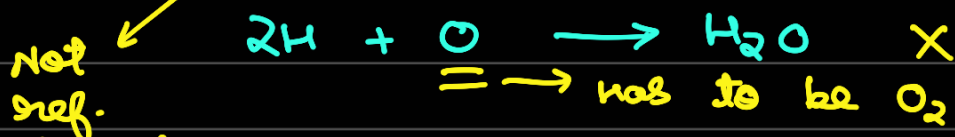
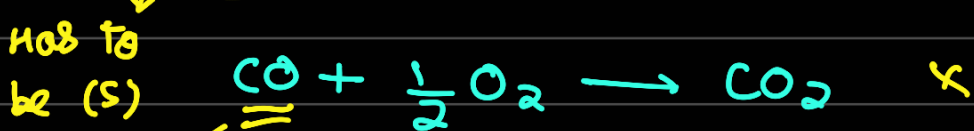
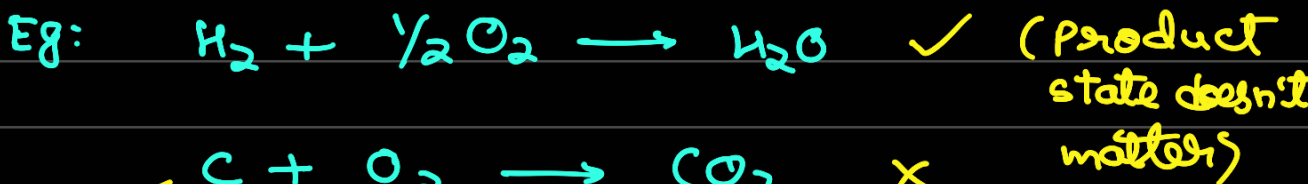


## Day-4

→ Formation enthalpy,  $\Delta H_F$  -

It is the value of  $\Delta H$  for formation of 1 mole of a compound from its constituent elements in their natural states.  $[O_2, N_2, H_2 \rightarrow \text{gas} ; C(s) \rightarrow \text{graphite}]$



Notation:  $\bar{h}_{F, T_{ref}}^0 \rightarrow$  standard formation enthalpy.



↳ identified as self. element??

Ashish Sarangi Sir will think about it !!

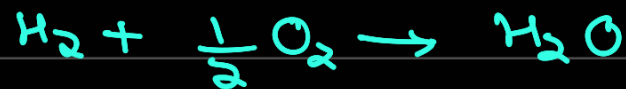
$$h_0 = H_p - H_R$$

$L_{\rightarrow} = 0$  for ref. elements

→ Using JANAF Table:

$$\bar{h}_{F,500K}^{\circ} = -243822 \text{ kJ/kmol}$$

$$\bar{h}_{F,298K}^{\circ} = -241845 \text{ kJ/kmol}$$



$$\bar{h}_{F,500}^{\circ} = \bar{h}_{F,298}^{\circ} + \left( \bar{C}_{P,\text{H}_2\text{O}} - \bar{C}_{P,\text{H}_2} - \frac{1}{2} \bar{C}_{P,\text{O}_2} \right) \times (500 - 298)$$

→ Absolute enthalpy = formation enthalpy (STP) + sensible enthalpy (+ latent heat in case of phase change)

→  $\text{CO} + \text{CO}_2 + \text{N}_2$  at 1 atm,  $x_{\text{CO}} = 0.1$ ,  $x_{\text{CO}_2} = 0.2$ ,  $T = 1200 \text{ K}$ . Find  $H_{\text{abs}}$ .

Ans)  $\bar{h}_{F,298,\text{CO}_2}^{\circ} = -393546 \text{ kJ/kmol}$

$$\bar{h}_{F,298,\text{CO}}^{\circ} = -110541 \text{ kJ/kmol}$$

$$\bar{h}_{F,298,\text{N}_2}^{\circ} = 0$$

$$h_{\text{sens.},\text{CO}}(1200 \text{ K}) = 28440 \text{ kJ/kmol}$$

$$h_{\text{sens.},\text{CO}_2}(1200 \text{ K}) = 44488 \text{ kJ/kmol}$$

$$h_{\text{sens.},\text{N}_2}(1200 \text{ K}) = 28118 \text{ kJ/kmol}$$

$$\begin{aligned} \therefore H_{\text{abs}} &= 0.1 \times (-110541 + 28440) \\ &\quad + 0.2 \times (-393546 + 44488) \\ &\quad + 0.7 \times (28118) \\ &= -58339.1 \text{ kJ kmol}^{-1} \end{aligned}$$

→ Upper & lower heating values of  
n-decane(g) ( $C_{10}H_{22}$ ) / kmol and per  
kg of fuel.  $\Delta H_{\text{latent, vap.}} = 44010 \text{ kJ/kmol}$

Ans.)