⇒ Excess Air :→ Any air supplied in Excess of "theoretical Air" is called Excess air. Generally Excess air is 25 to 100% to better & complete combustion.

⇒ Flash point & fire point :→ Flash point refers to that temperature at which vapours is given off from liquid fuel at a sufficient rate to form an inflammable mixture but not at a sufficient rate to support continious combustion.

fire point refers to that temperature at which vaporization of liquid fuel is sufficient Enough to provide for continious Combustion.

These temperatures depend not only on the fuel characteristics but also on the rate of heating, air movement over ful surface & means of ignition. These temperature are specified in refrence to certain standard Conditions. Although flash point & fire point temperatures are defined in relation with ignition but these temperatures are not measures of ignitability of fuel but of the initial voltality of fuel.

⇒ Adiabatic flame temperature :→ Adiabatic Flame temperature refers to the temperature that could be attained by the product of combustion when the combustion reactin

is carried out in limit of adiabatic operation of combustion chamber. Limit of adiabatic operation of combustion chamber means that in the absence of work, Kinetic & potential Energies the Energy released during combustion shall be carried by the combustion products with minimum or no heat transfer to the surroundings. This is the max^{m} temp. which can be ~~carried~~ attained in combustion chamber & is very useful parameter for designes.

Actual temperature shall be less than adiabatic flame temp. due to heat transfer to surroundings, incomplete combustion & dissociation etc.

⇒ Wet & dry analysis of combustion :→ Combustion Analysis when carried out considering water vapour into account is called "wet analysis" while the analysis made on the assumption that vapour is removed after condensing it is called dry analysis"

⇒ Volumetric & gravimetric Analysis :→ Combustion analysis when carried out based on upon percentage by volume of constituent reactants & product is called Volumetric Analysis

Percentage by mass of reactants & products is called gravimetric analysis.

⇒ Pour point :→ It refers to the lowest temp at which liquid fuel flows under specified condition.

⇒ Cloud point :→ When some petroleum fuels are cooled the oil assumes cloudy appearance. The is due to paraffin wax or other solid substance separating from solution. This temperature at which cloudy appearance is first evident is called cloud point.

⇒ Composition of air :→ Atmospheric air is considered to be comprising of nitrogen & oxygen in following proportions. Molecular weight of air is taken as 29.

Composition of air by mass = oxygen (23.3%) + Nitrogen (76.7%)

Composition of air by volume = oxygen (21%) + Nitrogen (79%)

⇒ Enthalpy of combustion :→ It is defined as the difference b/w the enthalpy of the products & enthalpy of the reactants when complete combustion occurs at given temperature & pressure.

It may be given as higher heating value (HHV) or lower heating value (LHV)

HHV of fuel is the Enthalpy of combustion when all the water (H_2O) formed during combustion is in liquid phase. LHV of fuel refers to the Enthalpy of combustion when all the water formed during combustion is in vapour form. The lower heating value will be less than the higher heating value by the amount of heat required for evaporation of water.

HHV = LHV + (Heat required for evaporation of water)

It is also called calorific value of fuel and is defined as the number of heat units liberated when unit mass of fuel is burnt completely in a calorimeter under given condition.

⇒ Fuel:- A fuel is a general terms, may be defined as a substance (containing mostly Carbon & hydrogen) which on burning with oxygen in the atmospheric air, produce a large amount of heat generated is calorific value of fuel.

As the principal constituents of a fuel are Carbon & hydrogen therefore, it is also known as hydrocarbon fuel. Sometimes a few traces of Sulphur are also present in it.

⇒ Classification of fuels:—

The fuels may be classified into the following three general forms:—

1) Solid fuels
2) Liquid fuels.
3) Gaseous fuels.

Each of these fuels may be further subdivided into the following two types:

(a) Natural fuels
(b) Prepared fuels.

Solid fuel:- Coal is the most common fuel. Coal is a dark brown / black sedimentary rock derived Primarily from the unoxidized remains of Carbon bearing Plant tissues. It can be further classified into different types based upon the composition. Composition can be Estimated using either "proximate analysis" or by ultimate analysis"

Proximate analysis is the one in which the individual Constituent Element such as C, H_2, S, N_2 etc are not determined rather only fractions of moisture, ~~volta~~ volatile matter, ash, Carbon etc are determined.

Thus Proximate analysis is not Exact and gives only some ideal about the fuel composition. Proximate analysis of ~~fuel~~ Coal gives various constituent in following range.

Moisture 3-30%, ~~volta~~ volatile matter 3-50%,
Ash 2-30% & Fixed Carbon 16-92%.

In ultimate analysis the individual element such as C, H_2, N_2, S & ash etc. present in the fuel are determined on mass basis of this it gives relative amounts of chemical constituents of fuel, such as:

Carbon — 50 to 95%
Hydrogen — 2 to 50%
Oxygen — 2 to 40%
Nitrogen — 0.5 to 3%
Sulphur — 0.5 to 7%
Ash — 2 to 30%

Different types of coal available are listed in the table here under.

Different types of coal

S.No	Types	% by mass		Ultimate analysis % by mass					Lower Calorific value kcal/kg
		Moisture	Volatile matter in dry coal	C	H_2	O_2	N_2+S_2	Ash	
1	Peat	20	65	43.70	6.42	44.36	1.52	4.00	3200
2	Lignite	15	50	56.52	5.72	31.89	1.62	4.25	2450
3	Bituminous	2	25	74.00	5.98	13.01	2.26	4.75	7300
4	Anthracite	1	4	90.27	3.30	2.32	1.44	2.97	7950