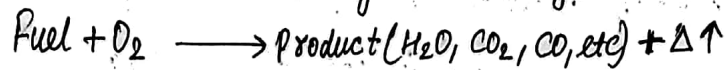


## \* Fuel :-

Any combustible substance that produces large amount of energy on combustion which can be used domestically or industrially.



### \* Classification of Fuel :-

(I) on the basis of occurrence :-

- (i) Primary / Natural
- (ii) Secondary / Artificial

~~(i) Primary fuel~~

<u>Primary fuel</u>	<u>State</u>	<u>Secondary fuel</u>
wood, coal	← solid	→ charcoal, coke, etc.
crude oil	← liquid	→ petrol, diesel, kerosene, L.P. gas
Natural gas	← gaseous	→ Oil gas, water gas, coal gas

### \* Characteristics of a good fuel :-

- (I) High calorific value →
- (II) Moderate ignition temperature.
- (III) Low moisture content → prevent weight loss.
- (IV) Low non-combustible matter → residue should be less.
- (V) Moderate rate of combustion
- (VI) Harmless combustion bi-product →
- (VII) Less smoke produce
- (VIII) Uniform size.

### (I) High calorific value :-

## \* Coal :-

### \* origin of coal formation :-

(layer by layer)  
Coal may be defined as a compact stratified mass of plants' debris' mainly accumulated as ~~in~~ "in-situ" or "drift" materials.

• Coalification → It is the process of formation of coal by action of decay, pressure and heat converted by the woody remains that decomposed many years ago ( $10^7$  to  $10^8$  years)

• Coalification covers in two stages

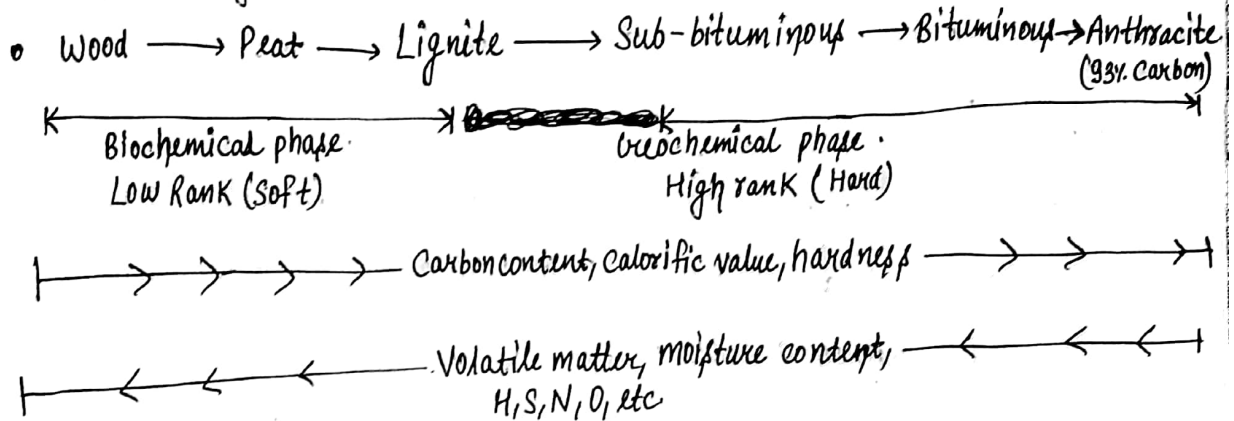
i) Biochemical Phase , ii) Geochemical Phase

i) Biochemical phase :- Cellulose & plants materials converted into peat by microbial metabolism <sup>caused</sup> by oxidation, reduction and Heterolytic reaction.

ii) Geochemical Phase :- The reaction mechanism of the chemical conversion in this phase is temperature, pressure and time-oriented.

• Rank :-

Rank is the qualitative measure of carbon content and may be defined as the extent or degree of maturation.



\* Analysis of Coal :-

① Proximate analysis :- It gives valuable informations regarding practical utility of coal and ~~also~~ give the quality of the coal. It includes the determination of Moisture content, Volatile matter, Ash and fixed carbon.

• Determination of Moisture content → It is the loss of weight of coal when it is heated in a hot air oven at around  $105^{\circ}\text{C}$  in a ~~crucible~~ crucible for 1 hour.

$$\% \text{ of Moisture} = \frac{\text{loss in wt.}}{\text{Sample taken}} \times 100$$

• Determination of volatile matter :- It is the loss in weight of moisture-free coal when it is heated in crucible in a muffle furnace at about  $950^{\circ}\text{C}$  for 7 minutes.

$$\% \text{ of volatile matter} = \frac{\text{loss in wt. due to removal of V.M.}}{\text{Sample taken (moisture free)}} \times 100$$

• Determination of Ash :- It is the non-combustible residue obtained after burning a known amount of dry coal in a open-crucible at  $700-750^{\circ}\text{C}$  for one hour.

$$\% \text{ of Ash} = \frac{\text{Amount of Ash formed}}{\text{Sample taken}} \times 100$$

- Fixed Carbon → After determination of Moisture, Volatile matter and ash, the rest amount is of fixed carbon  

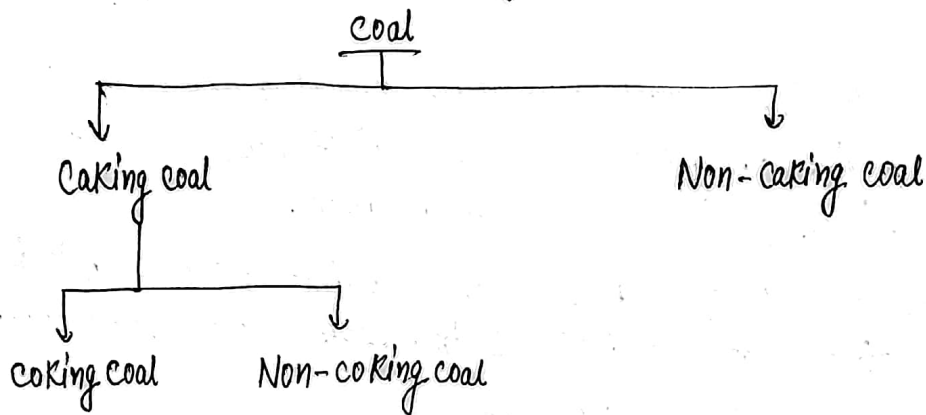
$$\% \text{ of Fixed Carbon} = 100 - [M\% + V.M.\% + Ash\%]$$

(II) Ultimate analysis :- It is useful in combustion calculation. It includes the determination of the constituents present in a dry coal, like ~~the~~ C, H, N, S, O, P.

### \* Carbonisation :-

The process of converting coal into coke is called carbonisation i.e., when a coking coal is heated in absence of air, a porous hard and strong residue left known as coke.

Coal is classified into four types on the basis of formation of coke



(I) Caking coal → In absence of air, it becomes soft, plastic and fuses together to form coherent ~~residue~~ masses

(II) Non-caking coal → Do not produce a good coherent masses but the rate of carbonisation is very high.

(i) Coking coal :- Coal which gives porous, hard and strong residue after heating in absence of air and coke is formed which is used for metallurgical process.

(ii) Non-coking coal :- It undergoes no fusion effect and also known as free burning coal and unable to form ~~any~~ coke.

All caking coals are not ~~caking~~ coking coals but all coking coals are caking coals.

• Types of Carbonisation :-

(I) High temp. Carbonisation :-  $900 - 1200^{\circ}\text{C}$

(II) Low temp. Carbonisation :-  $500 - 700^{\circ}\text{C}$