

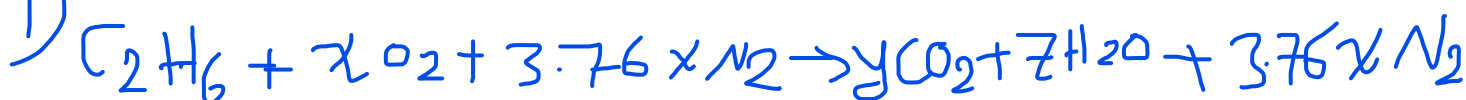


Solution of problem 7.8

Problem (7.8): One kmol of ethane C_2H_6 is burned with an unknown amount of air during a combustion process. An analysis of the combustion products reveals that the combustion is complete, and there are 3 kmol of free O_2 in the products. Determine (a) the air-fuel ratio (b) the percentage of theoretical air used during this process. The molar masses of air and ethane are 29 and 30 kg/kmol, respectively.

Ans. (29.9 kg air/kg fuel, 186%)

1) theo. Comb.



2) balan C

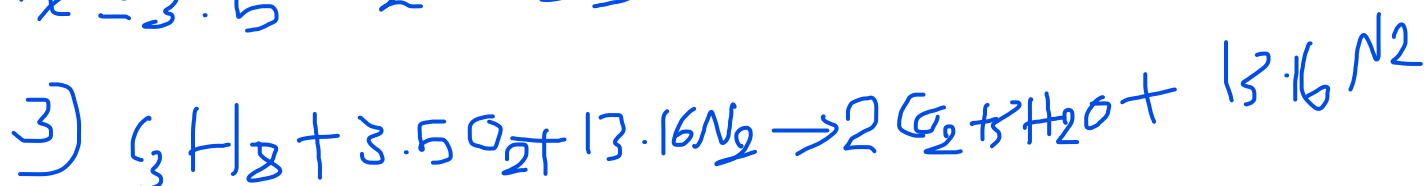
$$C: 2 = y$$

$$H: 6 = \frac{2z}{2} \Rightarrow z = 3$$

$$O: 2x = 2y + z$$

$$2x = 4 + 3 \Rightarrow \frac{2x}{2} = \frac{7}{2}$$

$$x = 3.5$$





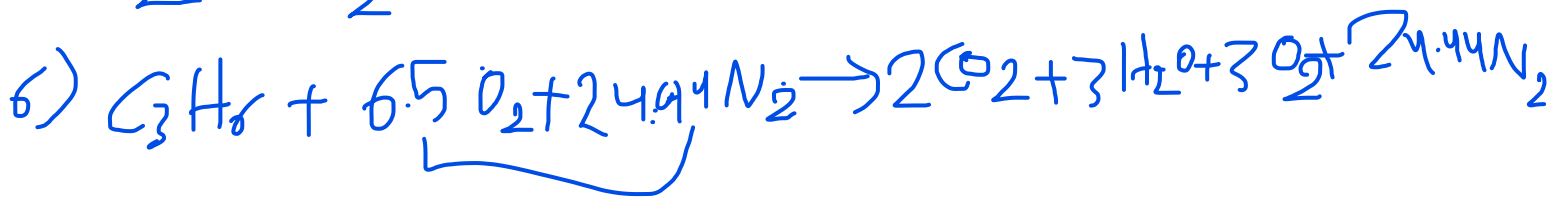
g) Actual Comb.



↙ balance

$$O: 2a = 4 + 3 + 6$$

$$\frac{2a}{2} = \frac{13}{2} \Rightarrow a = 6.5$$



$$7) AF = \frac{N_{air}}{N_{fuel}} \Rightarrow AF = \frac{6.5 + 24.44}{1} = O_{\text{air}} / \text{fuel}$$

$$8) P_{\text{thair}} = \frac{N_{air})_{act}}{N_{air})_{th}} = \frac{30.94}{2.5 + 13.16} \times 100\% = 185.71\%$$



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