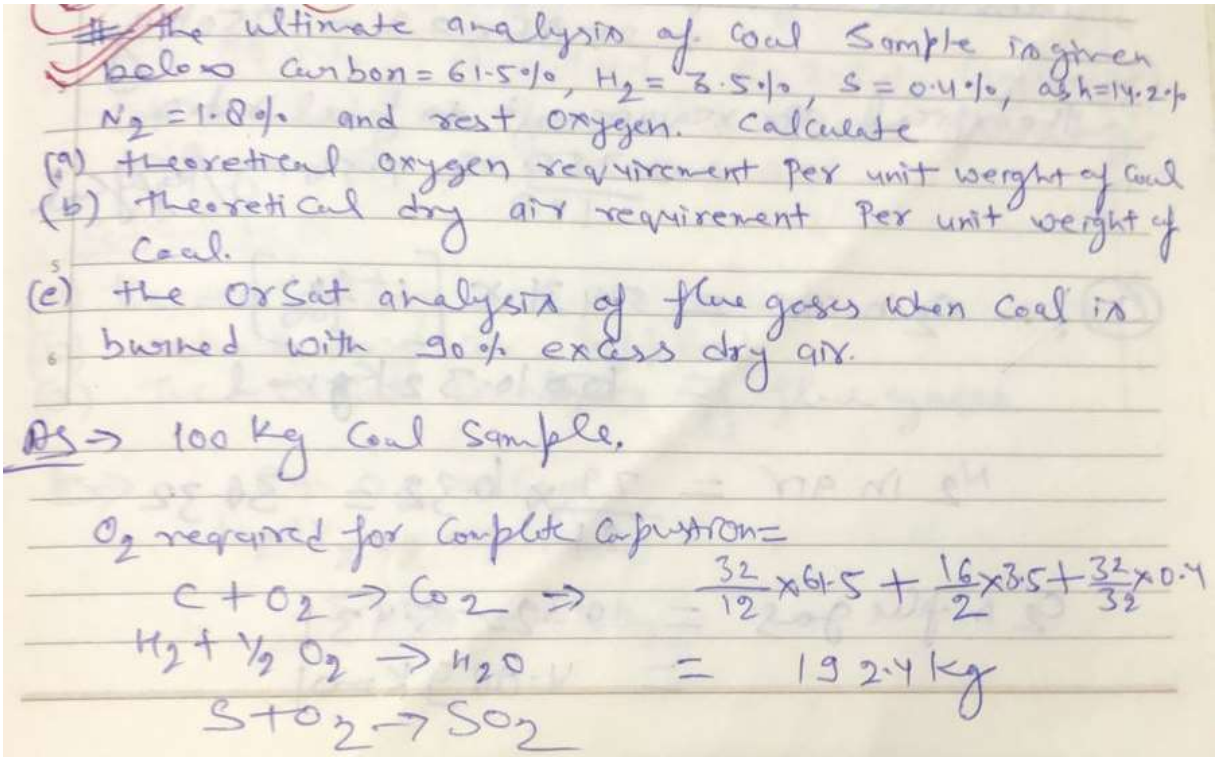
MSE-402

Combustion questions

Dr. Alka Gupta



The ultimate analysis of coal sample is given below carbon = 61.5%, H_2 = 3.5%, S = 0.4%, ash = 14.2%, N_2 = 1.8% and rest oxygen. Calculate

(a) theoretical oxygen requirement per unit weight of coal

(b) theoretical dry air requirement per unit weight of coal.

(c) the Orsat analysis of flue gases when coal is burned with 90% excess dry air.

Ans → 100 kg coal sample.

O_2 required for complete combustion =

$C + O_2 \rightarrow CO_2$ ⇒ $\frac{32}{12} \times 61.5 + \frac{16}{2} \times 3.5 + \frac{32}{32} \times 0.4$

$H_2 + \frac{1}{2} O_2 \rightarrow H_2O$ = 192.4 kg

$S + O_2 \rightarrow SO_2$

09 040-325 WEEK 07 WEDNESDAY

O_2 in Coal = 18.6 kg

theortical O_2 requirement = 192.4 − 18.6
= 173.0 kg / 100 kg Coal.

theortical O_2 requirement to fuel ratio
= 1.730 kg / kg Coal

(3) [theortical air requirement
$= \frac{173.0}{32} = 5.431$ Kmol
$= \frac{5.431}{.21} = 25.86$ Kmol]

theortical air requirement on weight basis
$= 25.86 \times 29 = 750$ kg

theortical air requirement to fuel ratio
$= \frac{750}{100} = 7.50$ kg / kg of fuel

(1) O_2 in air $= 5.431 \times \left[1 + \frac{90}{100}\right]$
= 10.32 Kg mol

N_2 in air $= \frac{79}{21} \times 10.32 = 38.32$

O_2 in flue gas $= 10.32 - 5.431$
= 4.889 Kmol

THURSDAY

N_2 in flue gas = N_2 in air + N_2 in C.

$= 38.92 + \left(\frac{1.0}{28}\right)$

$= 38.004$ Kmol

CO_2 Produced $= \frac{44}{12} \times 61.5 = 222.5$ kg

$= 5.125$ Kmol

SO_2 Produced $= \frac{60}{32} \times 0.4 = .8$ kg

$= 0.8/64$ Kmol.