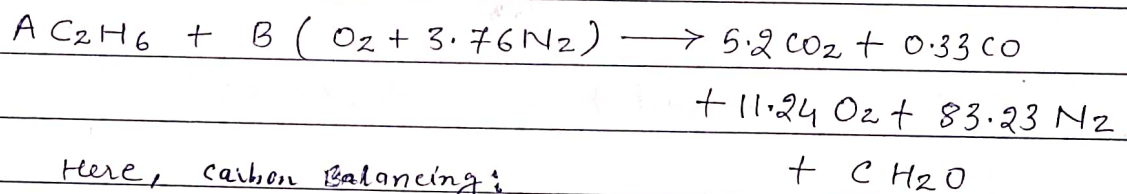


Q-1 a)



$$A/F = \frac{3.5 \times 4.76 \times 29}{30} = 16.1 \text{ kg of air/kg of fuel}$$

b) let 100 kmol of Dry gases.



Here, carbon Balancing:

$$2A = 5.2 + 0.33 = 5.53$$

$$\Rightarrow A = 2.765$$

$$6A = 2C \Rightarrow C = 3A = 8.295$$

O₂ → Balance:

$$C + 11.24 \times 2 + 0.33 + 5.2 \times 2 = 2B$$

$$\Rightarrow B = 20.7525$$

$$\text{Actual Air fuel Ratio} = \frac{20.7525 \times 4.76 \times 29}{2.765 \times 30}$$

$$= 34.535 \text{ kg of Air/kg of fuel.}$$

c)

$$\% \text{ of excess air} = \frac{34.535 - 16.1}{16.1} \times 100 = 114.5\%$$

alternatively it can be done by balancing N₂ on the both sides of chemical reaction

Alternate:

balancing for N_2

$$3.76 \times B = 83.23$$

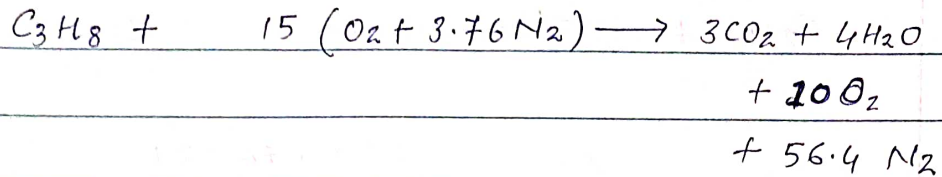
$$\Rightarrow B = 22.1$$

$$A/f = \frac{22.1 \times 4.76 \times 29}{2.765 \times 30} = 36.7 \text{ kg of Air / kg of fuel.}$$

$$\% \text{ excess air} = \frac{36.7 - 16.1}{16.1} \times 100 \approx 128\%$$

Ans: Range: 114% - 128%

Q-2)



enthalpy of product = enthalpy of Reactant

$$H_{\text{Re}} = 1 (h_{f0} + 0) = -103850$$

$$\text{Reactant 'h'} = -103,850 \text{ kJ}$$

Assuming all product as gas \rightarrow

$$H_{\text{Pr}} = 3/4 (h_T - 8667) \neq$$

Compound	h_f°	h_o
C_3H_8 (g)	-103850	—
CO_2	-393520	9364
H_2O	-241820	9904
O_2	0	8682
N_2	0	8669

$$\begin{aligned} & 3 (-393520 + h_{\text{CO}_2} - 9364) + 4 (-241820 + h_{\text{H}_2\text{O}} - 9904) \\ & + 10 (h_{\text{O}_2} - 8682) + 56.4 (h_{\text{N}_2} - 8669) \\ & = -103850 \end{aligned}$$

$$3h_{\text{CO}_2} + 4h_{\text{H}_2\text{O}} + 10h_{\text{O}_2} + 56.4 h_{\text{N}_2} = \cancel{216081218} \\ = 2687449.6$$

$$= \frac{2687449.6}{73.4} = 36613.75$$

$$T_{\text{N}_2} \cong 1195 \text{ K}$$

$$\text{1st guess } T = \underline{1150 \text{ K}}$$

$$H_{\text{RHS}} = 56.4 \times 35430 + 10 \times 37023 + 4 \times 42642 \\ + 3 \times 51602 \\ = \underline{\underline{2693856}} > 2687449$$

Second guess

$$T = 1140 \text{ K}$$

$$H_{\text{RHS}} = 56.4 \times 34760 + 10 \times 36314 + 4 \times 41780 \\ + 3 \times 50484 \\ = 2642176 < 2687449$$

so

Interpolating b/w $T = 1140$ & $T = 1160$

$$T_{\text{ans}} = 1157 \text{ K}$$