Answer on Question #60100 – Chemistry | Inorganic Chemistry

Calculating the standard enthalpy of combustion

Solution:

1) Hess' Law:

$\Delta H°_{rxn} = \Sigma \Delta H°_{f,\ products} - \Sigma \Delta H°_{f,\ reactants}$

The standard formation reaction for the ethane, carbon dioxide, and water:

$2C(s) + 3H_2(g) = C_2H_6(g)$ $\quad \Delta H°_{f,\ C2H6}$: -140 kJ*mol^{-1}

$C(s, gr.) + O_2(g) = CO_2(g)$ $\quad \Delta H°_{f,\ CO2}$: -394 kJ*mol^{-1}

$H_2(g) + 1/2\ O_2(g) = H_2O(l)$ $\quad \Delta H°_{f,\ H2O}$: -286 kJ*mol^{-1}

Meaning that the standard enthalpy changes of formation of water and carbon dioxide are exactly the same as the enthalpy change of combustion of Carbon and Hydrogen.

2) Substitute values into the equation. Since oxygen is an element in its standard state, its enthalpy of formation is zero.

$\Delta H°_{f,\ O2}$: 0

The equation for the combustion of C_2H_6 (ethane) is:

$C_2H_6 + 7/2O_2 = 2CO_2 + 3H_2O$

$[2*(-394) + 3*(-286)] - [(-140) + 7/2 * 0] = -1506$ kJ*mol^{-1}