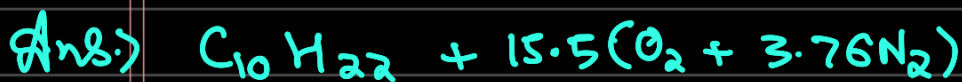


Day-5

→ Higher & lower heating values of n-decane(g) ($C_{10}H_{22}$) / kmol and per kg of fuel. $\Delta H_{\text{latent, vap. of water}}^{\circ} = 44010 \text{ kJ/kmol}$
If
× Vaporization enthalpy of n-decane = 359 kJ/kg
fuel at STP, find LHV, HHV of liquid n-decane.



$$\Delta H_{\text{R}} = H_{\text{prod}} - H_{\text{reac.}}$$

$$= 10 \times (-393546) + 11(-241845) - (-249659)$$

$$= -6346096^* \text{ kJ/kmol of } C_{10}H_{22} \text{ (LHV)}$$

Add 44010 for HHV

$$\begin{aligned} \text{So HHV} &= -6346096 - 44010 \times 11 \\ &= -6830206 \text{ kJ kmol}^{-1}^* \end{aligned}$$

Divide by $142.284 \text{ kg kmol}^{-1}$ to get kJ kg^{-1}

For liquid n-decane,

$$\begin{aligned} \text{LHV} &= (-6346096 + 359 \times 142.284) \text{ kJ kmol}^{-1} \\ &= -6295016.044 \text{ kJ kmol}^{-1}^* \end{aligned}$$

$$\text{HHV} = -6295016.044 - 11 \times 44010$$

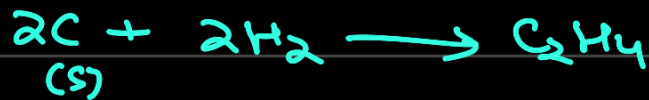
$$= -6779126.044 \text{ kJ kmol}^{-1} *$$

* Actually LHV, HHV = $-\Delta H_{\text{reac}}^{\circ}$
 so just remove the -ve sign I
 put.

→ Hess' law:

$\Delta H_{\text{reac}}^{\circ}$ → same irrespective of no. of
 steps

Eg: C₂H₄



Not feasible!

Step	Reac ⁿ	ΔH° (kJ/kmol)
1	$2C(s) + 2O_2 \rightarrow 2CO_2$	-787.4
2	$2H_2 + O_2 \rightarrow 2H_2O$	-571.5
3	$2CO_2 + 2H_2O \rightarrow C_2H_4 + 3O_2$	1411