# MSE-402

# Fuel Furnace and Refractory

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## COMBUSTION OF FUELS

### Conceptual Questions

Q.1. write down combustion equations.

Q. 2. Solve the oxygen and air requirements for the combustion of solid, liquid and gaseous fuels.

Q. 3. Determine the products of combustion.

Q.4. Determine the air/fuel ratio from the products of combustion.

## INTRODUCTION:

Combustion is the process of chemical reaction between fuel and oxygen(reactants). The process releases heat and produces products of combustion. The main elements which burn are :

1. Carbon
2. Hydrogen
3. Sulphur

- The heat released by 1 kg or $m^3$ of fuel is called the **calorific value**.
- The oxygen used in combustion processes normally comes from the air and this brings nitrogen in with it which normally does nothing in the process but makes up the bulk of the gases remaining after combustion (flue gasses).

The main elements in combustion are:

| | Symbol | Atomic Mass | Molecular Mass | Product |
|---|---|---|---|---|
| Carbon | C | 21 | | $CO_2$ |
| Hydrogen | $H_2$ | 1 | 2 | $H_2O$ |
| Sulphur | S | 32 | | $SO_2$ |
| Oxygen | $O_2$ | 16 | 32 | |
| Nitrogen | $N_2$ | 14 | 28 | |

- If the water formed during combustion leaves as vapour, it takes with it the latent heat of evaporation and thus reduces the energy available from the process. In this case the calorific value is called the lower Calorific value (LCV).

- If the products cool down after combustion so that the vapour condenses, the latent heat is given up and the calorific value is then the higher calorific value (HCV).

- Solid and liquid fuels are normally analyzed by mass to give the content of carbon, hydrogen, Sulphur and any other elements present.

- There is silica, moisture and oxygen present in small quantities which have some effect on process. The silica leaves slaggy deposits on the heat transfer surfaces in boilers.

- Gaseous fuels are normally analyzed by volumetric content and are in the main hydrocarbon fuels.