Enthalpy of formation from combustion

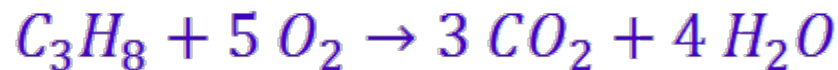The enthalpy of combustion $\Delta_{comb}H^o$ for propane, C_3H_8, is -2220 kJ. What is $\Delta_f H^o$ of C_3H_8?

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Solution: Write down the balanced equation

$$C_3H_8 + 5\,O_2 \rightarrow 3\,CO_2 + 4\,H_2O$$

Look up the enthalpies of formation of the CO_2 and H_2O. Remember that the enthalpy of formation of O_2 is zero. The tabulated values of enthalpy are given at 298 K, Keep in mind that H_2O is in the liquid phase.
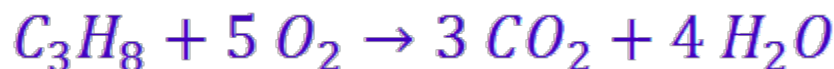
$$\Delta_f H(CO_2) = -393\ kJ/mol$$

$$\Delta_f H(H_2O) = -285\ kJ/mol$$

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$$\Delta_{rxn}H = 3\Delta_f H(CO_2) + 4\Delta_f H(H_2O) - \Delta_f H(C_3H_8)$$

$$\Delta_f H(C_3H_8) = 3\Delta_f H(CO_2) + 4\Delta_f H(H_2O) - \Delta_{rxn}H$$

$$\Delta_f H(C_3H_8) = 3(-393) + 4(-285) - (-2222)$$

$$\Delta_f H(C_3H_8) = -97 \text{ kJ/mol}$$