

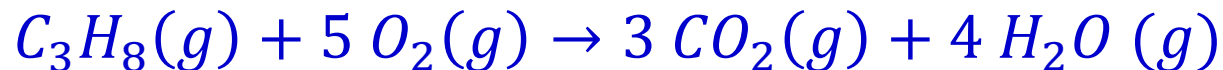
Internal energy of combustion

What is the molar internal energy of combustion for propane, C_3H_8 assuming that water is in the vapor phase ($T = 373 \text{ K}$)?

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Solution: Write down the balanced equation



Calculate the change in number of moles of gas, Δn_{gas} .

$$\Delta n_{\text{gas}} = \sum n_{\text{products}} - \sum n_{\text{reactants}}$$

$$\Delta n_{\text{gas}} = 3 + 4 - 1 - 5 = 1$$

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Use the relationship between enthalpy and internal energy:

$$\Delta H = \Delta U + P\Delta V$$

$$\Delta H = \Delta U + \Delta nRT$$

Thus,

$$\Delta U = \Delta H - \Delta nRT$$

If we wish to write these as molar quantities we can write:

$$\Delta U_m = \Delta H_m - \Delta \nu RT$$

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Hence in this case

$$\Delta U = -2220 \text{ kJ/mol} - (1) \left(8.31 \frac{\text{J}}{\text{molK}} \right) (373 \text{ K})$$
$$\Delta U = -2223 \text{ kJ/mol}$$