthalpy data on combustion enthalpies was provided by [NIST chemistry webbook](#).

According to the thermodynamics laws:

$$\Delta H_r = \Delta U_r + p\Delta V$$

$$\Delta V = (1 - 4 - 1)V_m = -4 * 22.4 * 10^{-3} \text{ m}^3/\text{mol}$$

$$\Delta U_r = \Delta H_r - p\Delta V = -137 + 101.325 * 4 * 22.4 * 10^{-3} = -128 \frac{\text{kJ}}{\text{mol}}$$

Answer: $\Delta H_r = -137$ kJ/mol. $\Delta U_r = -128$ kJ/mol.