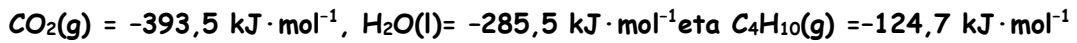


6.- Formazio-entalpia hauek egoera estandarrean emanda daude:



a) Kalkulatu butano gasaren errektuntza-beroa.

b) Zenbat litro butano gas (baldintza normaletan) erre behar da 20 litro ur 15°C -tik 35°C -ra berotzeko?

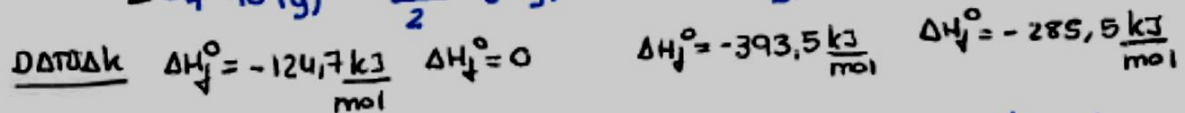
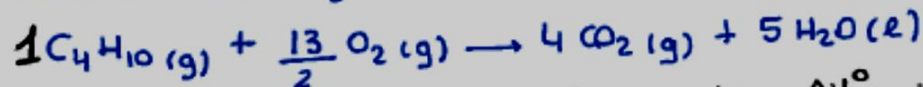
Datuak: Uraren bero espezifikoa = $4,18 \text{ kJ} \cdot \text{kg}^{-1} \cdot \text{K}^{-1}$;

uraren dentsitatea = $1 \text{ kg} \cdot \text{L}^{-1}$

Emaitza: a) $\Delta H_{\text{erre}}(\text{C}_4\text{H}_{10}) = -2.876,8 \text{ kJ} \cdot \text{mol}^{-1}$; b) $13 \text{ L C}_4\text{H}_{10}$

a) $\Delta H_{\text{c}}^\circ_{\text{C}_4\text{H}_{10}} ?$

• Butanoaren errektuntza:



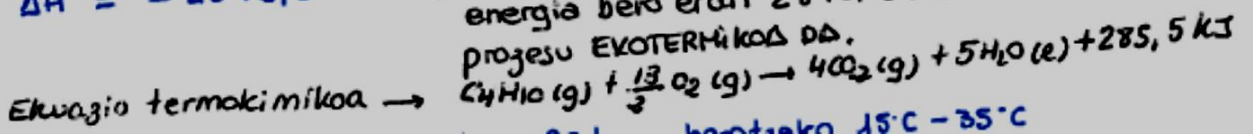
• Datuak substantzien formazio entalpiak direnez formula erabiliko dugu:

$$\Delta H^\circ = (n_{\text{p}} \cdot \Delta H_{\text{f}}^\circ_{\text{p}}) - (n_{\text{e}} \cdot \Delta H_{\text{f}}^\circ_{\text{e}})$$

$$\Delta H^\circ = (n_{\text{CO}_2} \cdot \Delta H_{\text{f}}^\circ_{\text{CO}_2} + n_{\text{H}_2\text{O}} \cdot \Delta H_{\text{f}}^\circ_{\text{H}_2\text{O}})_{\text{p}} - (n_{\text{C}_4\text{H}_{10}} \cdot \Delta H_{\text{f}}^\circ_{\text{C}_4\text{H}_{10}} + n_{\text{O}_2} \cdot \Delta H_{\text{f}}^\circ_{\text{O}_2})_{\text{e}}$$

$$\Delta H^\circ = (4 \text{ mol} \cdot (-393,5) \frac{\text{kJ}}{\text{mol}} + 5 \text{ mol} \cdot (-285,5) \frac{\text{kJ}}{\text{mol}}) - (1 \text{ mol} \cdot (-124,7) \frac{\text{kJ}}{\text{mol}})$$

$\Delta H^\circ = -2876,8 \text{ kJ} \rightarrow$ 1 mol butano erretzean askatzen den energia bero eran $2876,8 \text{ kJ}$ -ekoa da, prozesu EKOTERMIKO bat da.



b) $V(L)$ C_4H_{10} b.n erre beharden $20 L H_2O$ berotzeko $15^\circ C - 35^\circ C$

- Lehendabizi kalkulatuko dugu urak zenbat bero behar duen temperatura igotzeko:

$$Q = m \cdot c_e \cdot \Delta T = m \cdot c_e (T - T_0)$$

$$\rightarrow 20 L H_2O \cdot \frac{1 kg}{1 L H_2O} = 20 kg H_2O$$

$$Q = 20 kg \cdot 4,18 \frac{kJ}{kg \cdot K} \cdot 20 K = \boxed{1672 kJ}$$

urak behar duen beroa.

- $1672 kJ$ hauak butanoaren errekontzatik lortuko direnez erlazioatuko ditugu butanoaren errekontzarekin:

$$\begin{aligned} & \downarrow \text{Errekontza exotermikoa delako.} \\ & -1672 kJ \cdot \frac{1 mol C_4H_{10}}{-2876,8 kJ} \cdot \frac{22,4 b.n}{1 mol C_4H_{10}} \cong \boxed{13 L C_4H_{10}} \end{aligned}$$

Erre beharden C_4H_{10} -an bolumena b.n-etan

Baldintza normalak $1 mol \rightarrow 22,4 L$