Organic Compounds

Unit-3 Chapter - 9 Hydrocarbons

• Homologous Series :-

→ A Homologous Series is a group of compound in which the members have

(I). Similar Chemical properties
(II). A General formula
(III). Same functional Group
(IV). Any two adjacent members differ by CH_2.

Name of the Series	General formula	Examples
(I). Alkane	C_nH_{2n+2}	n=1, CH_4 (Methane) n=2, C_2H_6 (Ethane) n=3, C_3H_8 (Propane) n=4, C_4H_{10} (Butane) n=5, C_5H_{12} (Pentane)
(II). Alkene	C_nH_{2n}	n=2, C_2H_4 (Ethene) n=3, C_3H_6 (Propene) n=4, C_4H_8 (Butene) n=5, C_5H_{10} (Pentene) n=6, C_6H_{12} (Hexene
(III). Alkyne	C_nH_{2n-2}	n=2, C_2H_2 (Ethyne) n=3, C_3H_4 (Propyne) n=4, C_4H_6 (Butyne) n=5, C_5H_8 (Pentyne) n=6, C_6H_{10} (Hexyne) n=7, C_7H_{12} (Heptyne

iv. Alkyl halide	$C_nH_{2n+1}X$ where X = F, Cl, Br, I (C_nH_{2n+1}) = Alkyl	n=1, CH_3Cl (Chloromethane) n=2, C_2H_5Cl (Chloro ethane) n=3 C_3H_7Cl (Chloro Propane) n=4 C_4H_9Cl (Chloro Butane) n=5 $C_5H_{11}Cl$ (Chloro Pentane) n=6 $C_6H_{13}Cl$ (Chloro hexane) n=7 $C_7H_{15}Cl$ (Chloro heptane)
v). Alcohol	$C_nH_{2n+1}OH$	n=1, CH_3OH (Methanol) n=2 C_2H_5OH (Ethanol). n=3 C_3H_7OH (propanol) n=4 C_4H_9OH (Butanol) n=5 $C_5H_{11}OH$ (pentanol) n=6 $C_6H_{13}OH$ (Hexanol) n=7 $C_7H_{15}OH$ (Heptanol)

imp. long Questions

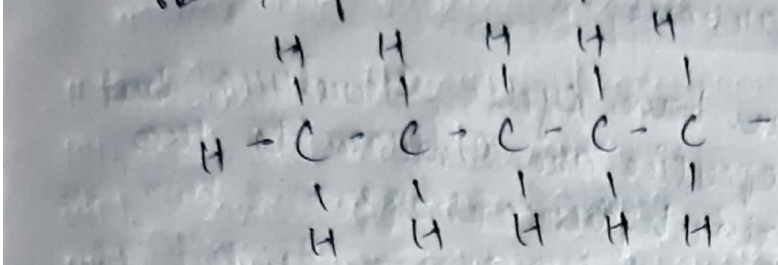
- **Classification of Hydrocarbons :-**

Hydrocarbons
- Open chain / Aliphatic
  - Saturated
  - Unsaturated
- closed chain / Cyclic
  - Alicyclic
    - 3 UNS
  - Aromatic

• Open chain :-

→ These are the hydrocarbons in which the first and last carbon atoms are not directly connected to each other.

for example :- n-pentane (C_5H_{12}).



→ Aliphatic hydrocarbons are of following two types:

(a). Saturated Hydrocarbons :-

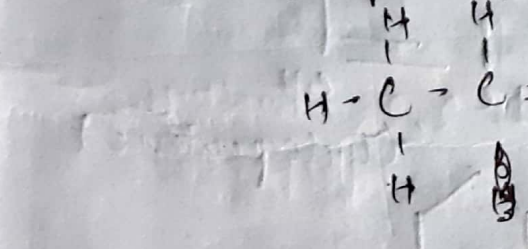
These are the hydrocarbons which contains only ~~carbon~~. C-C and C-H single bonds.

for example - methane, ethane (all the Alkanes).

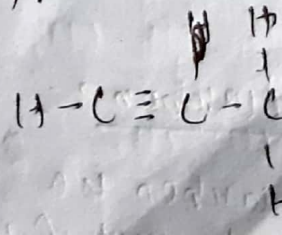
(b). Unsaturated Hydrocarbons :-

These are the hydrocarbons which contains C=C or C≡C. They include alkenes and alkynes.

for example - Propene (C_3H_6).



Propyne (C_3H_4).



• Close chain or cyclic hydrocarbons :

→ These are the hydrocarbons having closed chain or rings of carbon atom in their molecules.

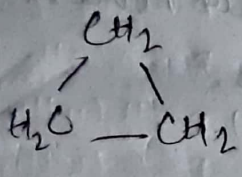
→ It is of following types :

(a) Alicyclic hydrocarbons :

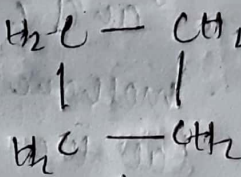
→ These hydrocarbons have cyclic structure but many of their properties are similar to the those of open chain hydrocarbons.

→ They can be either Saturated (C-C) or Unsaturated (C=C).

→ Example of Saturated Alicyclic hydrocarbon :-

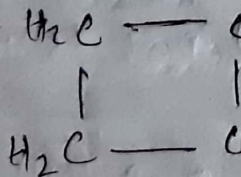


(cyclopropane)

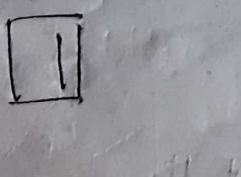


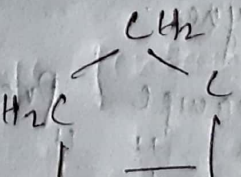
(cyclobutane)

→ Example of Unsaturated Alicyclic hydrocarbon



(cyclobutene)





(cyclopentene)

(b). Aromatic Hydrocarbon :-

An Aromatic hydrocarbon is a compound which is cyclic, planar and must satisfy Huckel's rule.

[Get lowest ... one

→ According to Huckel's rule. A compound which contains $(4n+2)$ π electron is an Aromatic compound

Eg :- Benzene

 → 6π bond

- **IUPAC :- International Union of Pure and Applied Chemistry**

IUPAC Nomenclature of Alkanes :-

(I). Expand the compound in open chain structures

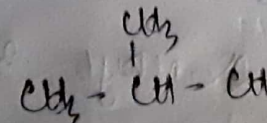
(II). Select the longest continious chain of carbon atoms which is called Principle chain and all other carbon atoms which are ~~non~~ not - included in the principle chain are called Substituents

(III). If the molecule contains two or more chains of same number of carbon atoms. Then, Select the one which contains more substituents

(IV). The numbering of carbon chains can be done from both ends of Principle chain but the set ~~contains~~ containing lowest locant number (At which - Substituent is attached) is the correct one.

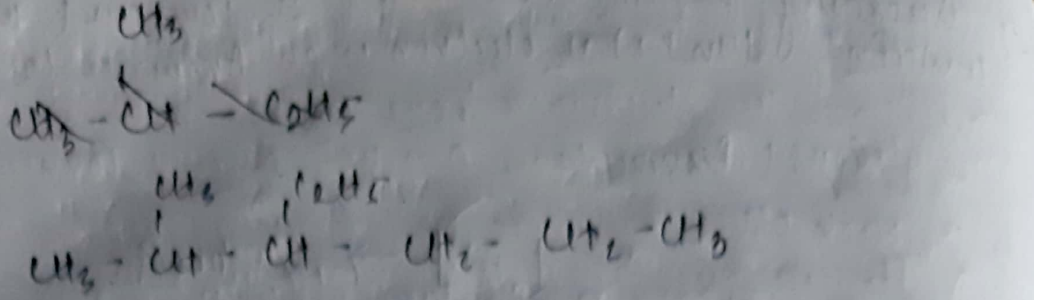
(V). The IUPAC name is written by separating the locant from the substituent name by a - (hyphen) and it is written as

locant - Substituent name wordroot + Suffix



$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_3$ → 2-methyl butane

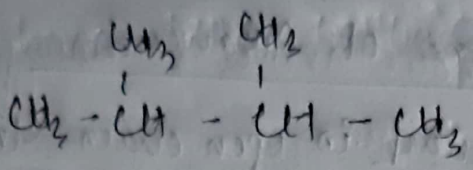
(VI). If two diff. substituents are present then, the numbering should be done such that the substituent which comes first in the Al. order must



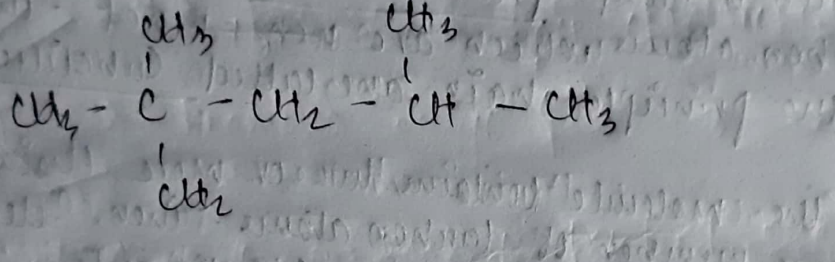
2-methyl, 3-ethyl hexane.

3-ethyl-2-methyl hexane.

(vii) if a particular substituent appears two or more times attached the prefix di, tri etc.



2,3-dimethyl butane

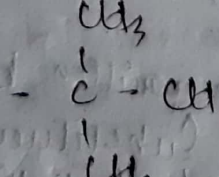


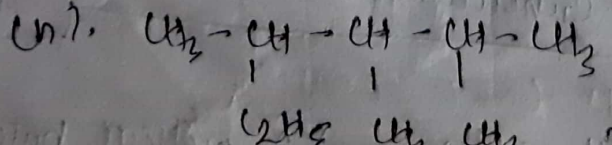
~~2,2,4 dimethyl~~

~~2,2,4 triethyl~~

2,2,4 trimethyl pentane.

H.W

(a).  → 2,2-dimethyl Propane.

(b). 

2,3,4-Trimethyl hexane. → ~~2,3,4-~~ ~~2,3,4-dimethyl ethyl Pentane~~

• IUPAC Nomenclature of Alkenes and Alkynes

I. Select the longest carbon chain containing maximum no. of multiple bonds that is C=C and C≡C.

II. If there is one multiple bond numbering should be done. So, that the carbon containing multiple bond gets the lowest position.

III. When both double bond and triple bond are present, numbering should be done so, that the double bond gets the lowest position and the compound is named as alkyne.

Ex:- $H_3C - CH = CH_2 - C \equiv CH$

Pent 2-en-4-yne.

IV. If the principle chain contains two or more double bond or triple bond then the suffix diene, triene etc or diyne, triyne are added respectively.

Ex:- $HC \equiv C - CH_2 - C \equiv CH$

Penta 1,4-diyne.

Ex:-

V. If the principle chain contains substituents along with multiple bonds then, numbering should be done so that the multiple bond gets lowest position.

Ex: $CH_2 = CH - CH_2 - CH = \overset{\overset{CH_3}{|}}{C} - CH_3$

5-methyl hepta 1,4-diene

2-methyl buta 1, 3-diene.

$$H_2C = \overset{\overset{CH_3}{|}}{C} - CH = CH_2$$

Examples:

1. $CH_2 = CH - CH = CH - CH_3 = CH_2$

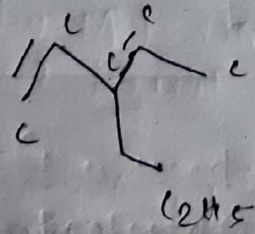
~~1, 3, 5 - hexa~~

hexa-1, 3, 5 tri triene

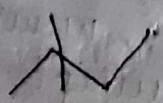
Bond line Notation :-

$$H_2C = CH - \underset{\underset{CH_3}{|}}{CH} - CH_2 - CH_3$$

3-methyl pent-1-ene



3-ethyl-penta-1, 3-diene



2, 2-dimethyl Butane

• IUPAC Nomenclature of Alkyl Halide :-

(i) Here, the steps are same as that of alkane only numbering is started from the carbon containing halogen.

(a). Ex :- $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - I$

1- Iodo 2-methyl propane

(b). $CH_3 - \underset{\underset{I}{|}}{CH} - \underset{\underset{CH_3}{|}}{CH} - CH_3$

3- ethyl - 2- iodo butane

• IUPAC Nomenclature of Alcohol :-

(i) Select the longest carbon chain containing OH group

(ii) Numbering should be done to give lowest position to the carbon containing the OH group.

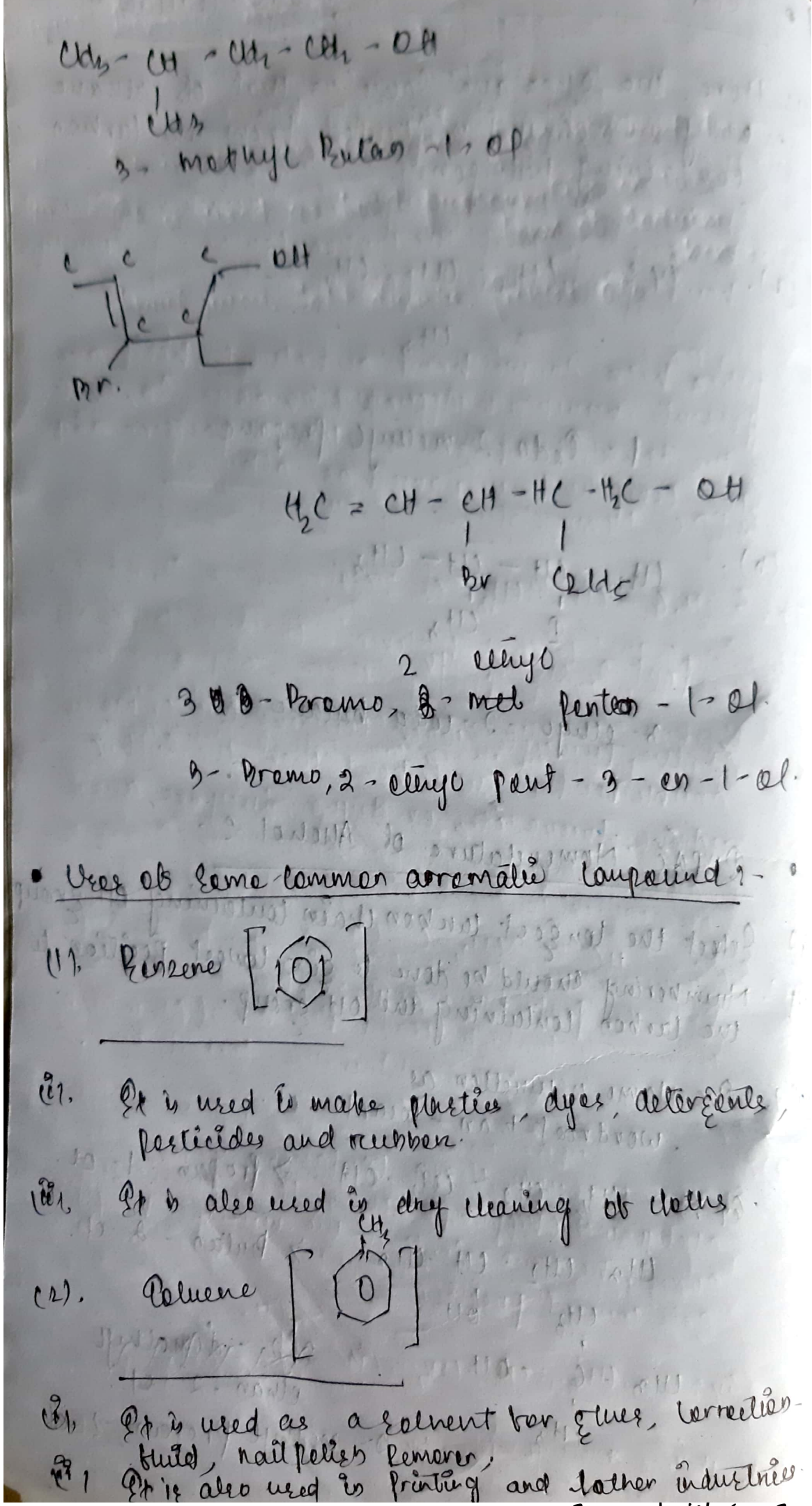
(iii). The name is written as
word root + an - locant - ol.

Ex :- $CH_3 - CH_2 - CH_2 - OH$ → Propan - 1- ol.

$CH_3 - CH_2 - \underset{\underset{OH}{|}}{CH} - CH_3$ → Butan - 2-ol.

$CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}} - CH_3$ → 2,2- dimethyl ethan - 2 - ol.

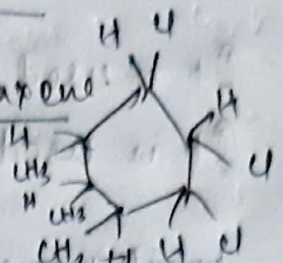
→ 2- methyl Propan - 2-ol


CH3 - CH - CH2 - CH2 - OH
CH3
3- methyl Butan -1- ol
OH
Br.
H2C = CH - CH - HC - H2C - OH
Br
C2H5
2 ethyl
3 Bromo, 2- meth penten - 1- ol.
3- Bromo, 2 - ethyl pent - 3 - en - 1 - ol.
• Uses of some common aromatic compound :-
(1). Benzene
(i). It is used to make plastics, dyes, detergents, pesticides and rubber.
(ii). It is also used in dry cleaning of clothes.
(2). Toluene
CH3
(i). It is used as a solvent for glues, correction fluid, nail polish Remover,
(ii). It is also used in Printing and leather industries.

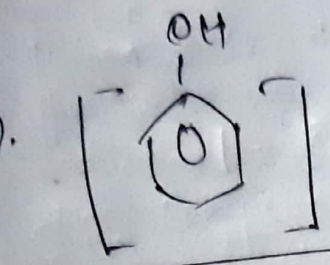
(iii) It is used in preparing explosives (TNT).

(iii). BHC (Benzene Hexachloride).

(i) It is commonly known as Gamaxene



(ii) It is used as an insecticide and as a pharmaceutical a treatment of lice.

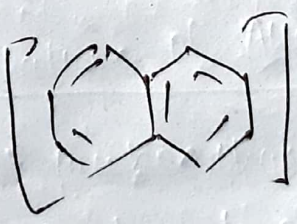
(iv).  Phenol

(i). It is used as disinfectant in household cleanliness.

(ii). Used in mouth wash.

(iii). Used as a preservative for some vaccines.

(iv). It is used to treat pharyngitis (sore throat).

(v). Naphthalene 

(i). It is used as an insecticide and Pest repellant.

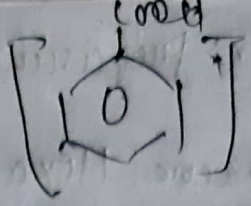
(ii). It is also used in dyes.

(vi). Anthracene 

(i). Used in Production of artificial red colour.

(ii). It is used in wood preservative and coating materials.

(vii). Benzoic Acid :-



(i). It is used in cosmetic products and for making dyes.
(ii). It is used as food preservatives in the form of sodium benzoate in fruit juices, soft drinks, pickles etc.