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Medical Class Companion
Chemistry

For NEET/AIIMS

Module-1

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Contents

Chapter 2

Atomic Structure

Chapter 3

Periodic Properties

CHAPTER 1

Nomenclature

SECTION A

Classification of carbon and hydrogen atoms , Types of alcohols and Amines, Defination of chiral carbon, Olephenic and acetylenic bonds, Vinylic carbon allylic carbon and benzylic carbon

1. Kekule's Principle

(a) Carbon has four valencies.

(b) Carbon has a property of catenation. It can make a large chain with addition of other carbons.

(c) A carbon atom can share 2, 4 or 6 electrons with other carbons & can form single, double or triple bond.

(d) For a carbon atom, it is not possible to make more than 3 bonds with adjacent carbon atom because a carbon atom complete its octet from overlapping which consists directional property.

2. Degree of Carbon

No. of carbon attached to carbon atom is called degree of carbon

there are four types : –

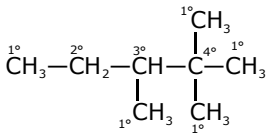
1. Primary carbon (1° carbon)

2. Secondary carbon (2° carbon)

3. Tertiary carbon (3° carbon)

4. Quaternary carbon (4° carbon)

Ex.



3. Degree of Hydrogen

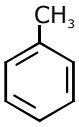
Degree of carbon on which that hydrogen attached. there are three types

1. Primary hydrogen (1° hydrogen)

2. Secondary hydrogen (2° hydrogen)

3. tertiary hydrogen (3° hydrogen)

Ex. How many 1°, 2° & 3°H atoms are present in



[Toluene] respectively.

(A) 3, 0, 5 (B) 3, 5, 0

(C) 4, 3, 0 (D) 0, 5, 3

Ans. **B**

4. Degree of Alcohol

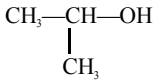
Degree of carbon on which alcohol atom attached. There are three types.

1. Primary alcohol (1° alcohol)

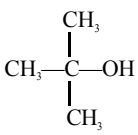
2. Secondary alcohol (2° alcohol)

3. tertiary alcohol (3° alcohol)

Ex. $CH_3—CH_2—OH$ (1° alcohol)



(2° alcohol)



(3° alcohol)

5. Degree of Amine

They are named according to the number of carbons attached to nitrogen. there are three types.

1. Primary Amine (1° Amine)

2. Secondary Amine (2° Amine)

3. tertiary Amine (3° Amine)

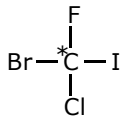
Ex. $–NH_2$ 1° Amine

–NH— 2°–Amine

3°–Amine

6. Chiral Carbon or Asymmetric Carbon Atom

Chiral carbon or asymmetric carbon atom is a carbon atom that is attached to four different types of atoms for groups of atoms

Ex. 

7. Olephenic and Acetylenic Bonds

A. Olephenic bond :

Alkenes are also called olefins because they form oily liquids on reaction with chlorine gas. An alkene consists of atleast one double bond. This double bond is known as the olefinic bond.

Ex. $CH_3CH=CH_2$ **Propene**

B. Acetylenic bonds :

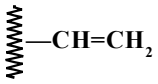
Acetylene, also called ethyne, the simplest and best-known member of the hydrocarbon series containing one or more pairs of carbon atoms linked by triple bonds, called acetylenic bond.

Ex. $CH\equiv CH$ **Ethyne**

8. Vinylic Carbon Allylic Carbon and Benzylic Carbon

A. Vinylic Carbon :

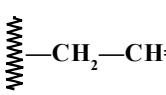
Vinylic carbon is a carbon that is involved in a double bond with another carbon. It is sp^2 hybridized. Vinylic carbon makes a double bond with another carbon which is also sp^2 hybridized. Both carbons involved in this bond are vinylic carbons.

Ex.  **Vinyl**

B. ALLYLIC CARBON :

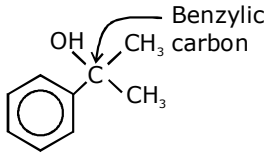
Allylic carbon can be described as the carbon atom that is adjacent to the double bond. This carbon atom is the nearest to the double bond, but it is not a part of the double bond.

The carbon atoms in the double bond are sp^2 hybridized. But the allylic carbon is sp^3 hybridized. It is bonded to the sp^2 hybridized carbon atom through a single bond.

Ex.  **Allyl**

C. BENZYLIC CARBON :

A benzylic carbon is a saturated carbon that is directly attached to a benzene ring.

Ex. 

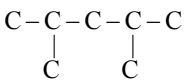
EXAMPLE 1

How many 1° carbon atom will be present in a simplest hydrocarbon having two 3° & one 2° carbon atom?

(A) 3 (B) 4

(C) 5 (D) 6

Sol. **B**



2, 4 - dimethyl pentane is the compound having 2 – 3° carbon & 1 – 2° carbon atom & 4-1° carbon atoms.

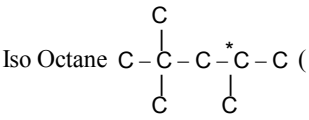
EXAMPLE 2

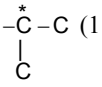
In which of the following tert. carbon is absent -

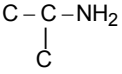
(A) Iso octane (B) Triptane

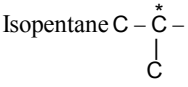
(C) Isopropyl amine (D) Isopentane

Sol. **C**

Iso Octane  (1 – 3° carbon atom)

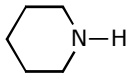
Triptane  (1 – 3° carbon atom)

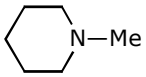
Isopropyl amine  (no tert. carbon atom)

Isopentane  (1 - tert. carbon atom)

EXAMPLE 3

Indicate the following as 1°, 2°, and 3°.

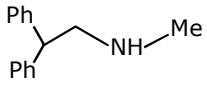
i. 

ii. 

Ans. **i → 2°, ii → 3°**

EXAMPLE 4

Indicate the following as 1°, 2°, and 3°.

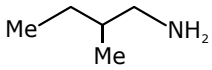
i. 

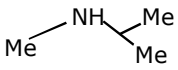
ii. **Et_3N**

Ans. **i → 2°, ii → 3°**

EXAMPLE 5

Indicate the following as 1°, 2°, and 3°.

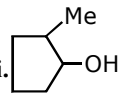
i. 

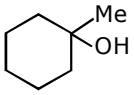
ii. 

Ans. **i → 1°, ii → 2°**

EXAMPLE 6

Indicate the following as 1°, 2°, and 3°.

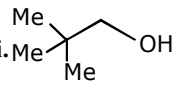
i. 

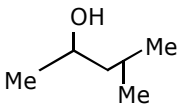
ii. 

Ans. **i → 2°, ii → 3°**

EXAMPLE 7

Indicate the following as 1°, 2°, and 3°.

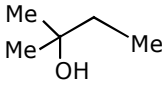
i. 

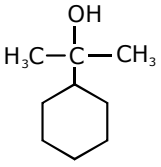
ii. 

Ans. **i → 1°, ii → 2°**

EXAMPLE 8

Indicate the following as 1°, 2°, and 3°.

i. 

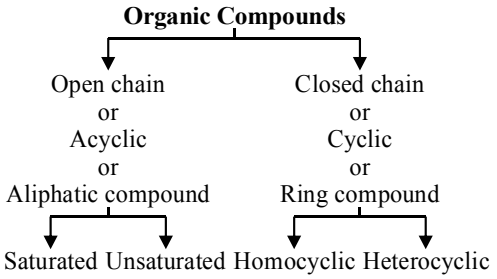
ii. 

Ans. **i → 2°, ii → 3°**

SECTION B

On the basic of structure, On the basic of homology

(A) based on structure

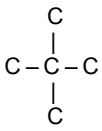


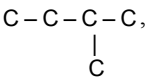
2.1 Aliphatic or Open chain compounds

Those compounds in which first & last carbon atoms are not connected with each other. Branched or unbranched chains are possible in these compounds.

For example : -

C – C – C – C ,





(unbranched) (branched)

There are two varieties in these compounds -

2.1.1 Saturated Hydrocarbons :–

(a) In such type, adjacent carbons are attached with single bonds.

Ex. $CH_3 – CH_2 – CH_3$

(b) General formula of these compounds is C_nH_{2n+2}

(c) These are also called as paraffins (Parum + Affinis i.e. little reactivity) because these are less reactive due to absence of π–bonds.

2.1.2 Unsaturated Hydrocarbons : –

(a) There will be a double bond or a triple bond between any two carbon atoms,

$CH_2 = CH – CH_3$ (Propene),

$CH \equiv C – CH_3$ (Propyne)

(b) Gen. formula is C_nH_{2n} or C_nH_{2n-2} .

(c) Alkenes are also called as olefins because they reacts with halogens to form oily substances olefins (Oleum + fines i.e. Oil forming).

(d) Due to presence of π bonds these are more reactive.

2.2 Closed chain compounds : –

In these compounds first & last carbons are attached with each other.

Ex. cyclopropane .

These are of two types –

2.2.1 Homocyclic compounds : –

These are the compounds in which the complete ring is formed by carbon atoms only. These are also of two types -

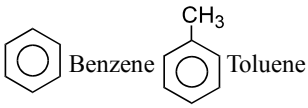
(a) Alicyclic compounds : –

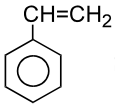
These are the compounds having the properties like aliphatic compounds. These may be saturated or unsaturated like aliphatic compounds.

Cyclopropane, Cyclopropene, Cyclobutene

(b) Aromatic compounds : –

These compounds consist of at least one benzene ring i.e. a six-membered carbcyclic ring having alternate single and double bonds. These compounds have some fragrant odour and hence, named as aromatic (greek word aroma means sweet smell)

Ex.  Benzene Toluene

 Styrene

2.2.2 Heterocyclic Compounds : –

These are cyclic compounds having ring or rings built up of more than one kind of atoms.

 Furan  Thiophene

(B) Based on homology

If the difference of CH_2 or 14 molecular weight is present between successive members of a series of organic compounds then this is known as homologous series, Members are known as Homologous & overall concept is known Homology.

The general characterstics of a homologous series are :

(i) General formula same

(ii) General methods of preparation same.

(iii) Chemical properties same

(iv) Type of functional group must be same.

(v) Physical properties different.

e.g. the Homologous series of monohydric alcohols can be represented by the general formula $C_nH_{2n+1}OH$. The formula of various homologous can be writtne by giving the values 1, 2, 3, ... to n.

n		
1	CH_3OH	The molecular formula of each member differs from the members above and below it by one CH_2 group
2	C_2H_5OH	CH_2
3	C_3H_7OH	CH_2
4	C_4H_9OH	CH_2

EXAMPLE 9

Which of the following is not an Aliphatic compound -

(A) iso propane (B) butane

(C) hexane (D) None of these

Sol. **D**

All are aliphatic compound, because according to the definition all the hydrocarbons having straight or branched chain of carbon is aliphatic.

EXAMPLE 10

Which of the following is an unsaturated compound -

(A) Ethane (B) Ethene

(C) Ethyne (D) both B & C.

Sol. **D**

Compounds having carbon-carbon double or triple bond is known as an unsaturated compound.

EXAMPLE 11

Which of the following is the pair of homocyclic & heterocyclic compound -

(A) cyclopropane and cyclohexane

(B) cycloethane and oxyrane

(C) pyridine and thiophene

(D) cyclo pentane and furane

Sol. **D**

Cyclopentane and furane is a pair of homocyclic & heterocyclic compound. In which cyclopentane is homocyclic and furane is hetrocyclic.

EXAMPLE 12

Alicyclic compounds are :
(A) aromatic compounds
(B) aliphatic cyclic compounds
(C) heterocyclic compounds
(D) None of the above

Ans. **B**

EXAMPLE 13

Which one of the following is the heterocyclic compound?
(A) Pyrene (B) Thiophene
(C) Phenol (D) Aniline

Ans. **A**

EXAMPLE 14

A group closely related compounds which can be expressed by a general formula and in which two consecutive members differ by 14 in their molecular masses is called :
(A) a homologous series
(B) a homogeneous series
(C) a heterogeneous series
(D) an electrochemical series

Ans. **A**

EXAMPLE 15

Which one is not correct for a homologous series ?
(A) All members have a general formula
(B) All members have same chemical properties
(C) All members have same physical properties
(D) All members have same functional group

Ans. **C**

EXAMPLE 16

The formula C_nH_{2n-2} shows -
(A) Alkene & Alkyne (B) Alkyne & Alkadiyne
(C) Alkane & Alkadiene (D) Alkyne & Alkadiene

Ans. **D**

Sol. For Acetylene & Allene

$HC \equiv CH$ $CH_2 = C = CH_2$

(C_2H_2) (C_3H_4)

SECTION C

On the basic of group - Radicals of alkanes, Radicals of alkenes and alkynes, Radicals of aromatic hydrocarbon

(C) On the basis of group

(a) Functional Group

(1) it is responsible for chemical behaviour or properties of any organic compound.

(2) It is made up of single atom or group of atoms eg. —O—, —OH, —COOH etc.

(b) Hydrocarbon Groups

If one hydrogen (or more hydrogen atoms in some cases) is taken out from a hydrocarbon, the group left is known as a hydrocarbon group.Hydrocarbons are of three major types, hydrocarbon groups too belong to three main class; these are ;

(1) Acyclic hydrocarbon groups

(2) Alicyclic hydrocarbon groups

(3) Aromatic benzenoid hydrocarbon groups

Acyclic Hydrocarbon Groups

Alicyclic hydrocarbon groups are of three types :

(i) Alkyl groups (ii) Alkenyl groups

(iii) Alkynyl groups

(i) Alkyl groups :

These are univalent groups or radicals obtained by the removal of one hydrogen atom from a molecule of an alkane. The symbol '**R**' is often used to represent an alkyl group. The general formula of an alkyl group is C_nH_{2n+1}.

$R - H \xrightarrow{-H} R -$

$C_nH_{2n+2} \xrightarrow{-H} C_nH_{2n+1}-$

Alkyl groups are of five types :

(a) Normal Alkyl group :

This is formed by the removal of one primary hydrogen atom from the straight chain alkane. A normal alkyl group is written as *n*-alkyl group is common naming system and in its IUPAC namenclature, the prefix n – is dropped.

Some examples are :

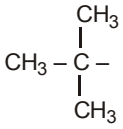
R	Common Name	IUPAC Name
$CH_3–CH_2–CH_2–$	*n*-Propyl (*n*–Pr)	Propyl (Pr)
$CH_3–CH_2–CH_2–CH_2–$	*n*-Butyl (*n*-Bu)	Butyl (Bu)
$CH_3–CH_2–CH_2–CH_2–CH_2–$	*n*-Pentyl	s-Pentyl

(b) Secondary alkyl group : This is formed by the removal of one hydrogen from the secondary carbon atom from alkane. It is denoted by *sec* – alkyl or *S* - alkyl group in both of the system of nomenclature.

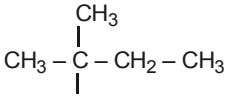
Some examples are given below :

Structure	Common name	IUPAC name
$CH_3–CH_2–CH–CH_3$	*Sec*-butyl (S-Bu)	1-methyl propyl

(c) Tertiary alkyl group : This group is formed by the removal of one hydrogen from the tertiary carbon of the corresponding alkane. It is denoted by *tert* or *t*-alkyl group in both system of nomenclature. Some example are :

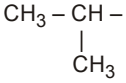


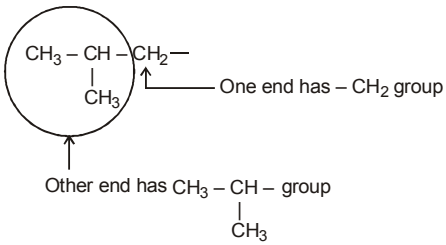
Tert butyl (t-Bu)



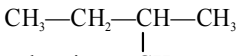
tert - pentyl

(d) Isoalkyl group : An alkyl group containing one terminal CH_2 – group

and  group on the other end with no other branching is said to be an *isoalkyl* group or *i*-alkyl group.

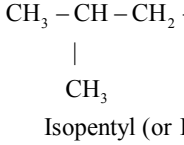


Hence, it is isoalkyl group, i.e., isobutyl group.



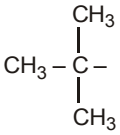
monovalent carbon is not CH_2—

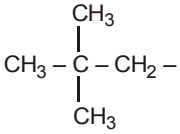
It is not *isobutyl* group



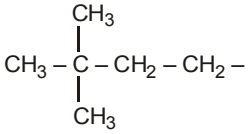
Isopentyl (or Isoamyl group)

Isohexyl group

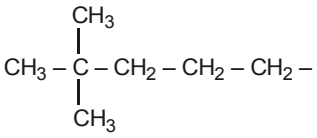
(e) Neoalkyl group : A neoalkyl group contains one CH_2 – group on one end and one  group on the other end with no other branching in the chain.



Neopentyl group



Neohexyl group



Neoheptyl group

Note : Methylene group : If two hydrogen atoms are removed from methane then the group obtained is methylene group, i.e., – CH_2 –

Alkenyl Group

Hydrocarbon group containing carbon-carbon double bond is called alkenyl group. Their common names are accepted in IUPAC system in most of the cases. Some examples are :

$CH_2 = CH –$	Vinyl group
$CH_2 = CH – CH_2 –$	Allyl group
$CH_3 – CH = CH –$	Propenyl group
$CH_3 – CH =$	Ethylidene
$CH_3 – CH_2 – CH =$	Propylidene
	1-methyl ethylidene

Alkynyl group

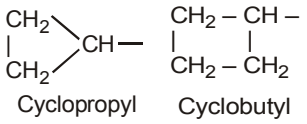
Hydrocarbon group containing carbon-carbon triple bond may be called an alkynyl group. Their common names are accepted in IUPAC system in most of the case. Some examples are :

Structure	Common name	IUPAC name
$C \equiv$	Methynyl	Methynyl
$CH \equiv C –$	Ethynyl	Ethynyl
$CH \equiv C – CH_2 –$	Propargyl	Propargyl
$CH_3 – C \equiv C –$	Propynyl	Propynyl

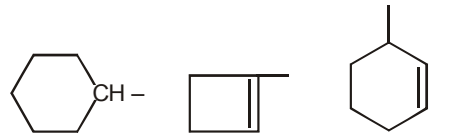
Alicyclic Hydrocarbon Groups

These are obtained when one hydrogen atom is removed from the ring carbon. These groups may be classified as :

cycloalkyl groups



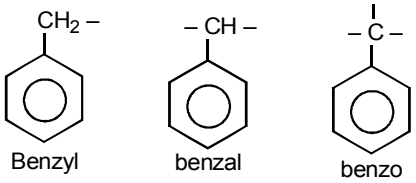
Cyclopropyl Cyclobutyl



Cyclohexyl 1-Cyclobutenyl 2-Cyclohexenyl

Aromatic Benzeoid Hydrocarbon Groups

Aromatic hydrocarbon groups have one or more hydrogen atoms less than the present hydrocarbons. These are in general denoted by Ar- and called aryl groups. The simplest aryl group is phenyl group (C_6H_5). This is denoted by Ph or ϕ.



Benzyl benzal benzo

EXAMPLE 17

Example of a gem dihalide is : -

(A) Pentamethylene chloride

(B) Ethylene chloride

(C) Propylene chloride (D) Benzal chloride

Ans. **D**

Sol. The example of a gem dihalide is benzal chloride. In such a halide both Cl atoms are attached to the same carbon atom. (Banzal chloride)

EXAMPLE 18

$C_3H_6Br_2$ can shows -

(A) Two gem dibromide

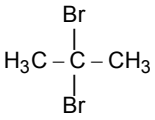
(B) Two vic dibromide

(C) Two tert. dibromo alkane

(D) Two sec. dibromo alkane

Ans. **A**

Sol. 1, 1 - dibromo propane



2, 2 - dibromo propane

(Two gem dibromides)

EXAMPLE 19

Which of the following has iso group?

(A) $CH_3—CH_2—\underset{\displaystyle CH_3}{\underset{|}{CH}}—CH_3$

(B) $CH_3—\underset{\displaystyle CH_3}{\underset{|}{CH}}—\underset{\displaystyle |}{CH}—CH_3$

(C) $CH_3—CH_2—\underset{\displaystyle |}{CH}—CH_3$

(D) $CH_3—\underset{\displaystyle |}{CH}—CH_3$

Ans. **A**

EXAMPLE 20

Which of the following has neo group?

(A) $CH_3—\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}—CH_2—CH_3$

(B) $CH_3—\underset{\displaystyle CH_3}{\underset{|}{CH}}—\underset{\displaystyle CH_3}{\underset{|}{CH}}—CH_3$

(C) $CH_3—\underset{\displaystyle CH_3}{\underset{|}{CH}}—CH_2—CH_2—$

(D) $CH_3—\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}—CH—CH_3$

Ans. **A**

EXAMPLE 21

In C_3H_8 the total number of structure ?

Ans. **1**

$CH_3—CH_2—CH_3$

SECTION D

Comman name system, Derived Name system

Nomenclature

Mainly three systems are adopted for naming an organic compound –

Common Name or Trivial System

Derived System

IUPAC system or Jeneva System

5. Common or Trivial System

Initially organic compounds are named on the basis of source from which they were obtained.

eg.

S. No.	Organic Compound	Trivial Name	Source
1.	CH_3OH	Wood spirit or Methyl spirit	Obtained by destructive distillation of wood.
2.	NH_2CONH_2	Urea	Obtained from urine
3.	CH_4	Marsh gas (fire damp)	Itwasproduced in marsh places.
4.	CH_3COOH	Vinegar	Obtained from Acetum i.e. Vinegar
5.	COOH | COOH	Oxalic acid	Obtained from oxalis plant.
6.	HCOOH	Formic acid	Obtained from formicus [Red ant]
7.	$CH_3-CH(OH)-COOH$	Lactic acid	Obtained from milk
8.	$CH_2(OH)-CH(OH)-COOH$	Malic acid	Obtained from apple ⇒ mallum
9.	$CH_3CH_2CH_2COOH$	Butyric acid	Obtained from butter.
10.	$CH_3(CH_2)_4COOH$	Caproic acid	Obtained from goats.

Some typical compounds in which common & trivial names are also differ.

S. No.	Compound	Trivial Name	Source
1.	CH_4	Marsh gas	Methane
2.	CH_3OH	Woodspirit	Methyl alcohol
3.	CH_3COOH	Vinegar	Acetic acid
4.	$CH_3-C(=O)-CH_3$	Acetone	Dimethyl ketone
5.	$CH_2=CH-C(=O)-H$	Acrolein	Acryl Aldehyde
6.	$CH_3-C(CH_3)(H)-C(=O)-H$	Pevaldehyde	Neo valer Aldehyde

Common –Names (R is termed as alkyl-)

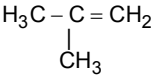
S. No.	Compound	Source
1.	R–X	Alkyl halide
2.	R–OH	Alkyl alcohol
3.	R–SH	Alkyl thio alcohol
4.	$R-NH_2$	Alkyl amine
5.	R–O–R	Dialkyl ether
6.	R–S–R	Dialkyl thioether
7.	R–C(=O)–R	Dialkyl ketone
8.	R–NH–R	Dialkyl amine
9.	R–N(R)–R	Trialkyl amine
10.	R–O–R’	Alkyl alkyl’ ether
11.	R–C(=O)–R’	Alkyl alkyl’ ketone
12.	R–S–R’	Alkyl alkyl’ thio ether
13.	R–NH–R’	Alkyl alkyl’ amine
14.	R–N(R’)–R”	Alkyl alkyl’ alkyl” amine

5.1 Position of double bond : –

In an unsaturated hydrocarbon if the position of double bond is on Ist or last carbon then it’s prefix will be α (alpha) if it is on 2nd carbon it is termed as β (Beta) & the γ (gamma) & δ (delta) and so on.

eg.

$H_2C = CH - CH_2 - CH_3$	α - butylene
$H_3C - CH = CH - CH_3$	β - butylene
$H_3C - CH_2 - CH = CH_2$	α - butylene
$H_2C = CH - CH_3$ or $H_3C - CH = CH_2$	(Both are same positions, propylene)


Isobutylene

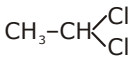
$CH_3–CH_2–CH=CH–CH_2–CH_3$ γ - hexylene

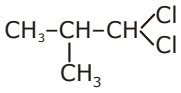
$CH_3–\ CH_2–CH_2–CH=CH–CH_2–CH_2–CH_3$ δ - octylene

5.2 Common – Naming of dihalides : –

(a) When two same halogen atoms are attached to the same carbon such compounds are called **Gemdihalides**.

(b) Common names of such compounds are alkylidene halides

eg. :  Ethylidene chloride

 Isobutylidene Iodide

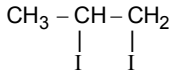
Exception :

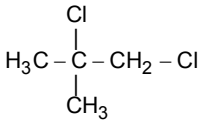
 Methylidene halide(wrong)

Methylene halide (right)

(c) When two same halogen atoms are attached to adjacent carbon, these are called as vicinal dihalides.

Common names of such compounds are alkylene halide.

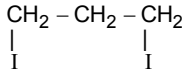
eg :  Propylene Iodide

 Isobutylene chloride

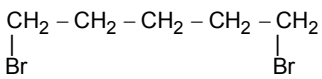
(d) When two same halogen atoms are attached at the two ends of a carbon chain its common naming will be polymethylene halide.

'poly' word indicates the number of $–CH_2–$ groups.

$–CH_2–$	2	3	4	5	6
Poly	di	tri	tetra	penta	Hexa

eg. 

Trimethylene Iodide



Pentamethylene Bromide

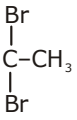
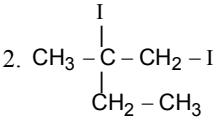
Exception :

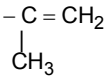
$CH_2 – X$ dimethylene halide (wrong)

$CH_2 – X$ ethylene halide (right)

eg. Make the structure of following organic compounds -

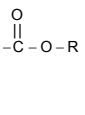
1. Isopropylidene Bromide
2. Active amylene Iodide
3. Isobutylene

Sol. 1.  2. 

3. 

5.3 Common - Naming of the functional group having carbon : –

Chart - 1

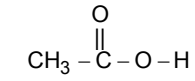
Functional group	Suffix	Functional group	Suffix
	-aldehyde		-ic Acid
	-yl halide		-amide
– C ≡ N	-o-nitrile	– N ≡ C	-o-isonitrile
	-ate		-icanhydride

Prefix : –

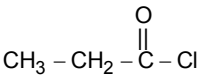
1. Carbon → Form-
2. Carbon → Acet-
3. Carbon → Propion-
4. Carbon → Butyr |→ Normal / → Iso -
5. Carbon → Valer

3C + (=) double bond → Acryl-

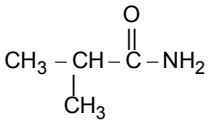
4 C + double bond → Croton-

eg.  

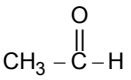
Formaldehyde Acetic Acid



Propionyl chloride

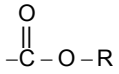


Isobutyr amide



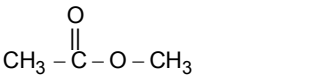
Acetaldehyde

5.4 Nomenclature of Ester :-

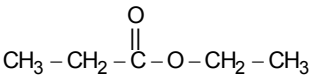


The group which is attached to the oxygen is written as alkyl & the remaining structure is named same as defined in chart-1.

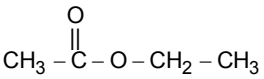
eg.



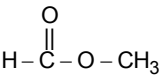
Methyl acetate



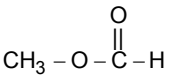
Ethyl propionate



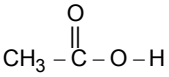
Ethyl acetate



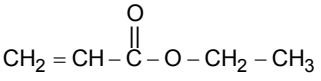
Methyl formate



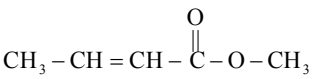
Methyl formate



Acetic acid

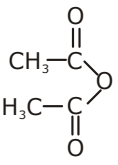


Ethyl acrylate

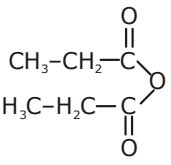


Methyl crotonate

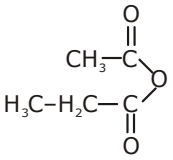
5.5 Nomenclature of Anhydride : –



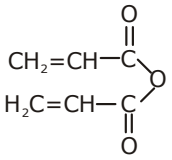
Acetic anhydride



Propionic anhydride



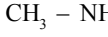
Acetic propionic anhydride



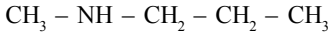
Acrylic anhydride

5.6 Nomenclature of Amine : –

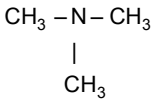
The common name of amine is obtained by citing the name of the alkyl groups bonded to the nitrogen atom in alphabetical order followed by **amine.** The entire name is written in one word. For examples.



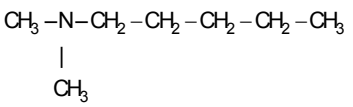
Methylamine



ethylproplyamine



Trimethylamine

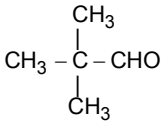


Dimethylpentylamine

Common or Travel Names

EXAMPLE 22

The trivial name of the following compound is



(A) Pevaldehyde
(B) Trimethyl acetaldehyde
(C) trimethyl acetaldehyde
(D) t - butyl formaldehyde

Ans. **A**

EXAMPLE 23

Acrolein is -
(A) An unsaturated aldehyde
(B) A saturated aldehyde
(C) A polymer
(D) An alkene

Ans. **A**

Sol. $CH_2 = CH - CHO$ unsaturated aldehyde.

EXAMPLE 24

The common name of the compound
$CH_2 = CH - CH_2 - NH_2$ is -
(A) Vinyl amine (B) Allyl amine
(C) Divinyl amine (D) Diallylamine

Ans. **B**

Sol. $CH_2 = CH - CH_2$ - is allyl group.

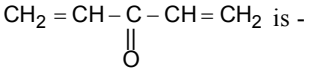
EXAMPLE 25

The common name of the compound
$CH_3 - CH_2 - S - CH_2 - CH_3$ is -
(A) Diethyl ether
(B) Ethyl methyl thioether
(C) Diethyl thioether
(D) None

Ans. **C**

EXAMPLE 26

The common name of the compound



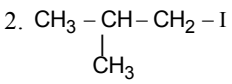
(A) Divinyl ketone (B) Diallyl ketone
(C) Both A and B (D) None

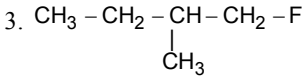
Ans. **A**

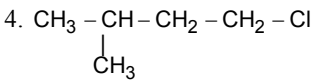
Sol. $CH_2 = CH -$ is called as vinyl group.

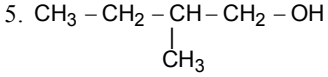
EXAMPLE 27

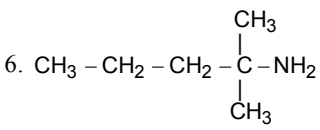
Write the common names of the following -
1. $CH_3 - CH_2 - Br$

2. 

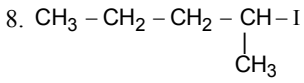
3. 

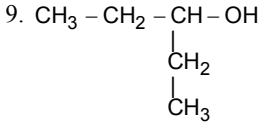
4. 

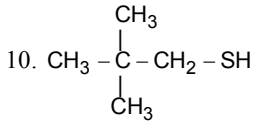
5. 

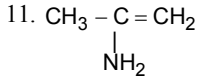
6. 

7. $CH_2 = CH - SH$

8. 

9. 

10. 

11. 

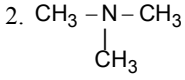
12. $CH \equiv C - CH_2 - Br$

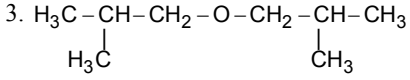
Sol. 1. Ethyl Bromide
2. Isobutyl Iodide
3. Active amyl fluoride
4. Iso pentyl chloride
5. Active amyl alcohol
6. Tertiary hexyl amine
7. Vinyl thio alcohol
8. Active secondary amyl Iodide
9.Secondary amyl alcohol.
10. Neopentyl thio alcohol
11. Isopropenyl amine
12. Propargyl Bromide

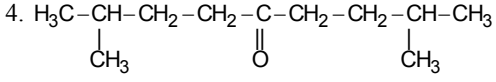
EXAMPLE 28

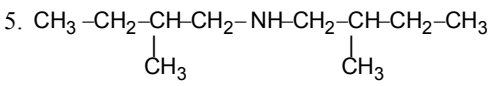
Write down the structures of the following -
1. Di allyl amine 2. Tri methyl amine
3. Di isobutyl ether 4. Di isopentyl ketone
5. Di Active amyl amine 6. Di normal propyl ether
7. Tri neopentyl amine

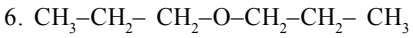
Sol. 1. $CH_2 = CH - CH_2 - NH - CH_2 - CH = CH_2$

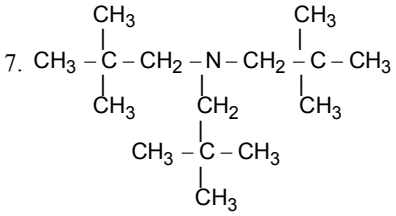
2. 

3. 

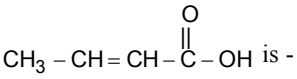
4. 

5. 

6. 

7. 

EXAMPLE 29

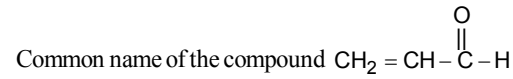
Common name of the compound  is -

(A) Crotonic acid (B) Acrylic acid
(C) Allylic acid (D) None

Ans. **A**

Sol. 4C + (=) → croton
Suffix is 'ic' acid.

EXAMPLE 30

Common name of the compound 
is -

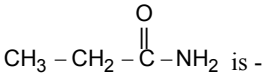
(A) Croton aldehyde (B) Acryl aldehyde
(C) Propion aldehyde (D) Butyr aldehyde

Ans. **B**

Sol. 3C + (=) → Acryl
Suffix is aldehyde.

EXAMPLE 31

Common name of the compound

 is -

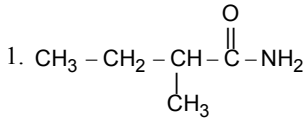
(A) Acetamide (B) Propionamide
(C) Butyramide (D) Acetic amide

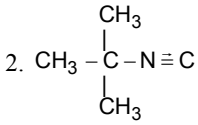
Ans. **B**

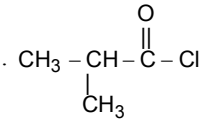
Sol. 3C → Propion
Suffix is amide.

EXAMPLE 32

Write down the common names of the following :

1. 

2. 

3. 

Sol. 1. Secondary Valer amide
2. Tertiary valero-isonitrile
3. Isobutyryl chloride

6. Derived system

According to this system name to any compound is given according to the parrent name of the homologous series. This system is reserved for the following nine homologous series.

Chart - 2

S. No.	Series Name of Homologous series	Derived Name	Structure of group
1.	Alkane	Methane	
2.	Alkene	Ethylene	>C=C<
3.	Alkyne	Acetylene	–C≡C–
4.	Alcohol	Carbinol	
5.	Aldehyde	Acetaldehyde	
6.	Carboxyllic acid	Acetic acid	
7.	Acid halide	Acetyl halide	
8.	Amide	Acetamide	
9.	Ketone	Acetone	

6.1 Types of Ethylene:– (Symmetrical & Unsymmetrical)

(a) Symmetrical : –

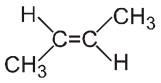
In the given two alkyl groups one group is attached to the one carbon of ethylene & next on the next carbon.

(b) Unsymmetrical : –

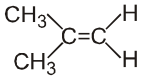
When both the given groups are attached on the same carbon.

Note : – Symmetrical & Unsymmetrical : terms are used only when two alkyl groups are given.

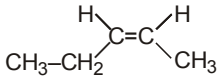
eg.



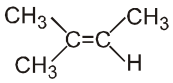
Symmetrical dimethyl ethylene



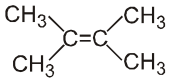
Unsymmetrical dimethyl ethylene



Symmetrical ethyl methyl ethylene



Tri methyl ethylene



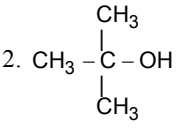
Tetra methyl ethylene

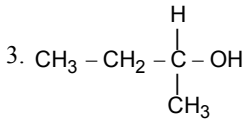
$CH_3–C\equiv C–CH_3$ Dimethyl acetylene

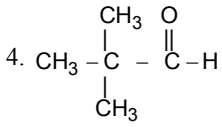
EXAMPLE 33

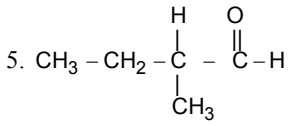
Write down the derived names of the following-

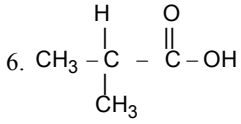
1. $CH_2=CH–CH_2–C\equiv C–H$

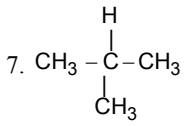
2. 

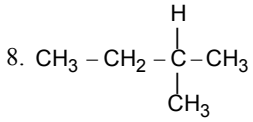
3. 

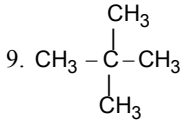
4. 

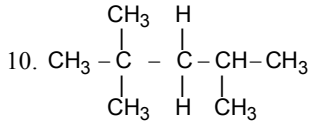
5. 

6. 

7. 

8. 

9. 

10. 

Sol.

1. Allyl acetylene
2. Tri methyl carbinol
3. Ethyl methyl carbinol
4. Tri methyl acetaldehyde
5. Ethyl methyl acetaldehyde
6. Di methyl acetic acid
7. Tri methyl methane
8. Ethyl di methyl methane
9. Tetra methyl methane
10. Tertiary butyl Isopropyl methane.

Class of Compound	Structure	Common name
Alkanes	(i) CH_4	Methane
	(ii) $CH_3 - CH_3$	Ethane
	(iii) $CH_3 - CH_2 - CH_3$	Propane
	(iv) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{CH}}}}-CH_3$	Isobutane
	$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{C}}}}-CH_3$	Neopentane
Alkenes	$CH_2 = CH_2$	Ethylene
	$CH_3 - CH = CH_2$	Propylene
Alkynes	$CH \equiv CH$	Acetylene
	$CH_3 - C \equiv CH$	Methyl acetylene
	$CH_3 - C \equiv C - CH_3$	Dimethyl acetylene
	$CH_3 - X$	Methyl halide
Alkyl halides	$CH_3-\underset{\displaystyle Br}{\overset{|}{CH}}-CH_3$	Isopropyl bromide
	$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle Br}{\underset{|}{\overset{|}{C}}}}-CH_3$	Tert-butyl bromide
	$CH_3-\underset{\displaystyle Br}{\overset{|}{CH}}-CH_2-CH_3$	Sec-butyl bromide
	$CH_3 - CHCl_2$	Ethylidene dichloride
	$CH_2Cl - CH_2Cl$	Ethylene dichloride
Alcohol	$CH_3 - OH$	Methyl alcohol
	$CH_3 - CH_2 - OH$	Ethyl alcohol
	$CH_3 - CH_2 - CH_2 - OH$	*n* - Propyl alcohol
	$CH_3-CH-\underset{\displaystyle CH_3}{\overset{|}{CH_2OH}}$	Isobutyl alcohol
	$HO - CH_2 - CH_2OH$	Glycol
	$OHCH_2 - CHOH - CH_2OH$	Glycerol
Ether	$CH_3 - O - CH_3$	Dimethyl ether
	$CH_3 - CH_2 - O - CH_3$	Ethyl methyl ether
	$CH_3 - CH_2 - O - CH_2 - CH_3$	Diethyl ether

Class of Compound	Structure	Common name
	$CH_3-CH_2-CH_2-O-\underset{\displaystyle CH_3}{\overset{|}{CH}}-CH_3$	Isopropyl propyl ether
Aldehydes	HCHO	Formaldehyde
	$CH_3 - CHO$	Acetaldehyde
	$CH_3 - CH_2 - CH_2 - CHO$	Butyraldehyde
Ketones	$CH_3-\overset{\displaystyle O}{\overset{\|\|}{C}}-CH_3$	Acetone
	$CH_3 - CH_2 -\overset{\displaystyle O}{\overset{\|\|}{C}} - CH_3$	Methyl ethyl ketone
	$CH_3-CH_2-\overset{\displaystyle O}{\overset{\|\|}{C}}-CH_2-CH_2-CH_3$	Ethyl propyl ketone
Carboxylic acids	HCOOH	Formic acid
	$CH_3 - COOH$	Acetic acid
	$CH_3 - CH_2 - CH_2 - COOH$	Butyric acid
	$\begin{matrix} COOH \\ \vert \\ COOH \end{matrix}$	Oxalic acid
	$CH_2\begin{matrix}\diagup COOH \\ \diagdown COOH\end{matrix}$	Malonic acid
	$\begin{matrix} CH_2 - COOH \\ \vert \\ CH_2 - COOH \end{matrix}$	Succinic acid
	$CH_2\begin{matrix}\diagup CH_2 - COOH \\ \diagdown CH_2 - COOH\end{matrix}$	Glutaric acid
Esters	$HCOOCH_3$	Methyl formate
	$CH_3COOC_2H_5$	Ethyl acetate
	$CH_3 - CH_2 - CH_2 - COOC_2H_5$	Ethyl butyrate
Anhydrides	$CH_3-\overset{\displaystyle O}{\overset{\|\|}{C}}-O-\overset{\displaystyle O}{\overset{\|\|}{C}}-CH_3$	Acetic anhydride
	$CH_3-CH_2-\overset{\displaystyle O}{\overset{\|\|}{C}}-O-\overset{\displaystyle O}{\overset{\|\|}{C}}-CH_2-CH_3$	Propionic anhydride
Acid chlorides	$CH_3-\overset{\displaystyle O}{\overset{\|\|}{C}}-Cl$	Acetyl chloride
Cyanides	$CH_3 - CN$	Methyl cyanide
	$CH_3 - CH_2 - CN$	Ethyl cyanide

SECTION E

Hydro carbons - (Single bonded), unsaturated hydrocarbon, Functional group having compound - Only are F.G. containing compounds, More than are F.G. containing compounds, Bicyclo and spiro

Any given organic structure has only one IUPAC name and any given IUPAC name represents only one molecular structure.

The IUPAC name of any organic compound essentially consists of three parts, i.e.,

(1) root word (2) Suffix and

(3) Prefix

Root Word

If is the basic unit of the name. If denotes the number of carbon atoms present in the principal chain of the molecule. Chain containing one to four carbon atoms are known by special root words (based upon the common names of alkanes) while chains from C_5 onwards are known by Greek number roots. Thus :

Chain length	Word root	Chain lengh	Word root	Chain length	Word root
C_1	Meth	C_8	Oct	C_{14}	Tetradec
C_2	Eth	C_9	Non	C_{20}	Eicos
C_3	Prop	C_{10}	Dec	C_{30}	triacont
C_5	Pent	C_{11}	Undec	C_{40}	Tetracont
C_6	Hex	C_{12}	Dodec	C_{50}	Pentacont
C_7	Hept	C_{13}	Tridec	C_{60}	Hexacont

Suffix

There are two types of suffixes, i.e., Primary suffix and Secondary suffix.

(a) Primary suffix : A primary suffix is always added to the root word to indicate whether carbon chain is saturated or unsaturated. The primary suffix for the various saturated and unsaturated carbon chains and groups are given below :

Nature of carbon chain	Primary surfix	Chain lengh
Saturated, C – C	–ane	Alkane
Unsaturated, C = C	–ene	Alkene
Unsaturated, C ≡ C	–yne	Alkyne

Nature of group	Primary suffix	Generic name
Alkane – one hydrogen atom	–yl	Alkyl
Alkene – one hydrogen atom	–enyl	Alkenyl
Alkyne – one hydrogen atom	–ynl	Alkynyl

If the parent, carbon-chain contains two, three, four or more double or triple bonds, numerical prefixes such a di (for two), tri (for three), tetra (for four) etc. are added to the primary suffix. For example :

	Type of carbon chain	*Primary suffix*	*Generic name*
(i)	Having two double bonds	diene	Alkadiene
(ii)	Having three double bonds	triene	Alkatriene
(iii)	Having n double bonds	polyene	Alkapolyene
(iv)	Having two triple bonds	diyne	Alkadiyne
(v)	Having three triple bonds	triyne	Alkatriyne

(b) Secondary suffix : Suffix added after the primary suffix to indicate the particular functional group (groups) present in the carbon chain is known as secondary suffix. Secondary suffix of some important functional groups are given below.

Class of organic compounds	*Functional group*	*Secondary suffix*	*Class of organic compounds*	*Functional group*	*Secondary suffix*
Alcohols	– OH	–ol	Acid chlorides	– COCl	–oyl chloride
Aldehydes	– CHO	–al	Esters	– COOR	Alkyl… oate
Ketones	– CO –	–one	Nitrilie	– CN	nitrile
Carboxylic acids	– COOH	–oic acid	Amide	– $CONH_2$	–amide

It may be noted that while adding the secondary suffix to the primary suffix, the terminal 'e' of the primary suffix (i.e., ane, ene, yne) is dropped if the secondary suffix begins with **a, e, i, o, u, & y** but is retained if the secondary suffix begins with a **consonant except *y*.**

Structure	root Word	Prim-ary suffix	Seco-ndary suffix	IUPAC name
$CH_3 - CH_2 - OH$	Eth	ane	ol	Ethanol
$CH_3 - CH_2 - CH_2 - CHO$	But	ane	al	Butanal
$CH_2 = CH - \overset{O}{\overset{\|}{C}} - CH_3$	But	ene	one	Butenone
$CH_3 - (CH_2)_4 - COOH$	Hex	ane	oic	Hexanoic acid

Prefix

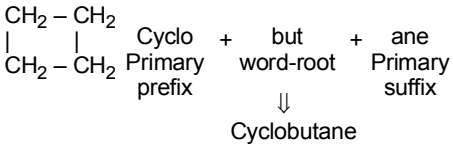
Prefixes are used to indicate

(i) the cyclic nature of compound and

(ii) the nature of the substituents present on the parent chain. Thus, prefixes are of two types :

(a) Primary prefix : The primary prefix cyclo is added before the root word of indicate the cyclic nature of the compound.

Thus



In open chain compound no prefix (primary) is added.

(b) Secondary prefix : In IUPAC system of nomenclature, certain functional groups are not considered as functional groups but instead are treated as substituents. These are called secondary prefix and are added immediately before the root word (or the primary prefix in case of alicyclic compounds) in **alphabetical** order to denote the side chains or substituent groups. The secondary prefixes for some groups which are always treated as substituent groups are given below

Substituent group	Secondary prefix	Substituent group	Secondary prefix
–F	Fluoro	– OR	Alkoxy
– Cl	Chloro	$-\overset{\oplus}{N}\equiv N$	Diazo
–Br	Bromo	$-NH_2$	Amino
–I	Iodo	$-CH_3$	Methyl
$-NO_2$	Nitro	$-C_2H_5$	Ethyl
– NO	Nitroso	$CH_3-CH_2-CH_2-$	Propyl
$CH_3-\underset{|}{CH}-CH_3$	1-methyl ethyl	$CH_3-\underset{|}{\overset{CH_3}{\overset{|}{C}}}-$	1-1-dimethyl Ethyl

The order of IUPAC naming given below

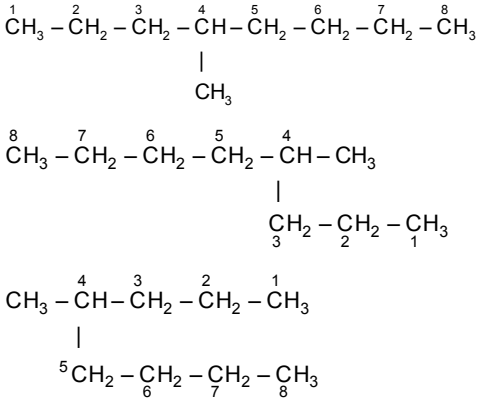
Secondary prefix + Primary prefix + word root + primary suffix + secondary suffix.

Secondary prefix – primary prefix - generic name

I. IUPAC Nomenclature of Branched-chain Alkanes

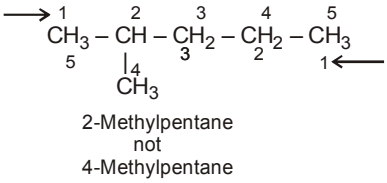
Branched-chain alkanes are named according to the following rules :

1. Longest Chain Rule : Locate the longest continuous chain of carbon atoms. This chain determines the parent name of the alkane. Notic that the longest continuous chain is chosen regardless of how the molecule is written.

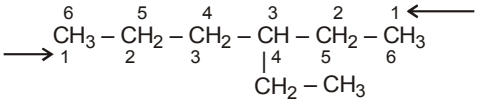


2. Lowest Locant Rule or Lowest Sum Rule : The carbon atoms of the longest continuous chain, i.e., parent chain are numbered by arabic numerals 1, 2, 3, 4 ..... from one end of the chain to the other. in such a manner that carbon atom carrying first substituent gets the lowest number. The number that locates the position of the substituent is known as **locant.**

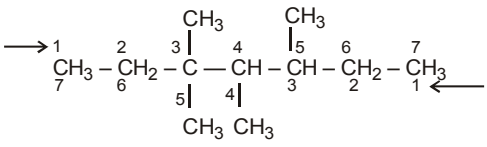
However, if there are two or more substituents, the numbering of parent chain is done in such a way that the sum of locants is the lowest. This is called the **lowest sum rule.**



2-Methylpentane
not
4-Methylpentane



3-Ethylhexane
not
4-Ethylhexane



3,3, 4, 5-Tetramethylheptane