CLASSIFICATION & NOMENCLATURE

1. KEKULE'S PRINCIPLE

(a) Carbon has four valencies.

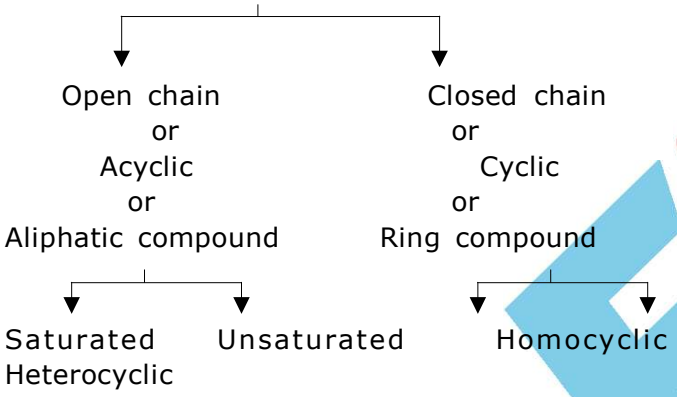
(b) Carbon has a property of catenation. It can make a large chain with addition of other carbons.

(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. CLASSIFICATION OF ORGANIC COMPOUNDS

Organic Compounds

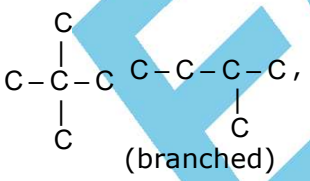


2.1 Aliphatic or Open chain compounds :–

Are 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.

Example - $CH_3 - CH_2 - CH_3$

(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.

example. 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 -

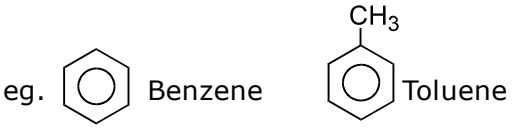
(a) Alicyclic compounds : –

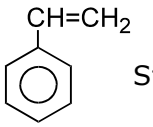
These are the compounds having the properties like aliphatic compounds. These may be saturated or unsaturated like aliphatic compounds.

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)





2.2.2 Heterocyclic Compounds : –

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

3. GROUPS

Atom or a group of atoms which possess any 'charge' on it or any 'free valency' are called as **Groups**.

3.1 Alkyl group : –

When a hydrogen is removed from saturated hydrocarbon then alkyl group is formed. It is represented by R & its general formula is C_nH_{2n+1}. A bond is vacant on alkyl group on which any functional group may come.

$CH_4 \xrightarrow[-H]{} CH_3$ – Methyl

$CH_3 - CH_3 \xrightarrow[-H]{} CH_3-CH_2$ – ethyl

(a) C_3H_7 has following two isomers –

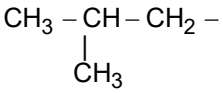
(i) Normal propyl $CH_3 - CH_2 - CH_2 -$

(ii) Isopropyl (1-methyl ethyl)

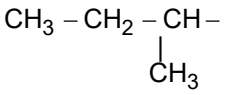
(b) C_4H_9 has following four isomers –

(i) n - butyl $H_3C - CH_2 - CH_2 - CH_2 -$

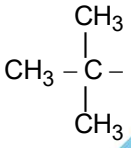
(ii) Iso butyl (2-methyl propyl)



(iii) Secondary butyl (1-methyl propyl)



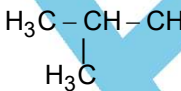
(iv) Tertiary butyl (1,1-dimethyl ethyl)



(c) C_5H_{11} has following eight isomers –

(i) $H_3C - CH_2 - CH_2 - CH_2 - CH_2 -$
n-pentyl

(ii)

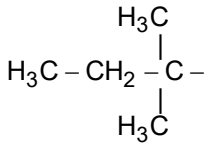


Isopentyl (3-methyl butyl)

(iii)

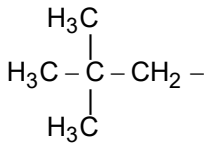
Active amyl (2-methyl butyl)

(iv)



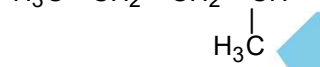
Tertiary pentyl (1,1-dimethyl propyl)

(v)



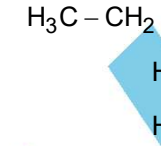
Neo pentyl (2,2-dimethyl propyl)

(vi)



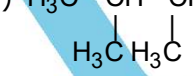
Active secondary amyl (1-methyl butyl)

(vii)



Secondary amyl (1-ethyl propyl)

(viii)



Active Isosecondary amyl (1,2-dimethyl propyl)

3.2 Alkenyl group : –

$CH_2 = CH -$ Vinyl $CH_2 = CH - CH_2 -$ Allyl

$CH_3 - CH = CH -$ Propenyl(1-propenyl)

Isopropenyl (1-methyl-1-ethenyl)

3.3 Alkynyl group –

$CH \equiv C -$ Ethynyl

$CH \equiv C - CH_2 -$ Propargyl (2-propynyl)

$CH_3 - C \equiv C -$ Propynyl (1-propynyl)

3.4 Normal group : –

(a) It is represented by 'n'.

(b) Straight chain of carbon atom is known as normal group.

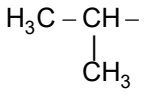
(c) Free bond will come either on Ist carbon atom or on last carbon atom.

n – butyl $C - C - C - C -$

n – propyl $C - C - C -$

3.5 Iso group : –

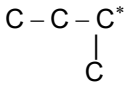
(a) It is represented by following structure ;



(b) When two methyl groups are attached to the same carbon atom, group is named as iso

3.6 Secondary group : –

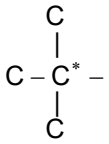
(a)It is represented by following structure.



(b)When ethyl & methyl groups attached to the terminal carbon atom, group is named as secondary-

3.7 Tertiary group : –

(a)It is represented by following structure -

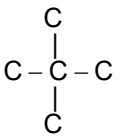
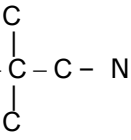


(b)When three (alkyl groups) (similar or dissimilar) are attached to the same carbon atom, group is named as tertiary.

3.8 Neo group : –

(a)When a carbon atom is attached to other four carbon atom group is named as neo group.

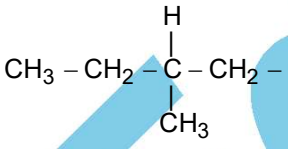
(b)It is represeted by following structure -

 for eg.  Neo pentyl

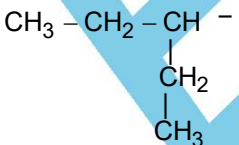
3.9 Amyl group : –

It is of four types -

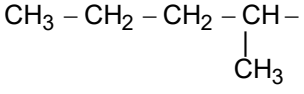
(a)Active amyl



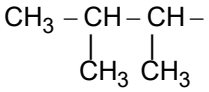
(b)Secondary amyl



(c)Active secondary amyl



(d)Active iso secondary amyl



4. NOMENCLATURE

Mainly three systems are adopted for naming an organic compound –

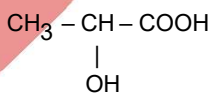
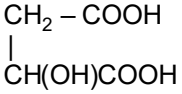
Common Names or Trivial System

Derived System

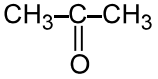
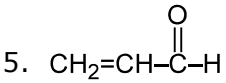
IUPAC system or Jeneva System

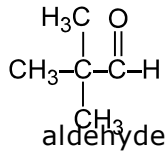
5. COMMON OR TRIVIAL SYSTEM

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

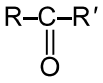
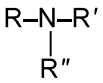
S. N.	Organic Compound	Trivial Name	Source
1.	CH_3OH	Wood spirit or Methyl spirit	Obtained by destructive distillation of wood.
2.	NH_2CONH_2	Urea	Obtained from urine
3.	CH_4	Marsh gas (fire damp)	It was produced in marsh places.
4.	CH_3COOH	Vinegar	Obtained from Acetum - i.e. Vinegar
5.		Oxalic acid	Obtained from oxalis plant.
6.	$HCOOH$	Formic acid	Obtained from formicus [Red ant]
7.		Lactic acid	
8.		Malic acid	
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. N.	Compound	Trivial Name	Common Name
1.	CH_4	Marsh gas	Methane
2.	CH_3OH	Woodspirit	Methyl alcohol
3.	CH_3COOH	Vinegar	Acetic acid
4.		Acetone	Dimethyl ketone
5.		Acrolein	Acryl Aldehyde

6.  Pivaldehyde Tertiary valer aldehyde

(Common – Names R is termed as alkyl **)**

S.N.	Compound	Name
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.		Dialkyl ketone
8.	R–NH–R	Dialkyl amine
9.		Trialkyl amine
10.	R–O–R′	Alkyl alkyl′ ether
11.		Alkyl alkyl′ ketone
12.	R–S–R′	Alkyl alkyl′ thio ether
13.	R–NH–R′	Alkyl alkyl′ amine
14.		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.

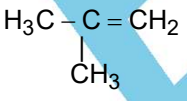
eg. $H_2C = CH - CH_2 - CH_3$ α - butylene

$H_3C - CH = CH - CH_3$ 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

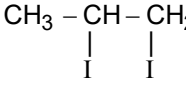
5.2 Common – Naming of dihalides : –

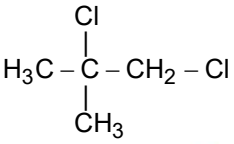
(a) When two same halogen atoms are attached to the same carbon such compounds are called **Gemdihalides**.

(b) Common names of such compounds are alkylidene halides

(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.

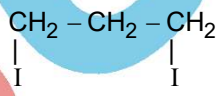
eg  Propylene Iodide

 Isobutylene chloride

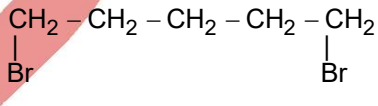
(d) When two same halogen atoms are attached at the two ends of a carbon chain its common naming will be polymethylene halide.

'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 : –

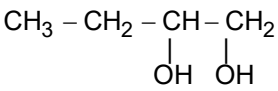
CH_2 – X dimethylene halide (wrong)

|

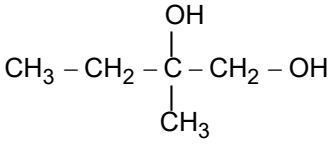
CH_2 – X ethylene halide (right)

5.3 Common - Naming of di-hydroxy compounds:

(a) When two –OH groups are attached to adjacent carbon's they are termed as alkylene glycol.



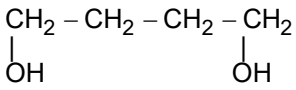
Butylene glycol



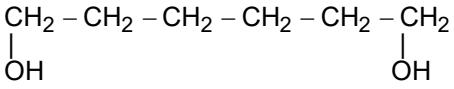
Active amylene glycol

(b) When two –OH group are attached at the two ends of a carbon chain, these compounds are named as polymethylene glycol.

Poly → Number of CH_2 groups.

eg. : 

Tetra methylene glycol



Hexamethylene glycol

Exception :

CH_2 – OH Dimethylene glycol (wrong)

|

CH_2 – OH Ethylene glycol (right)

eg. Make the structure of following organic compounds -

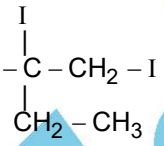
1. Isopropylidene Bromide

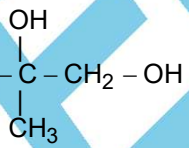
2. Active amylene Iodide

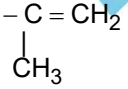
3. Isobutylene glycol

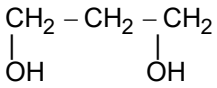
4. Isobutylene

5. Trimethylene glycol

Sol. **2.** 

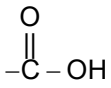
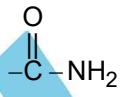
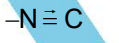
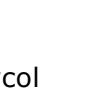
3. 

4. 

5. 

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

Chart - 1

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

Prefix : –

1 Carbon → Form- 2 Carbon → Acet-

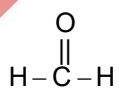
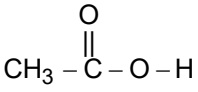
3 Carbon → Propion-

4 Carbon → Butyr- → Normal / Iso

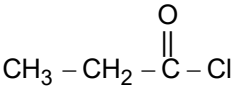
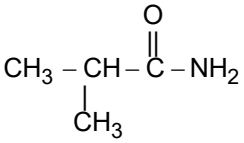
5 Carbon → Valer- → Normal- / Iso / Secondary- / Tertiary-

3 C + (=) double bond = Acryl-

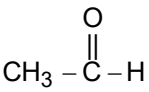
4 C + double bond = Croton-

eg.  

Formaldehyde Acetic Acid

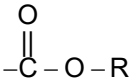
 

Propionyl chloride Isobutyr amide

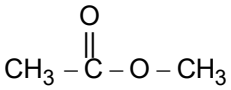


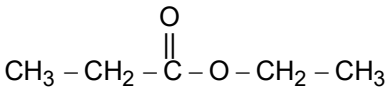
Acetaldehyde

5.5 Nomenclature of Ester : –

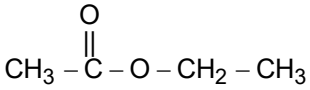


The group which is attached to the oxygen is written as alkyl & the remaining structure is named same as defined in chart-1.

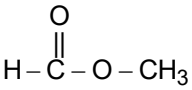
eg.  Methyl acetate



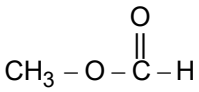
Ethyl propionate



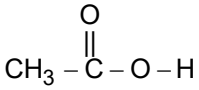
Ethyl acetate



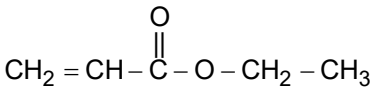
Methyl formate



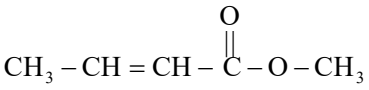
Methyl formate



Acetic acid



Ethyl acrylate



Methyl crotonate

5.6 Nomenclature of Anhydride : –

Rule : – Add the total number of carbon atoms & divide it by 2, the substract will give you the number of C - atom. Now name it according to Chart - 1.

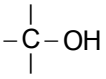
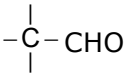
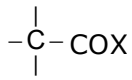
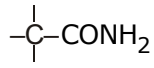
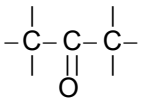
$\frac{\text{Total}}{2}$ = Substract = Number of C atom $\frac{4}{2}$ = 2

Acetic anhydride

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

Series	Name of Homologous series	Derived Name	Structure of group
1.	Alkane	Methane	
2.	Alkene	Ethylene	>C=C<
3.	Alkyne	Acetylene	–C≡C–
4.	Alkanol	Carbinol	
5.	Alkanal	Acetaldehyde	
6.	Alkanoic acid	Acetic acid	
7.	Alkanoyl halide	Acetyl halide	
8.	Alkanamide	Acetamide	
9.	Alkanone	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.

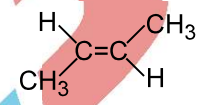
(b) Unsymmetrical : –

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

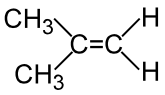
Note : – Symmetrical & Unsymmetrical : – terms are used only when two alkyl groups are given.

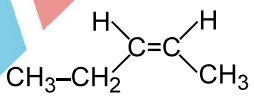
eg.

Symmetrical dimethyl ethylene

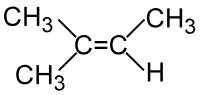


Unsymmetrical dimethyl ethylene

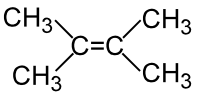




Symmetrical ethyl methyl ethylene



Tri methyl ethylene



Tetra methyl ethylene

$CH_3-C\equiv C-CH_3$ Dimethyl acetylene

7. I.U.P.A.C SYSTEM OR GENEVA SYSTEM (International Union of Pure & Applied Chemistry)

This system is based on the total number of carbons in the selected carbon chain in any organic compound. Following **word root** are used in this system.

1C	2C	3C	4C	5C	6C	7C
Meth	Eth	Prop	But	Pent	Hex	Hept

8C	9C	10C	11C	12C	13C	14C
Oct	Non	Dec.	Undec	Dodec	Tridec	Tetradec

19C 20C 21C

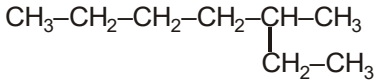
Nonedec Eicosane Uneicosane
22C 23C 30C
Twoeicosane Trieicosane Tricontane

7.1 Rules for IUPAC Nomenclature : –

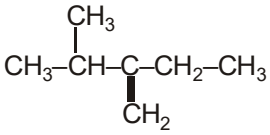
(Using only preffix)

Rule-1. Logest Chain Rule

Select the longest continuous chain of carbon atoms as the parent chain. If some carbon-carbon multiple bond is present, the parent chain must contain the carbon atoms involved in it.



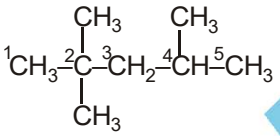
Preffix : methyl
Word root : hept
p.suffix : ane



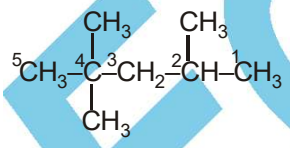
Preffixes : ethyl ; methyl
Word root : but
p.suffix : ene

Rule-2. Lowest Number Rule

The numbering is done in such a way that the substituted carbon atoms have the lowest possible numbers.



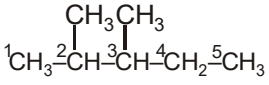
2,2,4-Trimethylpentane
(Correct)



2,4,4-Trimethylpentane
(Wrong)

Rule-3. Use of Prefixes Di, Tri, etc.

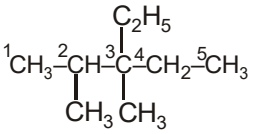
If the compound contain more than one similar alkyl groups, their positions are indicated separately and an appropriate numerical prefix, di, tri etc., is attached to the name of the substituent. The positions of the substituents are separated by commas, for example,



2,3-Dimethylpantane

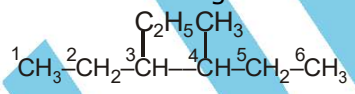
Rule-4. Alphabetical Arrangement of Prefixes

If there are different alkyl subsitituents present in the compound, their names are written in the alphabetical order. However, the numerical prefixes such as di, tri etc, are not considered for the alphabetical order. For example ,



3-Ethyl-2,3-dimethylpentane

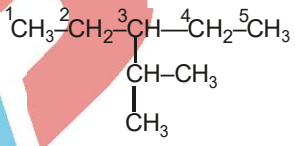
Naming different alkyl substituents at the equivalent positions. If two different alkyl groups are located at the equivalent positions, then numbering of the chain is done in such a way that the alkyl group which comes first in alphabetic order gets the lower position.



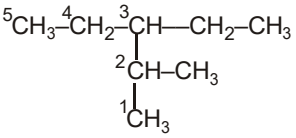
3-Ethyl-4-methylhexane

Rule-5. Rule for large number of substituents

If a compound has two or more chain of the same length, then parent chain selected in such a way that greater number of substituent works as preffix.



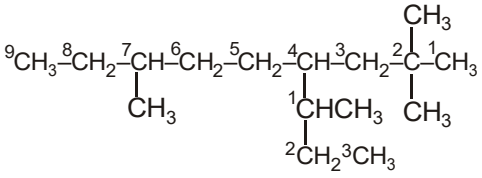
3-iso propyl pentane
one substituent - wrong name



3-ethyl-2-methyl pentane
two substituent - correct name

Rule-6. Naming the Complex Alkyl Substituents

If the alkyl substituent is further branched, it is named as substituted alkyl group. For this purpose, the carbon atoms of the alkyl group are separately numbered in such a way, that the carbon atom directly attached to the parent chain is given number 1. The prefix/name of such a substituent is enclosed in brackets.



Here, substituted propyl group is present at carbon number 4 of the parent chain. The propyl group has methyl substituent at carbon number 1 of the alkyl group. Thus, the name of the above compound is :

2,2,7-Trimethyl-4-(1-methyl propyl) nonane

8. NOMENCLATURE OF COMPOUNDS CONTAINING FUNCTIONAL GROUPS

In case some functional group (other than C=C and C ≡ C) is present in molecule, it is indicated by adding secondary suffix after the primary suffix. The terminal 'e' of the primary suffix is generally removed before adding the secondary suffix. The terminal 'e' of the primary suffix is removed if it is followed by a suffix begining with 'a', 'i', 'o', 'u' or 'y' .

Some of functional group always works as preffix

Functional group	Preffix name
– X	halo
– OR	alkoxy
	epoxy
$-NO_2$	nitro
– NO	nitroso
– N = N –	azo

Commonly used group, which works as suffix

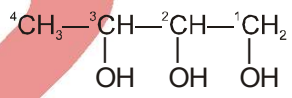
Functional group	Suffix name
– COOH	oic acid
– CH = O	al
	one
– OH	ol
– CN	nitrile

Name of an organic compound containing functional group is derived through the following steps.

1. Select the longest continuous chain of the carbon atoms as parent chain. The selected chain must include the carbon atoms involved in the functional groups like –COOH, –CHO, –CN etc., or those which carry the functional groups like –OH, $-NH_2$, –Cl, $-NO_2$, etc. The number of carbon atoms in parent chain decides the word root.
2. In order to decide the primary suffix, the presence of carbon-carbon multiple bond in chain is observed.
3. The functional group present is identified. This enables the selection of appropriate secondary suffix or prefix.
4. The carbon atoms of the parent chain are numbered in such a way so that the carbon atom of the functional group gets the lowest possible number. In case the functional group does not have the carbon atom, then the carbon atom of the parent chain attached to the functional group should get the lowest possible number.
5. The name of the compound is then arrived at by arranging prefixes and suffixes along with their positions as follows.

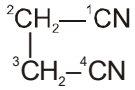
9. NOMENCLATURE OF COMPOUNDS WITH MORE THAN ONE SIMILAR FUNCTIONAL GROUPS

If the organic molecule contains more than one similar functional groups, then in addition to various rules the numerical prefixes di (for 2), tri (for 3), etc., are added before the secondary suffix which indicates the functional group. While adding such words the vowel e of the primary suffix is retained. For example.

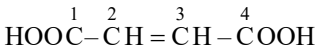


Here, word root is but, primary suffix is ane and secondary suffix is ol. The —OH groups are positioned at carbon number 1,2 and 3. Thus, the name is :

Butane-1, 2, 3-triol



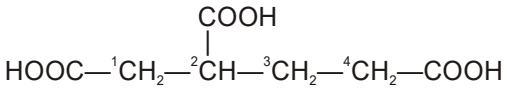
Butane-1, 4-dinitrile



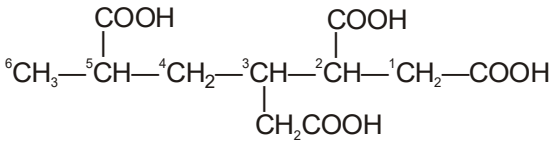
But-2-en-1, 4-dioic acid

Note: If an unbranched chain is linked directly to more than two carboxyl groups, these groups are named by substitutive use of suffix "tricarboxylic acid" , atc. The principal chain selected should be linked directly to maximum possible number of carboxyl groups.

For example.



Butane-1, 2, 4-tricarboxylic acid



3-(Carboxymethyl) hexane-1, 2, 5tricarboxylic acid

Similarly, the substitutive prefixed for aldehydes. cyanides, acylchlorides and amides are carbaldehyde, carbonitrile, chlorocarbonyl and carboxamide respectively.

10.NAMING THE COMPOUNDS WITH TWO OR MORE DIFFERENT FUNCTIONAL GROUPS

If the molecule contains more than one dissimilar functional groups, the parent chain must contain maximum possible number of functional groups. The numbering of the parent chain is done in such a way so that the functional group of higher priority gets the lower number. **The order of priority** of various groups for the sake of numbering is given in following table.

11.Nomenclature of hydrocarbon having more than one multiple bond

1. When more than one double or triple bond is present then

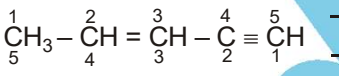
word root ⇒ Alka

eg. $CH_2 = CH–CH = CH_2$

buta -1,3-diene

2. When double and triple bonds are present, the hydrocarbon is named as alkenyne

3. The numbering of the parent chain should always be done from that end which gives lowest sum for the multiple bonds. For example,

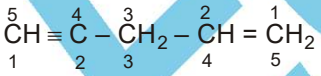


→2 + 4 = 6

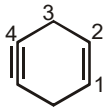
→1 + 3 = 4

3-Penten-1-yne not 2-Penten-4-yne

4. If, however, there is a choice in numbering, the dobule bond is always given preference over the triple bond.



1-Penten-4-yne not 4-Penten-1-yne



1-Hexene-4-yne not 4-Hexene-1-yne

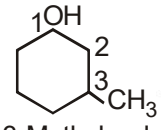
12 Nomenclature of alicyclic compounds

Names of alicyclic compounds are derived by putting another preffix 'cyclo' before the word root which depends upon the number of carbon atoms in the ring. The suffixes ane, ene or yne are written depending upon saturation or unsaturation in the ring.

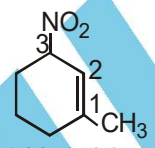
Cyclohexane

Cyclopentene

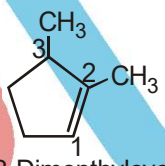
If some substituent or functional group is present, it is indicated by some appropriate prefix or suffix and its position is indicated by numbering the carbon atoms of the ring. The numbering is done in such a way so as to assign least possible number to the functional group or substituent in accordance with the rules already discussed. Some examples are.



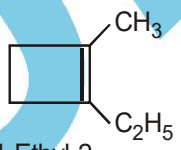
3-Methylcyclo-hexanol



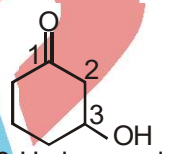
1-Methyl-3-Nitrocyclohexene



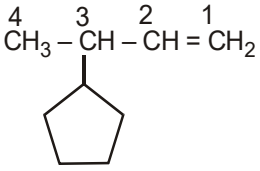
2-3-Dimenthylcyclo-pentene



1-Ethyl-2-Methylcyclobutene



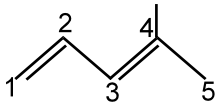
3-Hydroxycyclo hexanone



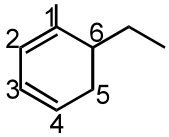
3-Cyclopentyl-1-butene

13. Naming Compounds With Bond Line Formula

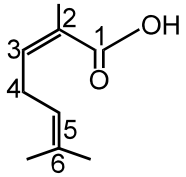
In this representation of organic molecules, carbon and hydrogen atoms are not shown and the lines representing carbon – carbon bonds are drawn in zig-zag manner. A single line (–) represents a single bond, two parallel lines (=) represents a double bond and three parallel lines (≡) represent a triple bond. The only atoms specitically written are those that are neither carbon nor hydrogen bound to carbon. The intersection of lines represent carbon atoms carrying appropriate number of hydrogen atoms. Some bond line structures along with their IUPAC names are given below.



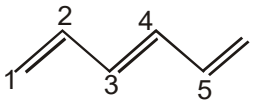
Methylpenta-1, 3-diene



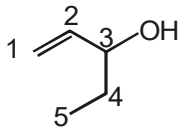
6-Ethyl-1-methyl cyclohexa-1, 3-diene



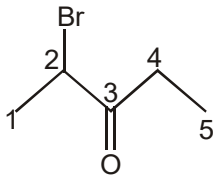
2, 6-Dimethythepta-2, 5-dien-oic acid



Hexa-1, 3, 5-triene



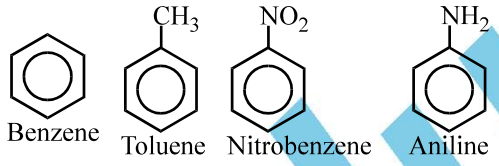
Pent-2-en-3-ol



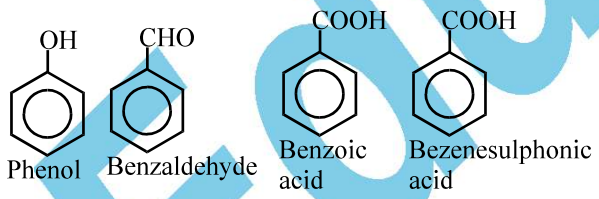
2-Bromopentan-3-one

14. Naming of aromatic compounds : :

(a) Mono substituted benzene

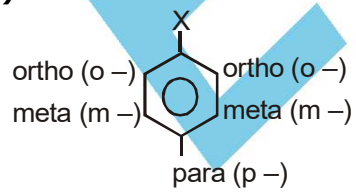


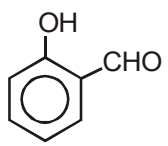
Benzene, Toluene, Nitrobenzene, Aniline



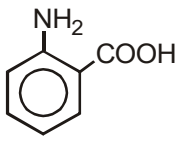
Phenol, Benzaldehyde, Benzoic acid, Bezenesulphonic acid

(b) Disubstituted Benzene

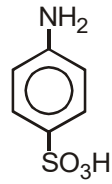




o-hydroxy benzaldehyde



m- amino benzoic acid



p-amino benzene sulphonic acid

15.NAMES OF BRIDGED BICYCLIC HYDROCARBONS

Saturated bicyclic systems having two or more atoms in common are named by prefixing 'bicyclo' to the name of the cyclic parent hydrocarbon system containing the same total number of carbon atoms in the skeleton. The number of carbon atoms in each of the three bridges, connecting the two tertiary carbon atoms is indicated in parentheses, in descending order and arabic numerals are used to indicate the number of carbon atoms and the numbers are separated by full stops.

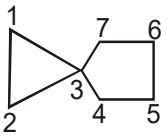
The bicyclic system is numbered starting with one of the tertiary bridging cabon and proceeding through longest bridge to the second bridging carbon continuing back to the first bridging carbon through the second longest chain. Numbering is completed by numbering the shortest bridge beginning with the atom next to the first bridging carbon. For example :

Bicyclo [2.2.1]heptane Bicyclo [3.2.2] Nonane

16. NAMES OF SPIRO BICYCLIC HYDROCARBONS

Spiro bicyclic hydrocarbons contain two rings consisting of carbon atoms only and the two rings are linked by a common carbon. These compounds are named by placing prefix 'spiro' before the name of the acyclic parent hydrocarbon with same number of skeletal carbon atoms. The numbers of skeletal atoms linked to the spiro atom are indicated by arabic numbers, separately by a fullstop. The numbers are written in ascending order and enclosed in square brackets.

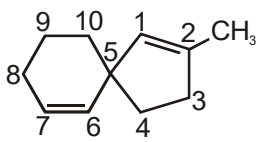
Ex.



spiro [2.4]heptane

Numbering of a spiro bicyclic hydrocarbon starts with a ring carbon next to the spiro atom and proceeds first through the smaller ring and then through the spiro atom and around the second ring. For example :

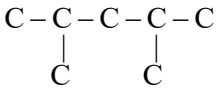
Ex.



2-Methylspiro [4, 5] deca-1, 6-diene

SOLVED PROBLEMS

Ex.1 ***How many 1º carbon atom will be present in a simplest hydrocarbon having two 3º & one 2º carbon atom?***
(A) 3 (B) 4 (C) 5 (D) 6 (Ans. B)

Sol. 

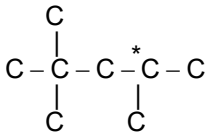
2, 4 - dimethyl pentane is the compound having 2 – 3º carbon & 1 – 2º carbon atom & 4-1º carbon atoms.

Ex.2 ***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

$HC \equiv CH$ (C_2H_2) $\quad$ $CH_2 = C = CH_2$ (C_3H_4)

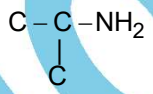
Ex.3 ***In which of the following tert. carbon is absent***
(A) Iso octane (B) Triptane
(C) Isopropyl amine (D) Isopentane (Ans. C)

Sol. Iso Octane 

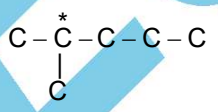
(1 – 3º carbon atom)

Triptane 

(1 – 3º carbon atom)

Isopropyl amine 

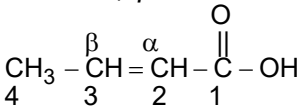
(no tert. carbon atom)

Isopentane 

(1 - tert. carbon atom)

Ex.4 ***The type of unsaturation present in crotonic acid is -***
(A) α, β (B) β, α
(C) α, α (D) β, β (Ans. A)

Sol. The type of unsaturation present in crotonic acid is α, β -



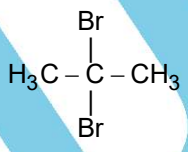
Crotonic acid or (2 - Butenoic acid)
The principal functional group is - COOH.

Ex.5 ***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.

Ex.6 ***$C_3H_6Br_2$ 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



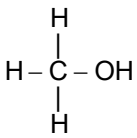
2, 2 - dibromo propane
(Two gem dibromides)

Ex.7 ***The trivial name of the compound $CH_2 = CH - CN$ is -***
(A) Vinyl cyanide (B) Cyano ethylene
(C) Acrylonitrile (D) 2 - propene nitrile (Ans. C)

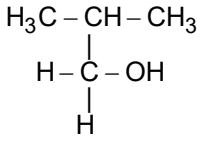
Sol. 3C + (=) $\rightarrow$ Acryl group
suffix of – CN group is onitrile.

Ex.8 ***The structure of isopropyl carbinol is : -***
(A) $(CH_3)_2CHOH$
(B) $CH_3 - CHOH - CH_2 - CH_3$
(C) $(CH_3)_2CH\ CH_2OH$
(D) $(CH_3)_3OH$ (Ans. C)

Sol. In derived name system

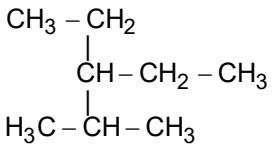


Carbinol



Isopropyl carbinol

Ex.9 ***The IUPAC name of the following compound is***



(A) 3 - isopropyl pentane
(B) 2- methyl -3-ethyl pentane
(C) 3 - ethyl -2-methyl pentane
(D) 3 -ethyl -4-methyl pentane (Ans. C)

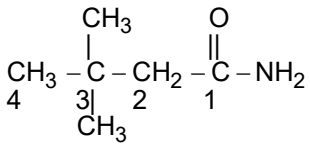
Sol. Select the longest chain having more substitutes.

Ex.10 The IUPAC name of the compound $CH_3CH = CHCH = CHC \equiv CCH_3$ is -
(A) 4, 6–octadien-2-yne
(B) 2, 4–octadien -6-yne
(C) 2–octyn - 4, 6-diene
(D) 6-octyn-2, 4-diene (Ans. B)

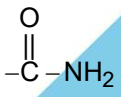
Sol. Between double bond & triple bond double bond is preferred.

Ex.11 The I.U.P.A.C. name of compound $(CH_3)_3C.CH_2CONH_2$ is : –
(A) 1, 1,1- trimethyl propanamide
(B) 3, 3, 3-trimethyl propanamide
(C) 3, 3-dimethyl butanamide
(D) 3-t-butyl propanamide (Ans. C)

Sol. The I.U.P.A.C. name of compound $(CH_3)_3C.CH_2CONH_2$ is -

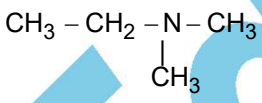


(3, 3-dimethyl butanamide)

The principal functional group is 
(Amido)

Ex.12 IUPAC name of four carbon 3º amine is -
(A) Dimethyl methane amine
(B) N, N-dimethyl ethane amine
(C) N-ethyl N-methyl methane amine
(D) Butane amine (Ans. B)

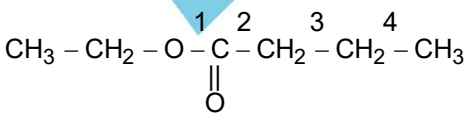
Sol. IUPAC name of four carbon 3º amine is N, N dimethyl ethane amine.



(N, N - dimethyl ethane amine)

Ex.13 IUPAC name of compound $CH_3CH_2OCOCH_2CH_2CH_3$ is -
(A) Propyl propanoate(B) Ethyl butanoate
(C) Propyl butanoate (D) Ethyl propanoate (Ans.B)

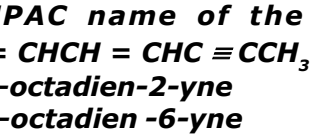
Sol. The IUPAC name of $CH_3CH_2OCOCH_2CH_2CH_3$ is ethyl butanoate.



Ethyl Butanoate

Ex.14 Trivial name of 2, 3- dihydroxy butanedioic acid is -
(A) Malic acid (B) Tartaric acid
(C) Citric acid (D) Lactic acid (Ans. B)

Sol. Trivial name of 2,3 dihydroxy butandioic acid is tartaric acid.

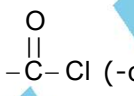


(Tartaric acid)

The principal functional group is – COOH group.

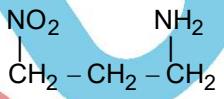
Ex.15 IUPAC name of carbonyl chloride is -
(A) Phosgene
(B) Chloromethanoyl chloride
(C) Dichloroketone
(D) Dichloromethanone (Ans. B)

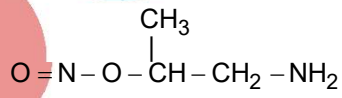
Sol. IUPAC name of carbonyl chloride is chloromethanoyl chloride.
(Chloromethanoyl chloride) Principal functional group is

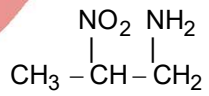


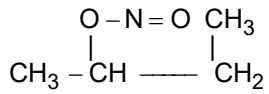
Its common name is phosgene and it is poisonous gas.

Ex.16 The structure of 2- nitro-1-propanamine is

(A) 

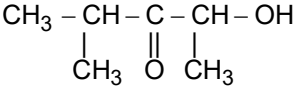
(B) 

(C) 

(D)  ***(Ans. C)***

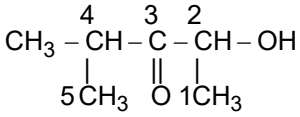
Sol. The N of nitro group will be attached from carbon chain so alternate 2^{nd} & 4^{th} are wrong in this way & the alternate 1^{st} is 3-nitro-1-propane amine.

Ex.17 The IUPAC name of -

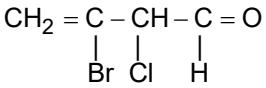


(A) 4 - methyl -2-hydroxy-3- pentanone
(B) 2-hydroxy -4- methyl-3- pentanone
(C) both are correct
(D) None (Ans. B)

Sol. The principal group is  & the alphabate H of hydroxy group comes first than M of methyl group. So numbering is done in the following way.

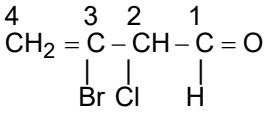


Ex.18 The IUPAC name for -



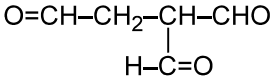
(A) 2-chloro-3- bromo-3-butenal
(B) 2-chloro-3-bromo-3-butene carbaldehyde
(C) 3-bromo-2-chloro-3-butenal
(D) 3-bromo-2-chloro-3-butenone (Ans. C)

Sol.



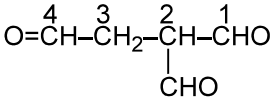
3-bromo-2-chloro-3-butenal

Ex.19 The correct IUPAC name of the following compound is -



(A) 1,1-diformyl propanal
(B) 3- formyl butanedial
(C) 2-formyl butanedial
(D) 1,1,3-ethane tricarbaldehyde (Ans. C)

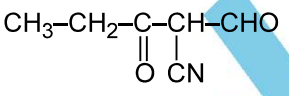
Sol. The IUPAC name of the given compound is 2-formyl butanedial,



2 - formyl butanedial

The principal functional group is – CHO.

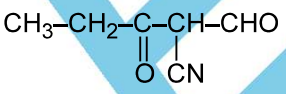
Ex.20 The correct IUPAC name of compound -



is -

(A) 2-cyano-3-oxopentanal
(B) 2 - formyl-3-oxopentanenitrile
(C) 2-cyano-1, 3-pentanedione
(D) 1, 3-dioxo -2-cyanopentane (Ans. B)

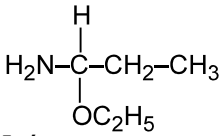
Sol. The correct I.U.P.A.C. name of



is 2-formyl -3- oxopentanenitrile Here the main functional group is -CN, which has nitrile suffix and CHO and CO are the side functional groups which are used as prefixes.

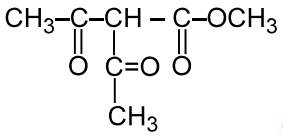
Ex.21 All the following I.U.P.A.C. names are correct except -
(A) 1-chloro-1-ethoxy propane
(B) 1-amino-1-ethoxypropane
(C) 1-ethoxy-2-propanol
(D) 1-ethoxy-1-propanamine (Ans. B)

Sol. All the given I.U.P.A.C. names are correct except 1-amino-1-ethoxypropane



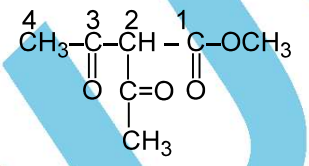
It's correct I.U.P.A.C. name is ethoxy -1- amino propane.

Ex.22 I.U.P.A.C. name of :



(A) Methyl-2,2 acetyl ethanoate
(B) 2, 2 acetyl-1-methoxy ethanone
(C) Methyl-2-acetyl-3-oxobutanoate
(D) None (Ans. C)

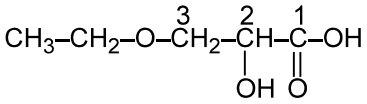
Sol. The I.U.P.A.C. name of the given compound is



Methyl-2-acetyl-3-oxobutanoate
The principal functional group is ester group.

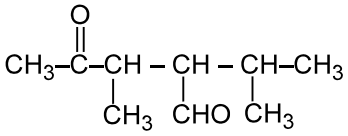
Ex.23 The IUPAC name of β-ethoxy - α- hydroxy propionic acid (trivial name) is -
(A) 1, 2-dihydroxy -1- oxo - 3- ethoxy propane
(B) 1 -carboxy - 2- ethoxy ethanol
(C) 3 -ethoxy - 2-hydroxy propanoic acid
(D) All above (Ans. C)

Sol. The compound β-ethoxy -α-hydroxy propionic acid is



3-Ethoxy -2-hydroxy propanoic acid
The principal functional group is - COOH.

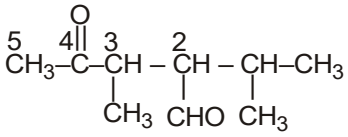
Ex.24 The IUPAC name of compound



is :

(A) 3,5-Dimethyl-4-Formyl pentanone
(B) 1-Isopropyl-2-methyl-4-oxo butanal
(C) 2-Isopropyl -3-methyl -4-oxo pentanal
(D) None of the above (Ans. C)

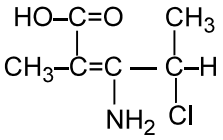
Sol. The IUPAC name of compound



is -

2-Isopropyl -3-methyl -4-oxo pentanal
In this compound the principal functional group is – CHO.

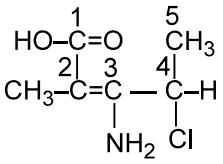
Ex.25 The IUPAC name of compound



is : -

(A) 2-amino -3-chloro-2-methyl -2-pentenoic acid
(B) 3-amino-4-chloro-2-methyl -2-pentenoic acid
(C) 4-amino-3-chloro-2-methyl -2-pentenoic acid
(D) All of the above (Ans. B)

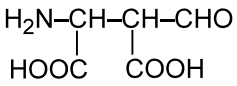
Sol. The IUPAC name of compound



is

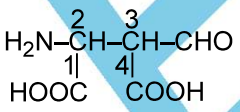
3-amino-4-chloro-2-methyl-2-pentenoic acid
The principal functional group is carboxylic acid (–COOH).

Ex.26 The IUPAC name of the structure is -



(A) 3-amino-2-formyl butane-1, 4-dioic acid
(B) 3-amino -2,3-dicarboxy propanal
(C) 2-amino -3- formyl butane -1, 4-dioic acid
(D) 1-amino -2-formyl succinic acid (Ans. C)

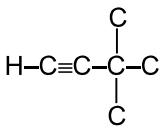
Sol.



Although CHO group is senior than NH_2 but after deciding senior most group (COOH) next groups are preferred as alphabatically. So numbering is done from left to right.
Prefix for NH_2– group is amino and for CHO – group is formyl.

Ex.27 How many carbons are in simplest alkyne having two side chains ?
(A) 5 (B) 6 (C) 7 (D) 8
(Ans. B)

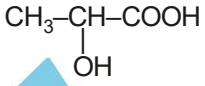
Sol.



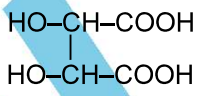
4-carbon chain having 2-methyl groups.

Ex.28 Which of the following is not correctly matched : -

(A) Lactic acid

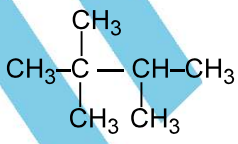


(B) Tartaric acid



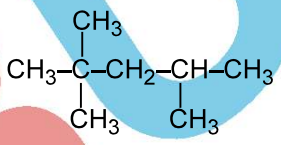
(C) Pyvaldehyde $CH_3C(CH_3)_2CHO$

(D) Iso–octane



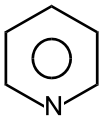
(Ans. D)

Sol. Iso–octane is -



Ex.29 Which of the following pairs have absence of carboxyclic ring in both compounds ?
(A) Pyridine, Benzene
(B) Benzene, Cyclohexane
(C) Cyclohexane, Furane
(D) Furane, Pyridine (Ans. D)

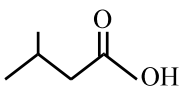
Sol.



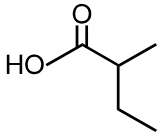
Furane Pyridine

Ex.30 Write the structural formula of the compound 3-methylbutanoic acid -

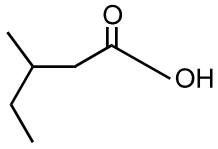
(A)



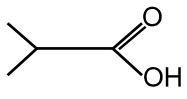
(B)



(C)

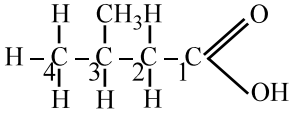


(D)



(Ans. A)

Sol.



3-methylbutanoic acid