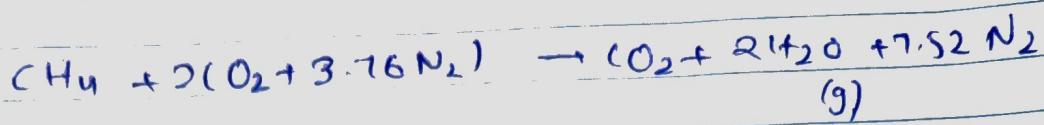


(1)

5) Methane / air

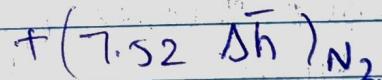
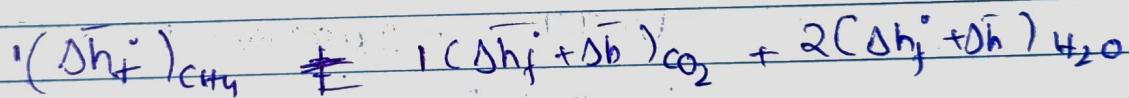
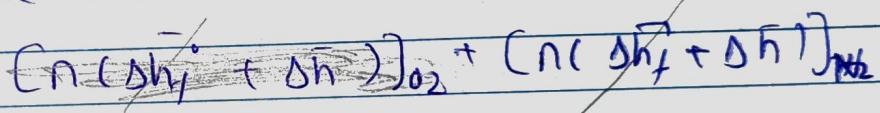
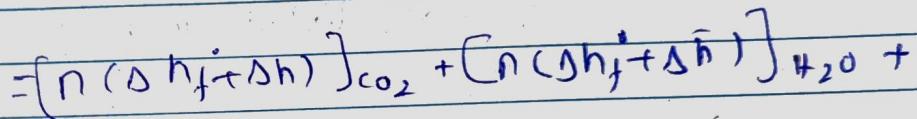
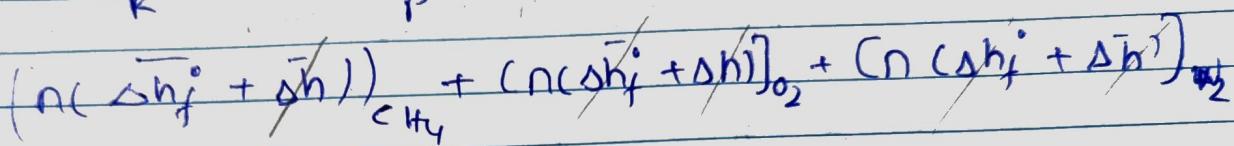


complete combust eqn

W.U.T

$$H_R = H_p \quad (\because \text{Heat of reaction} = \text{Heat of prod})$$

$$\sum n_R \bar{h}_R = \sum p \bar{h}_p$$



from jain's tables

$$-74.873 = (-393.522 + \bar{h}_{CO_2}) + 2(-241.826 + \bar{h}_{H_2O}) \\ + (7.52 \bar{h})_{N_2}$$

$$802.301 = \bar{h}_{CO_2} + 2\bar{h}_{H_2O} + 7.52 \bar{h}_{N_2}$$

$$109.62 + 2 \times 101$$

91

Given $T_{ab} = 1500$

$$\begin{aligned} \text{802.301} &= \Delta h_{CO_2} + 2\Delta h_{H_2O} + 7.52 \Delta h_{N_2} \\ &= 61.705 + 2(48.181) + 7.52(38.405) \end{aligned}$$

$$802.301 \# 446.8125 \text{ kJ/mol}$$

Given $T_{ab} = 2000$

$$\begin{aligned} \text{802.301} &= 91.439 + 2(72.740) + 7.52(56.131) \\ &\quad \text{kJ/mol} \end{aligned}$$

$$802.301 \# 659.16924 \text{ kJ/mol} \rightarrow$$

kJ/mol

Given $T_{ab} = 2500$

$$802.301 = 121.917 + 2(99.108) + 7.52(74.296)$$

$$802.301 \# 878.83 \text{ kJ/mol} - \text{high}$$

Tap should be 2000 & 2500

Given $T_{ab} = 2300$

$$802.301 = 2(88.421) + 209.660 + 7.52(66.995)$$

$$802.301 \# 790.3044 \text{ kJ/mol} \Delta(\text{diff})$$

kJ/mol

(1)

Given $T_{ab} = 2400$

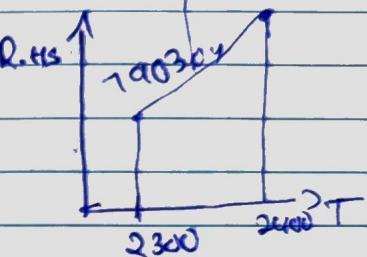
$$802.301 = \frac{115.779 + 2 \times (93.741)}{+ 2 \times (2400) + 7.32(70.640)}$$

$$802.301 \text{ kg/mol} \neq 834.4738 \text{ kg/mol}$$

find T when 802.301
834.4738

$$T_{ab} = [2300, 2400]$$

let us do intercept



$$\text{slope} = \frac{834.4738 - 790.304}{100}$$

$$= 0.441$$

$$(y - y_1) = m(x - x_1)$$

$$(y - 834.4738) = 0.441(x - 2400)$$

y should be 802.301

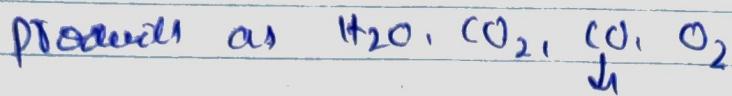
$$\boxed{T = 2327.04 \text{ K}}$$

by calorimetry $T_{ab} = 2325.59 \text{ K}$ - with complete combustion

by calorimetry $T_{ab} = 2224.617 \text{ K}$ - with incomplete combustion

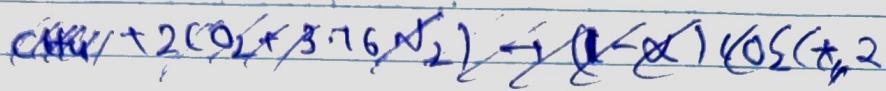
6)

$$\phi = 0.8$$

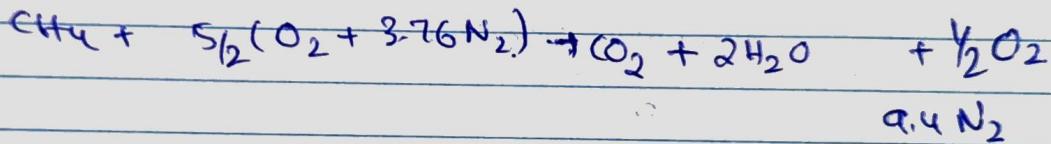
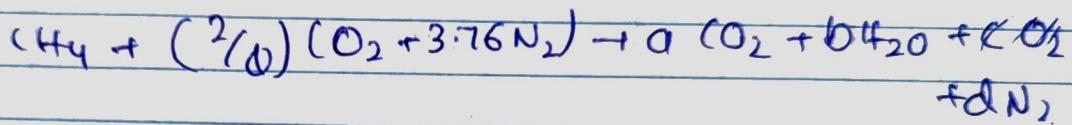


\downarrow
need to consider the

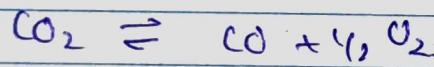
equⁿ



Write the balanced equⁿ



Write equⁿ r₂ⁿ

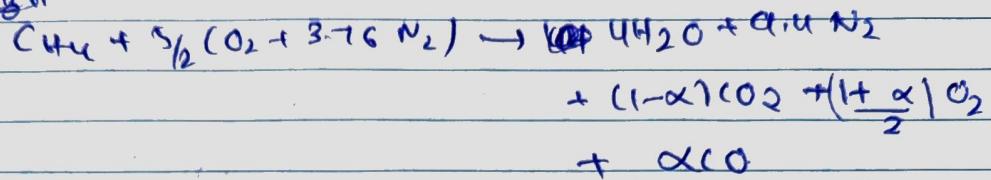


	Initial	Change Δ	Final	γ
H_2O	2	0	2	$\frac{2}{12.9 + 5x}$
CO_2	1	$-\infty$	$1 - \infty$	$-\infty$
N_2	9.4	0	9.4	$\frac{9.4}{12.9 + 5x}$
O_2	$\frac{1}{2}$	$+\alpha \frac{1}{2}$	$\frac{1}{2} + \alpha \frac{1}{2}$	$\frac{\frac{1}{2} + \alpha \frac{1}{2}}{12.9 + 5x}$
CO	0	$+\alpha$	α	$\frac{\alpha}{12.9 + 5x}$
				$12.9 + 5x$

(3)

"ideal the eqn"

Q31

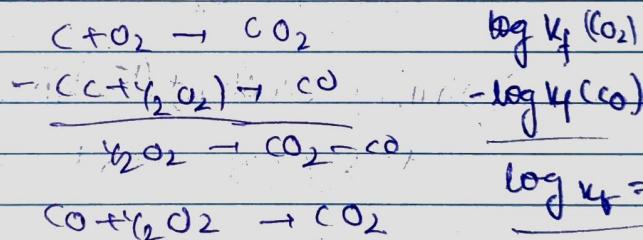


First law

$$\sum H_F = \sum H_P$$

$$\sum n_F H_F = \sum n_P H_P$$

Find α



$$\log K_f(O_2)$$

$$-\log K_f(CO)$$

$$\log K_f = \log K_f(CO_2) - \log K_f(CO)$$

~~Gross T = 2000K~~

$$K = \frac{4CO^4 O_2^2}{4CO_2}$$

~~Applying log K_f at $T = 2000K$, $\log K_f = 10.351$~~

$$= \frac{\alpha}{(2.9 + .5\alpha)} \left(\frac{1+\alpha}{2} \right)^2 \frac{1}{(1.9 + .5\alpha)}^{1/2} K$$

$$K = \frac{\alpha(1+\alpha)}{2(1+\alpha)} \sqrt{\frac{\alpha}{1-\alpha}} \left(\frac{1+\alpha}{2} \left(\frac{1}{1.9 + .5\alpha} \right)^{1/2} \right)$$

$$\log(K) = \log(\frac{\alpha(1+\alpha)}{2(1+\alpha)}) + \frac{1}{2} \log(\frac{1+\alpha}{2}) + \frac{1}{2} \log(\frac{1}{1.9 + .5\alpha})$$

~~WATER & SORP~~

$$(\Delta \bar{h}_f)_{CH_4} = 2(\Delta \bar{h}_f + \Delta h)_{H_2O} + 9.4(\Delta \bar{h})_{N_2} + \left(\frac{1-\alpha}{2} \right) (\Delta \bar{h}_f + \Delta h)_{CO_2}$$

↓

$$+ \left(\frac{1+\alpha}{2} \right) (\Delta h) O_2 + \cancel{\alpha(\Delta h)} CO_2$$
$$\Delta (\Delta \bar{h}_f + \Delta h)_{CO}$$

$$-74.873 = \cancel{\alpha}(-393.5)$$

$$-74.873 = 2(-241.826) + 2\Delta \bar{h}_{H_2O} + 9.4(\Delta \bar{h})_{N_2} + \left(\frac{1-\alpha}{2} \right) (-293.522)$$
$$+ (\Delta h)_{CO_2}$$
$$+ \left(\frac{1+\alpha}{2} \right) \Delta h O_2 + \alpha(-110.527) + \alpha \Delta h CO_2$$

$$293.522 + 558.525 = 2\Delta \bar{h}_{H_2O} + 9.4 \Delta \bar{h}_{N_2} + \left(\frac{1-\alpha}{2} \right) \Delta \bar{h}_{CO_2} + \left(\frac{1+\alpha}{2} \right) \Delta h O_2 + \alpha(\Delta h)_{CO_2}$$

$\cancel{+ \alpha(-110.527)}$

$+ \alpha(282.945)$

→ $\boxed{0}$

$$k = \left(\frac{\alpha}{1-\alpha} \right) \left(\frac{1+\alpha}{2} \left(\frac{1}{12.9 + \gamma_2 \alpha} \right) \right)^{1/2}$$

$$k^2 = \frac{\alpha^2}{(1-\alpha)^2} \left(\frac{1+\alpha}{2} \left(\frac{1}{12.9 + .5\alpha} \right) \right)$$

$$k^2 = \frac{\alpha^2 + \alpha^3}{(1-\alpha)^2 (2)(12.9 + .5\alpha)} = \frac{\cancel{\alpha^2 + \alpha^3}}{(2 - 2\alpha^2 - 4\alpha)(12.9 + .5\alpha)}$$

(5)

Given $T = 2000\text{K}$

$$\log k_f = -2.88$$

$$k_f = e^{-2.88}$$

$$k_f^2 = (e^{-2.88})^2$$

$$k_f^2 = 0.0031$$

Solve for α

$$k_f^2 \alpha = \frac{\alpha^2 + \alpha^3}{(2 + 2\alpha^2 - 4\alpha)(12.9 + 5\alpha)}$$

$$\alpha \approx 0.2059$$

Heat evap " □"

$$952.047 = Q \times (72.790) + 9.40$$

$$952.047 \# 83.8 \cdot 3620$$

Given $T = 1900$

$$\log k_f = -1.633 = 10.896$$

$$k_f^2 = 0.0016$$

Solve for α

$$\alpha = 0.15916$$

$$952.047 \# 776.7862$$

Heat evap " □" sub

Guess T = 2200 K

$$\log k_f = 7.186 - 9.408$$

$$k_f^2 = 0.0117$$

finding α at $k_f^2 = 0.0117$

$$\alpha \approx 0.32450$$

Sub in heat eqn " □ "

$$952.047 \# 966.0853$$

Guess T = 2100 K

$$\log k_f = 7.332 - 9.888$$

$$k_f^2 = 0.0060$$

finding α at $k_f^2 =$

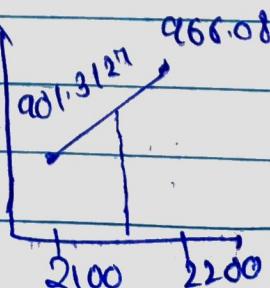
$$\alpha \approx 0.26046$$

Sub in heat eqn " □ "

$$952.047 \# 901.3127 - 1041 = 507343$$

Answer should be. b/w T = 2100 K, & T = 2200

$$\text{Slope} = \frac{966.0853 - 901.3127}{2200 - 2100} = 0.6477$$



⑥

$$y - y_1 = n(x - b)$$

$$(y - 966.085) = 0.6477(x - 2200)$$

$$\frac{(952.047 - 966.085)}{0.6477} + 2200 = x.$$

$$T_b = 21783 \text{ K}^{\circ}$$

to find concentration

we need " α " let's do interpolation

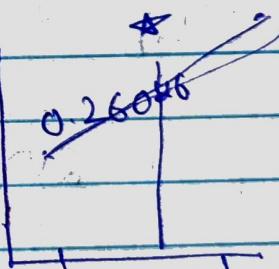
$$\frac{0.3245 - 0.26026}{2200 - 2100} = M$$

$$6.4e-04 = M$$

$$(\alpha - 0.3245) = (6.4e-04)(21783 - 2200)$$

$$\alpha = 0.3106$$

need to find
0.3245



plug in the value in table

	y	calculated	Calcs
H_2O	$\frac{2}{12.9 + y_L \alpha}$	0.1532	0.06
CO_2	$\frac{1-\alpha}{12.9 + y_L \alpha}$	0.0528	0.046
N_2	$\frac{9.4}{(12.9 + y_L \alpha)}$	0.7200	0.72182
O_2	$\left(\frac{1-\alpha}{2}\right) / (12.9 + y_L \alpha)$	0.0502	0.0537
CO	$\alpha / (12.9 + y_L \alpha)$	0.0238	0.04821

$T_{ab} = 2224.617\text{ K}$ calcs

$T_{ab} = 2178.3\text{ K}$ - calculated