Nishant Jindal

THERMOCHEMISTRY

0-1	44-49
S-I	25-31

(47) $\Delta G^\circ = -RT\ln K = -RT\ln\left(\frac{x}{2}\right)^2 = -2RT\ln\frac{x}{2}$

$$NH_4HS(s) \rightarrow NH_3(g) + H_2S(g)$$
$$\frac{x}{2} \qquad \frac{x}{2}$$

$$K_p = \left(\frac{x}{2}\right)\left(\frac{x}{2}\right) = \frac{x^2}{4}$$

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$$\Delta G = \Delta G^0 + RT \ln \frac{P_{NH_3}^2}{P_{N_2} \times P_{H_2}^3}$$

$$= -33\,kJ + \frac{8.3 \times 298 \times 2.303}{1000} \log \frac{4 \times 10^{-4}}{1 \times 3^3}$$

S-I

(27) $2A(S) \longrightarrow B + 2C + 3D$

2 atm 4 atm 6 atm

(28) $\ln K = \frac{\Delta S^\circ}{R} - \frac{\Delta H^\circ}{R}\left(\frac{1}{T}\right)$

$\underline{\ln K = -1.04 - \frac{1080}{}\left(\frac{1}{T}\right)}$

$\frac{\Delta H^\circ}{R} = 1080$

$\frac{\Delta S^\circ}{R} = -1.04$

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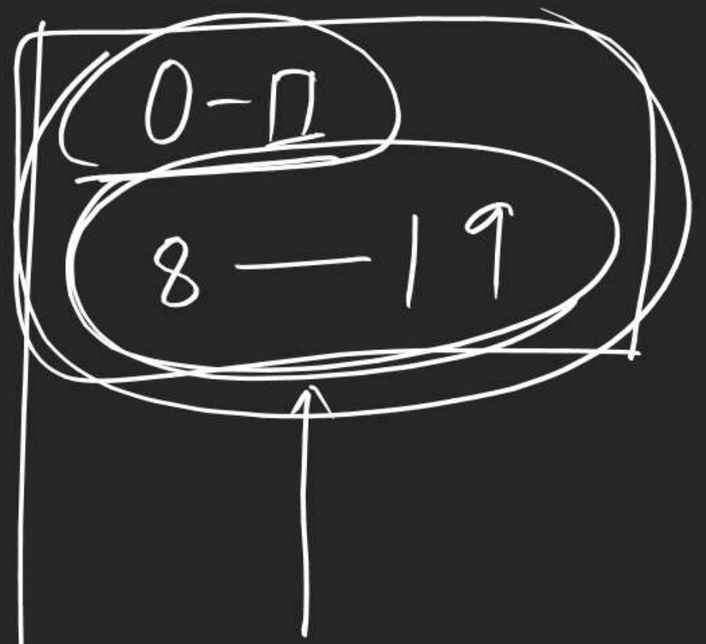
$\alpha \longrightarrow \beta$

$1 - 0.6 \quad\quad 0.6$

$= 0.4$

$$K_{eq} = \frac{0.6}{0.4} = 3/2$$

$$\Delta G^0 = -RT \ln K_{eq}$$



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THERMOCHEMISTRY

$$\Delta G_r = \Delta H_r - T\Delta S_r$$

Heat transfer at const 'P' $(Q_p) = \Delta H$

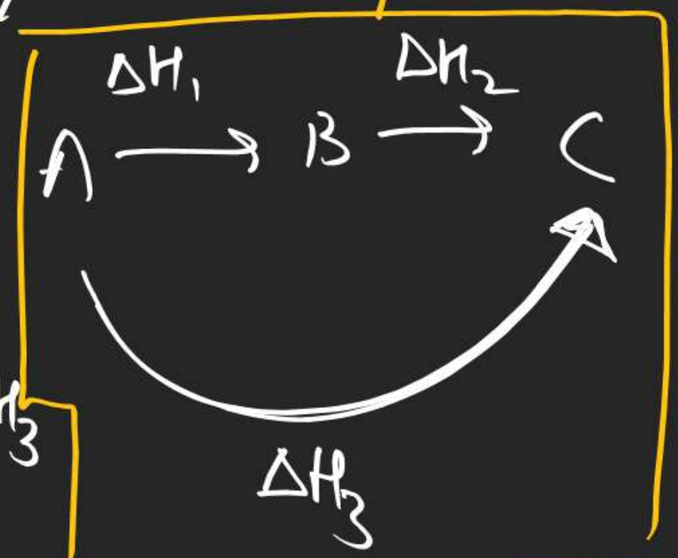
" " " V $(Q_v) = \Delta U$

Hess' Law

$A \longrightarrow B \quad \Delta H_1$

$B \longrightarrow C \quad \Delta H_2$

$A \longrightarrow C \quad \Delta H_1 + \Delta H_2 = \Delta H_3$



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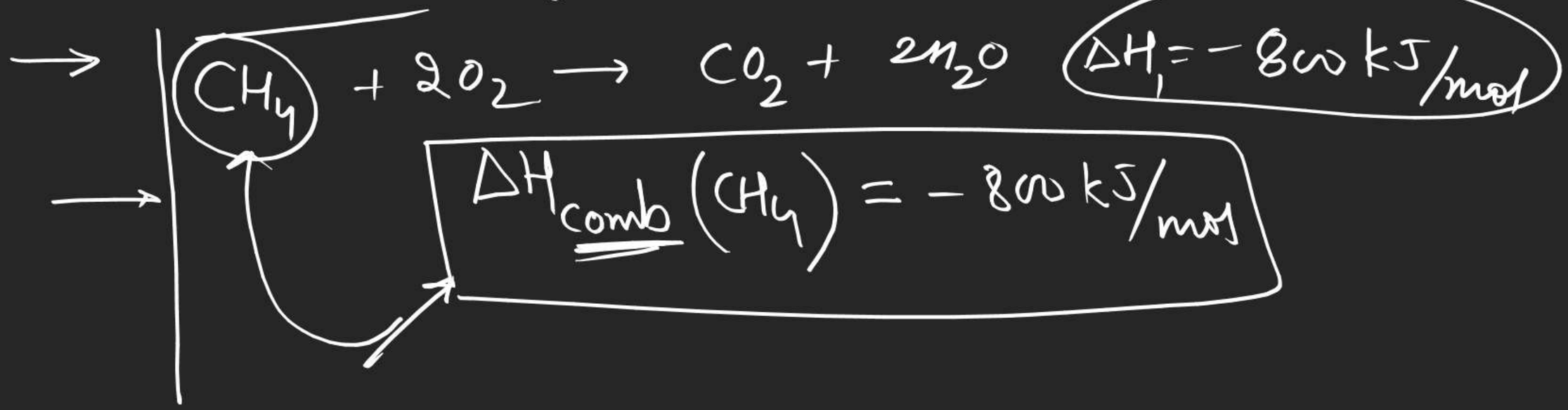
Hess law :→ Enthalpy change remains same whether a product is formed in single step or multi step.



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① Enthalpy of formation :⟶ (ΔH_f) :⟶

It is the enthalpy change when 1 mol substance is formed from its constituents elements each in its ref state or standard state.

⟶ $\frac{1}{2}N_{2(g)} + \frac{3}{2}H_{2(g)} \longrightarrow NH_{3(g)}$ $\Delta H_r = \Delta H_f[NH_{3(g)}]$

⟶ $C(\text{graphite}) + O_{2(g)} \longrightarrow CO_{2(g)}$ $\Delta H_1 = \Delta H_f(CO_{2(g)})$

— $C(\text{diamond}) + O_{2(g)} \longrightarrow CO_{2(g)}$ $\Delta H_2 \neq \Delta H_f[CO_{2(g)}]$

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Elements	Allotropic form
C	graphite
S	Rhombic (S_8)
P	P_4 (white)
Sn	white
Hg	$Hg(\ell)$
I_2	$I_2(s)$
Br_2	$Br_2(\ell)$
'O'	O_2

Standard state
or
Reference state

In general ref state is most stable form of the element

STP

Standard condⁿ H° S°

$N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$ $\quad \Delta H_r \neq \Delta H_f$

$\frac{1}{2}N_{2(g)} + \frac{3}{2}H_{2(g)} \longrightarrow NH_{3(g)}$ $\quad \Delta H_r = \Delta H_f(NH_{3(g)})$

$H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(g)}$ $\quad \Delta H_f[H_2O_{(g)}]$

$H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(\ell)}$ $\quad \Delta H_f[H_2O_{(\ell)}]$

$2Al_{(s)} + \frac{3}{2}O_{2(g)} \longrightarrow Al_2O_{3(s)}$ $\quad \Delta H_f[Al_2O_{3(s)}]$

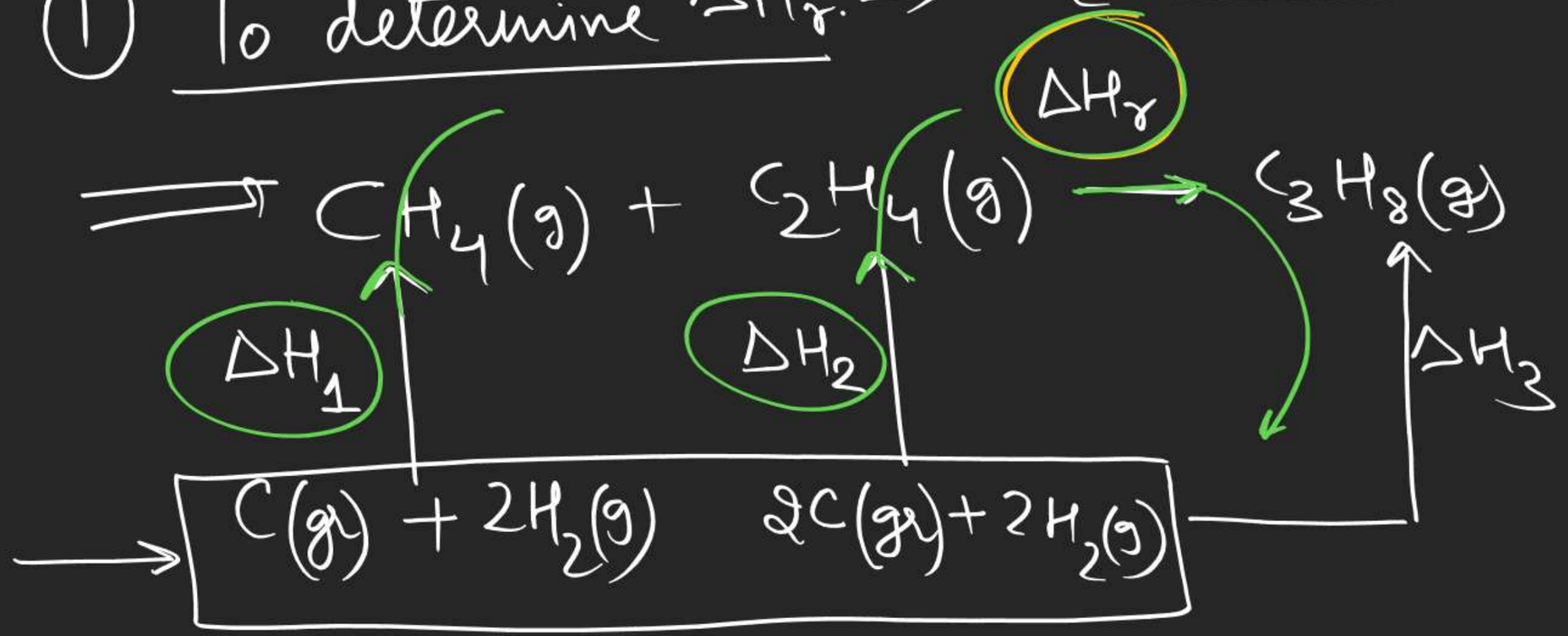
$\Rightarrow P_4(\text{white}) + 5O_2(g) \longrightarrow P_4O_{10}(s) \quad \Delta H_f[P_4O_{10}(s)]$

$Hg(\ell) + \frac{1}{2}O_2(g) \longrightarrow HgO(s)$

Application of ΔH_f

$$\Delta H_r = \sum \Delta H_f(P_r) - \sum \Delta H_f(R)$$

① To determine ΔH_r :→



$\Delta H_f[CH_4(g)]$
$\Delta H_f[C_2H_4(g)]$
$\Delta H_f[C_3H_8(g)]$

$$\Delta H_r + \Delta H_1 + \Delta H_2 = \Delta H_3$$

$$\Delta H_r = \Delta H_3 - \Delta H_1 - \Delta H_2$$

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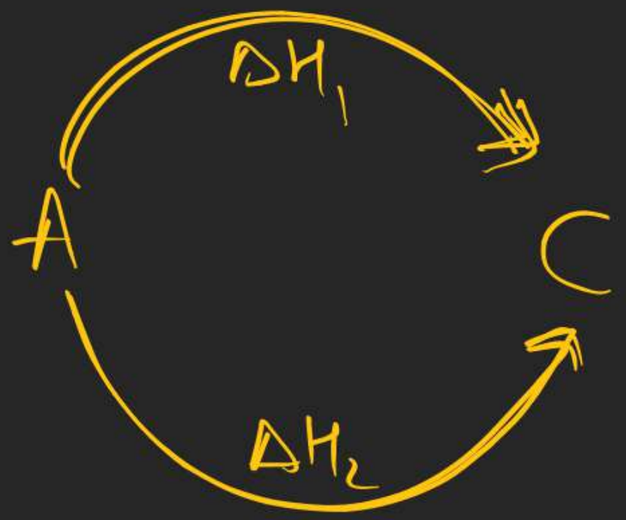

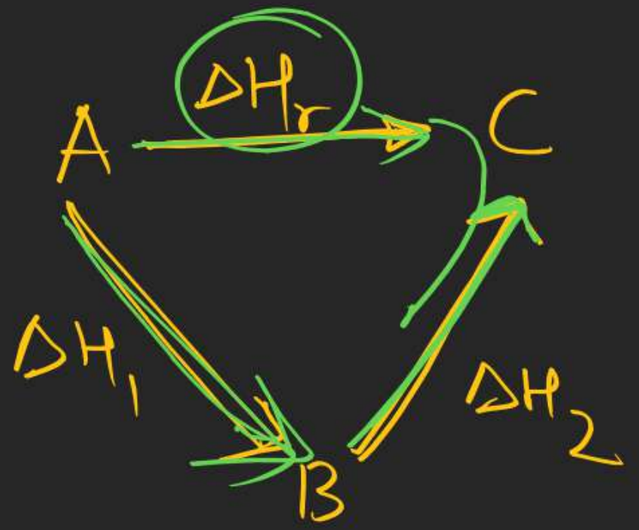

$$\Delta H_r = \Delta H_1 + \Delta H_2$$