CE213A- ODD SEMESTER 2018

Home Assignment 3: Energy conversions, Calorific value

Q1. The specifications of furnace oil from lab analysis is given below:

Co nstituent's	% By
Carbon	85.9
Hydrogen	12
Oxygen	0.7
Nitrogen	0.5
Sulphur	0.5
H2O`	0.35
Ash	0.05

GCV of fuel: 10880 kcal/kg

Calculate the Requirement of Theoretical Amount of Air.

Q2. A 1.000 g sample of octane (C_8H_{18}) is burned in a bomb calorimeter containing 1200 grams of water at an initial temperature of 25.00ºC. After the reaction, the final temperature of the water is 33.20ºC. The heat capacity of the calorimeter (also known as the "calorimeter constant") is 837 J/ºC. The specific heat of water is 4.184 J/g ºC. Calculate the heat of combustion of octane in kJ/mol.

Q3. Calculate the gross calorific value and net calorific value of a sample of coal 0.5g of which when burnt in a bomb calorimeter, raised the temperature of 1000g of water from 293K to 301.6K. The water equivalent of calorimeter is 350 g. The specific heat of water is 4.187 kJ kg^{-1}, latent heat of steam is 2457.2 $kJkg^{-1}$. The coal sample contains 93% carbon, 5% hydrogen and 2% ash.

Q4. A sample of coal has following composition on mass basis Carbon 82%, Hydrogen 8%, Sulphur 2%, Oxygen 4% and Ash 4%. Calculate using Dulong's formula higher and lower calorific value of fuel.

Q5. A gaseous fuel has following composition of volume: H_2=24%, CH_4=30%, C_2H_6=11%, C_2H_4=4.5%, C_4H_8=2.5%, CO = 6%, CO_2=8%, O_2=2% AND N_2=12%

Calculate (i) air to fuel ratio and (ii) volume of dry products of combustion using 40 % excess air

Reactions to be used

Reaction
$H_2 + \frac{1}{2} O_2 = H_2O$
$CH_4 + 2O_2 = CO_2 + 2H_2O$
$C_2H_6 + 3\ \frac{1}{2} O_2 = 2CO_2 + 3H_2O$
$C_2H_4 + 3O_2 = 2CO_2 + 2H_2O$
$C_4H_8 + 6O_2 = 4CO_2 + 4H_2O$
$CO + \frac{1}{2}\ O_2 = CO_2$