

RELATION BETWEEN GCV AND NCV:-

- $GCV = NCV + \text{Latent heat of condensation of steam}$
- $NCV = GCV - \text{Latent heat of condensation of steam}$

RELATION BETWEEN GCV AND NCV:-

- $NCV = GCV - 9 \times \text{Mass of hydrogen} \times \text{Latent heat of steam}$
 - $NCV = GCV - 0.09 \times \% \text{ of hydrogen} \times \text{Latent heat of steam.}$
- (latent heat of steam = 587 cal/g)

GCV FORMULA FOR BOMBS CALORIMETER:-

$$GCV = \frac{M * C_p * (t_2 - t_1)}{m}$$

Notations:

- Mass of the fuel sample taken = m gm
- Mass of water taken in the copper calorimeter = W gm
- Water equivalent of calorimeter = w gm
- Initial temperature of water = t_1 °C
- Final temperature of water = t_2 °C
- Specific heat of water = $C_p = 1 \text{ cal/g}$

ACID CORRECTION FORMULA:-

$$GCV = \frac{(W + w)[(t_2 - t_1) + t_c] - (t_f + t_a)}{M}$$

Fuse Wire Correction (t_f), Acid Correction (t_a), Cooling correction (t_c)

GCV FORMULA FOR BOY'S CALORIMETER:-

$$\text{GCV} = \frac{W (t_2 - t_1) \times C_p}{V}$$

(V) denotes **volume of fuel**

NCV FORMULA FOR BOYS CALORIMETER:-

$$\text{NCV} = \frac{W (t_2 - t_1) \times C_p}{V} - \frac{m \times 587}{V}$$

Latent heat of steam per m³ of fuel sample = $\frac{m \times 587 \text{ kcal}}{V}$

PROXIMATE ANALYSIS:-

Percentage	Name of Instrument	Temperature	Duration	Formula
Moisture(M) %	Oven	110°C	60 min	$m_2 = \frac{m - m_1}{m} \times 100$
Volatile Matter(Vm) %	Muffle Furnace	950 ⁰ ±25	7 min	$Vm = \frac{m_1 - m_2}{m} \times 100$
Ash content(Ash)%	Muffle Furnace	750°C	30 min	$\frac{\text{weight of residue}}{m} \times 100$
Fixed Carbon(FC) %	-	-	-	100-(M%+Vm%+Ash%+FC%)

ULTIMATE ANALYSIS:-

FOR CARBON:

$$\% \text{Carbon(C)} = \frac{12 \times x \times 100}{44 \times W}$$

FOR HYDROGEN:-

$$\% \text{ Hydrogen(H)} = \frac{2*y*100}{18*W}$$

FOR NITROGEN: -

$$\%N = \frac{(V_2 - V_1) * X * 14*100}{1000 * W}$$

Here 'x' denotes normality for NaOH.

FOR SULPHUR:-

$$\%S = \frac{a * 32 * 100}{233 * W}$$

QUANTITY OF AIR REQUIRED FOR COMBUSTION(kg):-

$$\text{Quantity of Air (In kg)} = O_2 \text{ req. (in Kg)} \times 100 / 23$$

VOLUME OF AIR REQUIRED FOR COMBUSTION(m3): -

$$\text{Volume of Air (in m}^3\text{)} = O_2 \text{ req (in m3)} \times 100 / 21$$