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1. Rxn equation: 0.2CO+0.24CH4+0.36H2+0.02O2+0.15N2+0.03CO2+aO2+bN2 cCO2+DH2O+eN2

Balancing the equation:

C=0.2+0.24+0.03= 0.47

d=(0.96+0.72)/2 = 0.84

0.2+0.04+0.06+2a=0.94+0.84

a=0.74

e=0.15+0.74(3.76)= 2.9324

b=(3.76)(0.74)=2.7824

so;

 0.2CO+0.24CH4+0.36H2+0.02O2+0.15N2+0.03CO2+0.74O2+2.7824N2 0.47CO2+0.84H2O+2.9324N2

When 20% excess air is supplied: 1+$\frac{20}{100}$= 1.2 moles of O2  and N2 extra

0.2CO+0.24CH4+0.36H2+0.02O2+0.15N2+0.03CO2+0.888O2+3.3388N2  0.47CO2+0.84H2O+3.5188N2+0.148CO2

Actual air to fuel ratio; no. of moles of fuel=0.2+0.24+0.36+0.02+0.15+0.03= 1mol

 No. of moles of air= 0.888+3.33888=4.22688mols

Ratio=4.22688/1= 4.22688

Wet analysis: Total no of moles of product=0.47+0.84+3.51888+0.148=4.97688

CO2=$\frac{0.47}{4.97688}×100\%$=9.44%

H2O=$\frac{0.84}{4.97688}×100\%$=16.88%

N2=$\frac{3.51888}{4.97688}×100\%$=70.71%

O2=$\frac{0.148}{4.97688}×100\%$=2.97%

2.) Stoichiometric equation:0.86C+0.14H2+aO2+bN2 cCO2+dH2O+eN2

C= 0.86

D=0.14

2a=1.72+0.14, a=0.93

b=(0.93)(3.76)=3.4968

e=3.4968

0.86C+0.14H2+0.93O2+3.4968N2 0.86CO2+0.14H2O+3.4968N2

When the system is 25% weak, 25% excess air is added= 1+0.25= 1.25mols

Actual equation:

S.A.F: Total no. of moles of fuel= 0.86+0.14=1

 Total no. of moles of air= 0.93+3.4968= 4.4268

S.A.F= 4.4268/1= 4.4268

A.A.F: Total no. of moles of fuel= 0.86+0.14=1

 Total no. of moles of air= 0.93+3.4968=5.49975

A.A.F= 5.49975/1= 5.49975

Total no. of moles= 5.6035moles

CO2=$\frac{0.86}{5.6035}×100\%$=15.35%

H2O=$\frac{0.14}{5.6035}×100\%$=2.50%

N2=$\frac{4.37}{5.6035}×100\%$=78%

O2=$\frac{0.2325}{5.6035}×100\%$=4.15%