Standard Enthalpies of Formation

Calculate ΔH°_{rxn} for following:

$$2\ C_3H_{6(g)} + 9\ O_{2(g)} \Rightarrow 6\ CO_{2(g)} + 6\ H_2O_{(l)}$$

$$\Delta H^\circ_{rxn} = \sum n_p \cdot \Delta H^\circ_f(\text{product}) - \sum n_r \cdot \Delta H^\circ_f(\text{reactant})$$

Info from book (Standard Enthalpy of Formation)

$3C_{(s)} + 3H_{2(g)} \rightarrow 1\ C_3H_{6(g)} \quad \Delta H^\circ_{f\ C_3H_{6(g)}} = 20.9\ \frac{kJ}{1\ mol\ C_3H_6}$

$C_{(s)} + O_{2(g)} \rightarrow 1\ CO_{2(g)} \quad \Delta H^\circ_{f\ CO_{2(g)}} = -393.5\ \frac{kJ}{1\ mol\ CO_2}$

$H_{2(g)} + \frac{1}{2} O_{2(g)} \rightarrow 1\ H_2O_{(l)} \quad \Delta H^\circ_{f\ H_2O_{(l)}} = -286\ \frac{kJ}{1\ mol\ H_2O}$

$$\Delta H^\circ_{rxn} = (6\ mol\ CO_2)(\Delta H^\circ_{f\ CO_2}) + (6\ mol\ H_2O)(\Delta H^\circ_{f\ H_2O}) - (2\ mol\ C_3H_6)(\Delta H^\circ_{f\ C_3H_6}) - (9\ mol\ O_2)(\Delta H^\circ_{f\ O_2})$$

$$\Delta H^\circ_{rxn} = (6\ mol\ CO_2)\left(-393.5\ \frac{kJ}{1\ mol\ CO_2}\right) + (6\ mol\ H_2O)\left(-286\ \frac{kJ}{1\ mol\ H_2O}\right) - (2\ mol\ C_3H_6)\left(20.9\ \frac{kJ}{1\ mol}\right) - (9\ mol\ O_2)\left(0\ \frac{kJ}{1\ mol\ O_2}\right)$$

$$\Delta H^\circ_{rxn} = -2361\ kJ + (-1716\ kJ) - 41.80\ kJ - 0\ kJ$$

$$\Delta H^\circ_{rxn} = -4.118 \times 10^3\ kJ$$

$$\Delta H^\circ_{rxn} = -4.12 \times 10^3\ kJ$$

which means

$$\frac{-4.12 \times 10^3\ kJ}{2\ mol\ C_3H_6\ react} = \frac{-4.12 \times 10^3\ kJ}{9\ mol\ O_2\ react} = \frac{-4.12 \times 10^3\ kJ}{6\ mol\ CO_2} = \frac{-4.12 \times 10^3}{6\ mol\ H_2O}$$