SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35.

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai.

DEPARTMENT OF AUTOMOBILE ENGINEERING

COURSE NAME : 19AUB301 – AUTOMOTIVE FUELS AND LUBRICANTS

III YEAR / V SEMESTER

Unit 1- Manufacture of Fuels and Lubricants

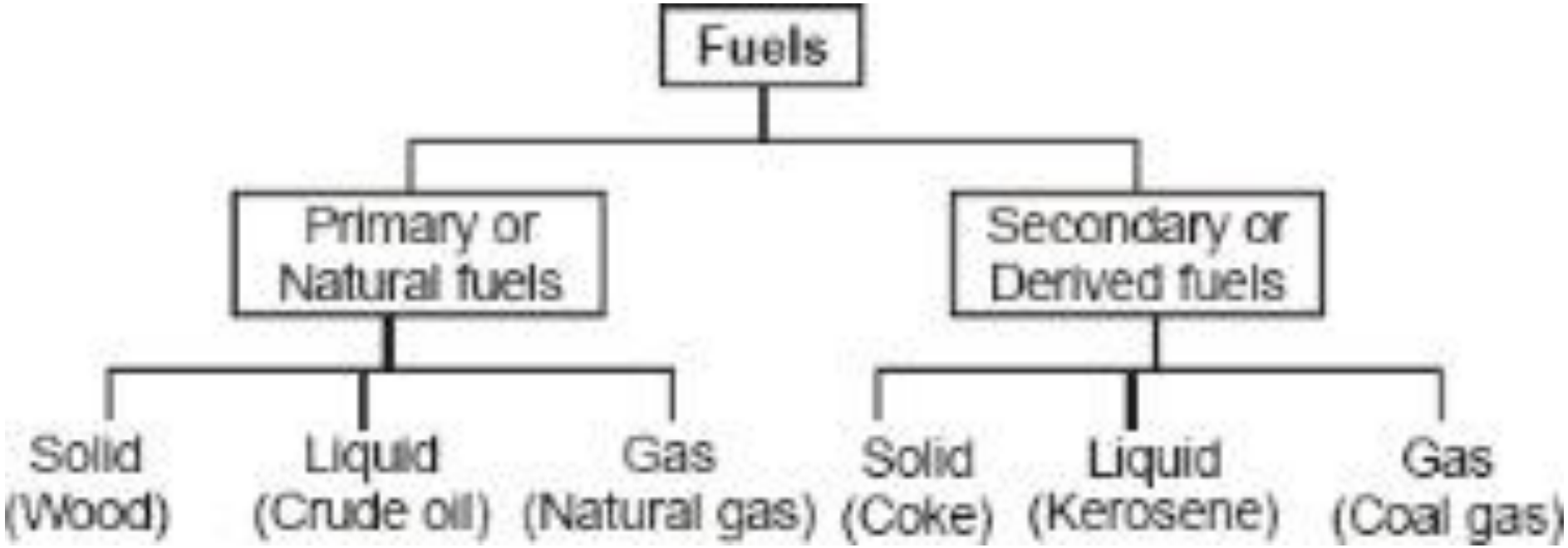
Topic : Introduction to Fuels & Structure of Petroleum.

FUELS

- Fuel is a combustible substance, containing carbon as main constituent, which on proper burning gives a large amount of heat.
- It can be used economically for domestic and industrial purposes.
- During the process of combustion of a fuel (like coal), the atoms of carbon, hydrogen, etc. combine with oxygen with the simultaneous liberation of heat at a rapid rate.

$$\textbf{FUEL} + O_2 \longrightarrow \textbf{PRODUCTS + HEAT}$$

CLASSIFICATION OF FUELS



STRUCTURE OF PETROLEUM

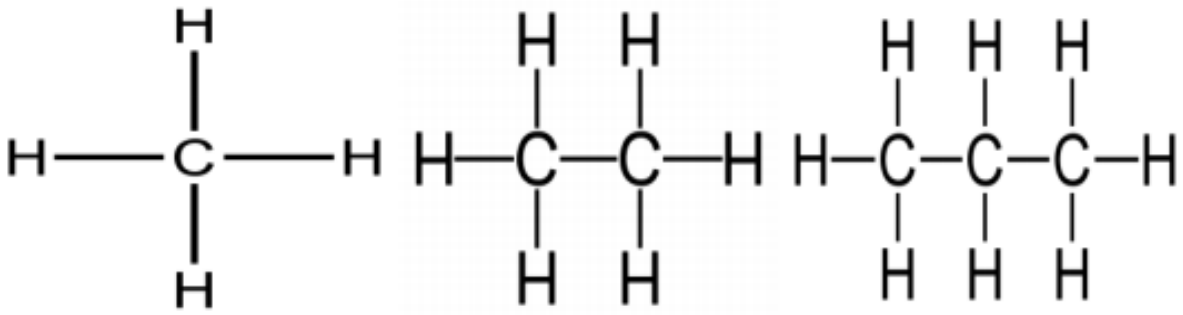
- The fuels are complex **mixtures of hydrocarbons** made by refining petroleum.
- Petroleum as obtained from the oil wells is predominantly a mixture of many hydrocarbons with differing molecular structure.
- It also **contains small amounts of sulphur, oxygen, nitrogen and impurities** such as water and sand.
- The carbon and hydrogen atoms may be linked in different ways and it determines physical and chemical properties of different hydrocarbon group.
- The **carbon to hydrogen ratio determines the energy characteristics of hydrocarbon fuel.**

DIFFERENT STRUCTURES OF PETROLEUM

- Depending upon the number of carbon and hydrogen atoms the petroleum products are classified into different groups. They are
  - Paraffin series (C_nH_{2n+2})
  - Olefin series (C_nH_{2n})
  - Naphthene series (C_nH_{2n})
  - Aromatic series (C_nH_{2n-6})

PARAFFIN SERIES

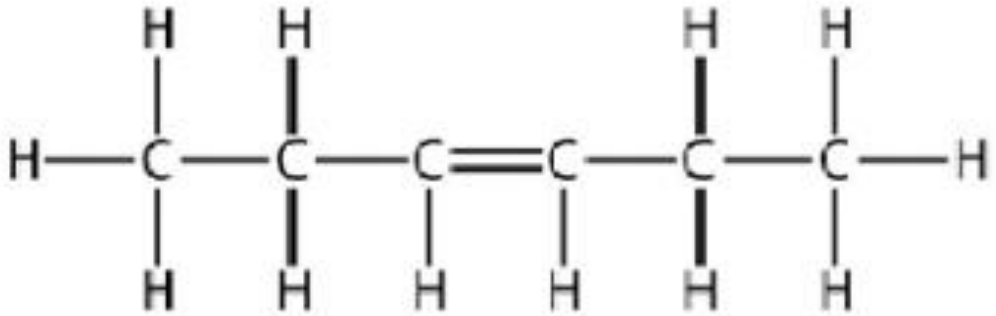
- The normal paraffin hydrocarbons are of straight chain molecular structure
- In these hydrocarbons the valency of all the carbon atoms is fully utilized by single bonds with hydrogen atoms.
- Therefore the paraffins hydrocarbons are saturated compounds and their characteristics are very stable.



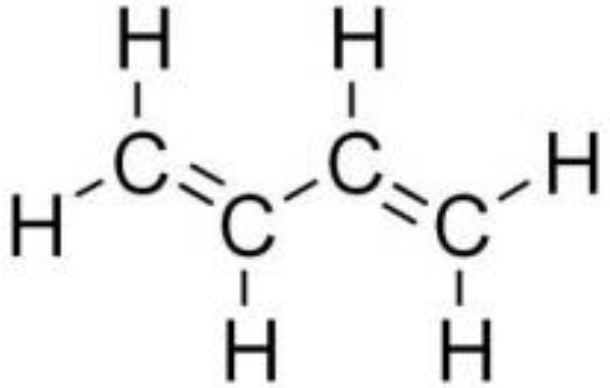
n =1: Methane n = 2 : Ethane n = 3 : Propane

OLEFIN SERIES

- Olefins are also straight chain compounds similar to paraffins but are unsaturated because they contain one or more double bonds between carbon atoms.



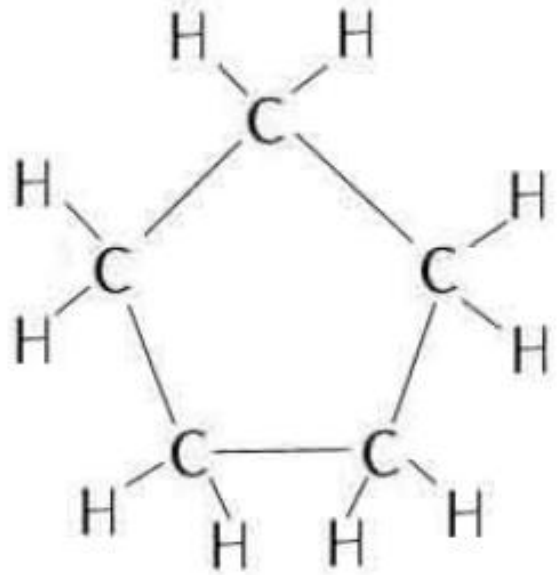
n=6: Hexene



n=6:Butadiene

NAPHTHENE SERIES

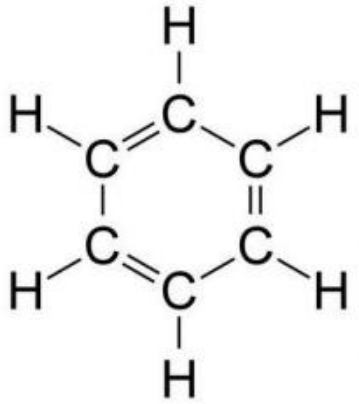
- The naphthenes have the same chemical formula as the olefin series of hydrocarbons but have a ring structure.
- Therefore often they are called as cyclo-paraffins.
- They are saturated and tend to be stable..



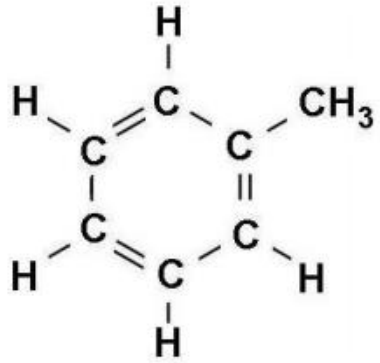
n = 5 : Cyclopentane

AROMATIC SERIES

- Aromatic compounds are ring structured having a benzene molecule as their central structure and have a general chemical formula CnH2n-6.
- Though the presence of double bonds indicates that they are unsaturated, a peculiar nature of these double bonds causes them to be more stable than the other unsaturated compounds.



n = 6: Benzene



Tolune

Family of Hydrocarbons	Chemical Formula	Molecular Structure	Saturated / Unsaturated	Stability
Paraffin	C_nH_{2n+2}	Chain	Saturated	Stable
Olefin	C_nH_{2n}	Chain	Unsaturated	Unstable
Naphthene	C_nH_{2n}	Ring	Saturated	Stable
Aromatic	C_nH_{2n-6}	Ring	Highly Unsaturated	Most unstable

GENERAL CHARACTERISTICS OF HYDROCARBON DUE TO MOELCULAR STRUCTURE

- In SI Engine Normal paraffins exhibit the poor antiknock but aromatics offer the best resistance to knocking in SI Engines
- For CI engines, the order is reversed i.e., the normal paraffins are the best fuels and aromatics are the least desirable.
- As the number of atoms in the molecular structure increases, the boiling temperature increases.
- Thus fuels with fewer atoms in the molecule tend to be more volatile.
- Thus paraffin's have the highest heating value and the aromatics the least.

REFERENCE

- https://en.wikipedia.org/wiki/Petroleum

THANK YOU !!!