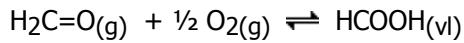


De verbrandingswarmte van formaldehyde $\text{H}_2\text{CO(g)}$ en mierenzuur HCOOH(l) bedragen resp. -563 kJ/mol en -270 kJ/mol . Bereken $\Delta_f H^\circ$ voor:



Oplossing

$$\begin{aligned}\Delta_r H^\circ &= \left(\Delta_f H^\circ_{\text{HCOOH(l)}} \right) - \left(\Delta_f H^\circ_{\text{H}_2\text{C=O(g)}} + \frac{1}{2} \Delta_f H^\circ_{\text{O}_2\text{(g)}} \right) \\ \Delta_r H^\circ &= \left(\Delta_f H^\circ_{\text{HCOOH(l)}} \right) - \left(\Delta_f H^\circ_{\text{H}_2\text{C=O(g)}} \right)\end{aligned}$$

Verbranding van formaldehyde:

$$\begin{aligned}\text{H}_2\text{C=O(g)} + \text{O}_2\text{(g)} &\longrightarrow \text{CO}_2\text{(g)} + \text{H}_2\text{O(l)} \\ \Delta_r H^\circ &= \left(\Delta_f H^\circ_{\text{CO}_2\text{(g)}} + \Delta_f H^\circ_{\text{H}_2\text{O(l)}} \right) - \left(\Delta_f H^\circ_{\text{H}_2\text{C=O(g)}} + \Delta_f H^\circ_{\text{O}_2\text{(g)}} \right) = -563 \frac{\text{kJ}}{\text{mol}} \\ \Rightarrow \Delta_f H^\circ_{\text{H}_2\text{C=O(g)}} &= \left(\Delta_f H^\circ_{\text{CO}_2\text{(g)}} + \Delta_f H^\circ_{\text{H}_2\text{O(l)}} \right) + 563 \frac{\text{kJ}}{\text{mol}}\end{aligned}$$

Verbranding van mierenzuur:

$$\begin{aligned}\text{HCOOH(l)} + \frac{1}{2} \text{O}_2\text{(g)} &\longrightarrow \text{CO}_2\text{(g)} + \text{H}_2\text{O(l)} \\ \Delta_r H^\circ &= \left(\Delta_f H^\circ_{\text{CO}_2\text{(g)}} + \Delta_f H^\circ_{\text{H}_2\text{O(l)}} \right) - \left(\Delta_f H^\circ_{\text{HCOOH(l)}} + \frac{1}{2} \Delta_f H^\circ_{\text{O}_2\text{(g)}} \right) = -270 \frac{\text{kJ}}{\text{mol}} \\ \Rightarrow \Delta_f H^\circ_{\text{HCOOH(l)}} &= \left(\Delta_f H^\circ_{\text{CO}_2\text{(g)}} + \Delta_f H^\circ_{\text{H}_2\text{O(l)}} \right) + 270 \frac{\text{kJ}}{\text{mol}}\end{aligned}$$

Daaruit volgt dat:

$$\begin{aligned}\Delta_r H^\circ &= \left(\Delta_f H^\circ_{\text{HCOOH(l)}} \right) - \left(\Delta_f H^\circ_{\text{H}_2\text{C=O(g)}} \right) \\ \Delta_r H^\circ &= \left[\left(\Delta_f H^\circ_{\text{CO}_2\text{(g)}} + \Delta_f H^\circ_{\text{H}_2\text{O(l)}} \right) + 270 \frac{\text{kJ}}{\text{mol}} \right] - \left[\left(\Delta_f H^\circ_{\text{CO}_2\text{(g)}} + \Delta_f H^\circ_{\text{H}_2\text{O(l)}} \right) + 563 \frac{\text{kJ}}{\text{mol}} \right] \\ \Delta_r H^\circ &= 270 \frac{\text{kJ}}{\text{mol}} - 563 \frac{\text{kJ}}{\text{mol}} \\ \Delta_r H^\circ &= -293 \frac{\text{kJ}}{\text{mol}}\end{aligned}$$