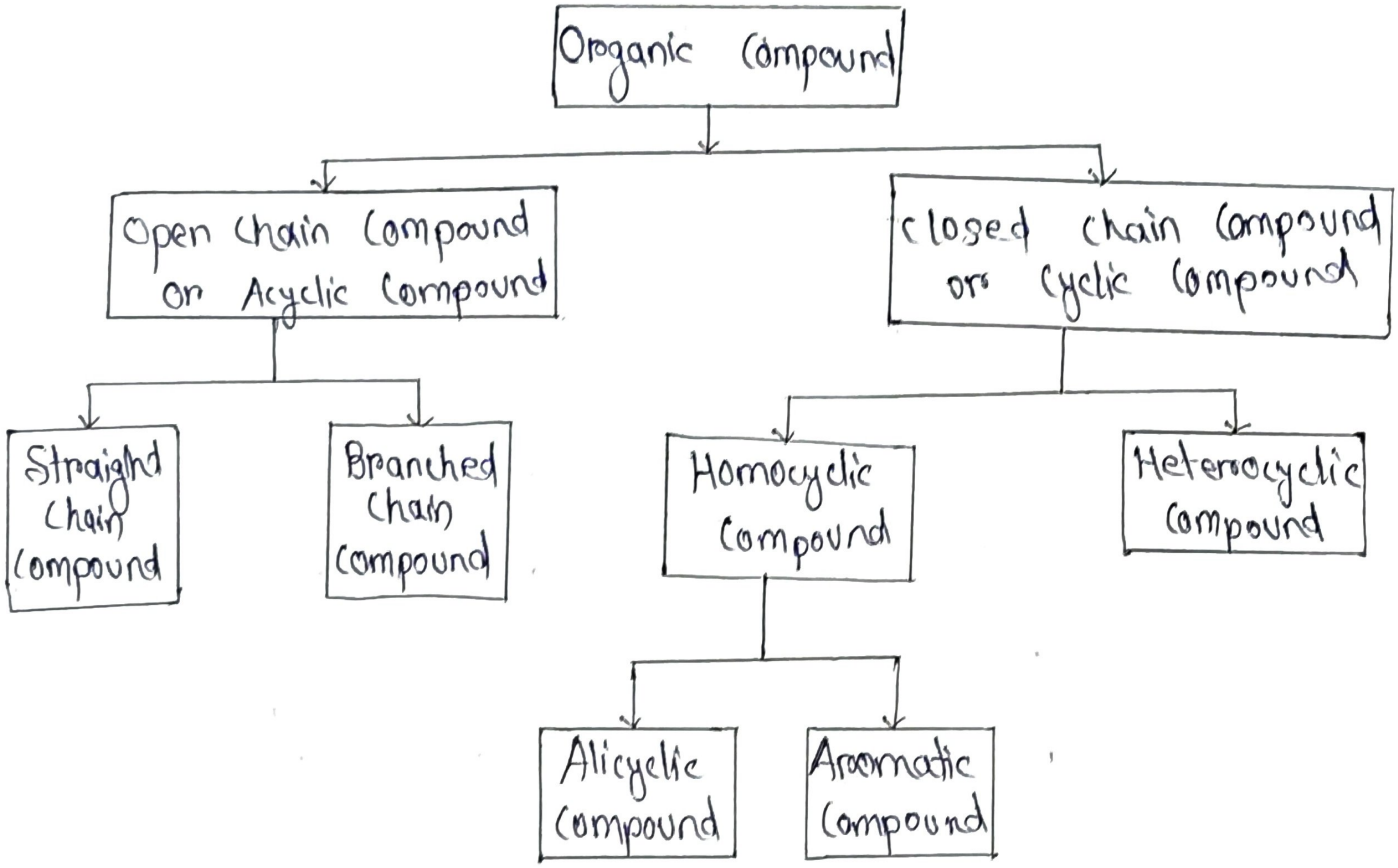
Organic Compounds :



Nomenclature of Organic Compounds Index :

1] Nomenclature of Acyclic Compounds (IUPAC)
2] Nomenclature of Alicyclic Compounds (IUPAC)
3] Nomenclature of Aromatic Compounds (IUPAC)
4] Nomenclature of Heterocyclic Compounds (IUPAC)
5] Nomenclature of Polynuclear Hydrocarbon
6] Nomenclature of Bicyclic Compounds
7] Nomenclature of Spiro Compounds.

Nomenclature of Acyclic Compounds (IUPAC)

* General Rules of Nomenclature

According to IUPAC, Name of Organic Compounds consists of three parts ① Word Root ② Suffix ③ Prefix.

① Word Root: Represent Number of carbon atom present in chain.

Chain length	Word Root
C_1	Meth -
C_2	Eth -
C_3	Prop -
C_4	But -
C_5	Pent -
C_6	Hex -
C_7	Hept -
C_8	Oct -
C_9	Non -
C_{10}	Dec -

Chain length	Word Root
C_{11}	Undec -
C_{12}	Dodec -
C_{13}	Tridec -
C_{14}	Tetradec -
C_{15}	Pentadec -
C_{16}	Hexadec -
C_{17}	Heptadec -
C_{18}	Octadec -
C_{19}	Nonadec -
C_{20}	Icos -

② Suffix:

(i) Primary Suffix: Indicate linkage in carbon atoms

chain	Suffix	General name
C–C	ane	Alkane
C=C	ene	Alkene
C≡C	yne	Alkyne

	Two	Three	four
Double bond	- diene	- triene	- tetraene
Triple bond	- diyne	- triyne	- tetrayne

Note: extra 'a' is added in word root if the primary suffix to be added begins with consonant (other than a, e, i, o, u)

Exa: For double bond, suffix is diene, if it is added to word root but (for 4 carbon) it becomes butadiene.

(ii) Secondary suffix: Represent functional group present in the molecule.

Class of Organic Compound	Functional Group	Secondary Suffix
Alcohol	$-OH$	-ol
Aldehyde	$-CHO$	-al
Ketones	$-\underset{\underset{|}{}}{C}=O$	-one
Carboxylic acid	$-COOH$	-oic acid
Acid chloride	$-COCl$	-oyl chloride
Acid amides	$-CONH_2$	-amide.
Ester	$-COOR$	alkyl.....oate
Nitrile.	$-C\equiv N$	-nitrile
Amines	$-NH_2$	-amine
Thioalcohol	$-SH$	Thiol

Note: While adding the secondary suffix to primary suffix, the terminal 'e' of the primary suffix (i.e. ane, ene, yne) is dropped if complete secondary suffix start with vowel. However, terminal 'e' is retained if the complete secondary suffix start with a

Exp:

(1) $CH_3-CH_2-CH_2-CH_2-OH$

butan-1-ol

Word root : but
pri. suffix : ane
sec. suffix : -ol

(2) $CH_3-CH_2-\underset{\underset{OH}{|}}{CH}-\underset{\underset{OH}{|}}{CH_2}$

butane-1,2-diole

Word root : but
pri. suffix : ane
sec. suffix : -diol

(3) $CH_3-CH_2-CH_2-CN$

butane-1-nitrile

Word root : but
pri suffix : ane
sec. suffix : -nitrile

③ Prefixes :

Indicates substitution of other group (not regarded as functional group) in place of hydrogen atom.

These are regarded as substituent or side chains.

Put before Wordroot.

These are (i) Alkyl group...
(ii) Some functional group which are not regarded as principle functional group.

Substituent	Prefix	Substituent	Prefix
	Alkyl group.		
$-CH_3$	Methyl	$-C_2H_5$	ethyl
$-C_3H_7$	propyl	$-CH(CH_3)_2$	Iso-propyl
$-C_6H_5$	Phenyl	$-C(CH_3)_3$	t-Butyl
	Functional Group as Prefix		
$-F$	Fluoro	$-NO$	Nitroso
$-Cl$	chloro	$-OCH_3$	Methoxy
$-Br$	Bromo	$-OC_2H_5$	Ethoxy
$-I$	Iodo	$-N\equiv N-$	Diazo
$-NO_2$	Nitro	$-OH$	Hydroxy

Note : If there is poly functional groups (more than one) one of the functional group is primary where as other functional group as secondary.

I Nomenclature of Saturated Hydrocarbons (Alkanes)

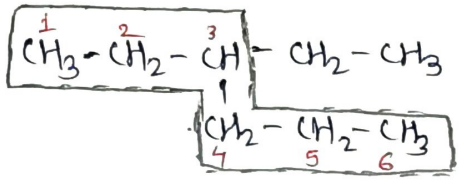
① Longest chain rule :

→ Select the longest continuous chain of carbon atom in molecules.

→ longest chain may or may not be straight.

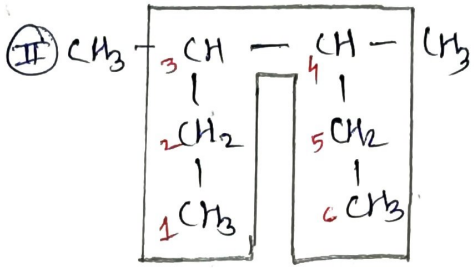
Examples

(I)

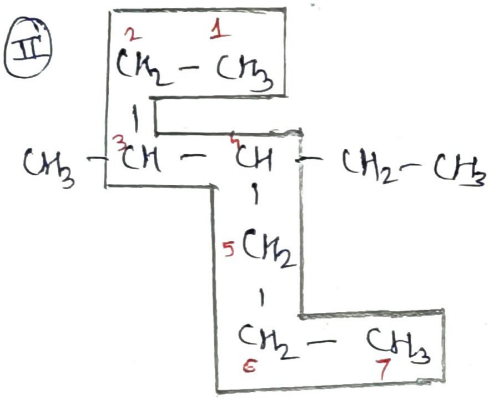


Name — 3-ethylhexane

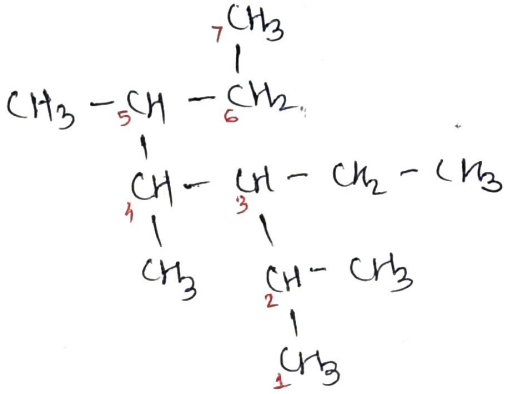
(II)



(III)

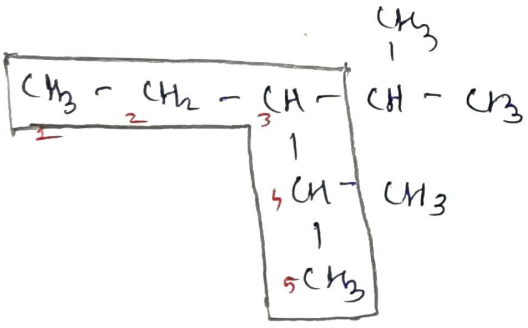


(IV)



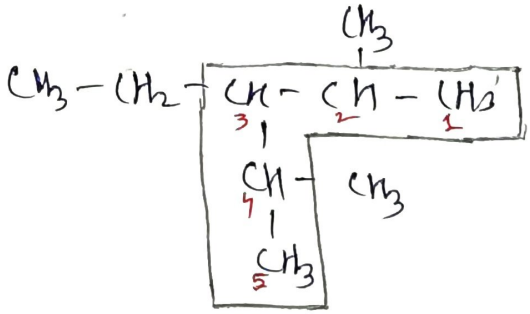
Note : If two different chain of equal length are possible, the chain with maximum number of side chain or alkyl group is selected. for example (IV), (V)

(V)



Wrong

longest chain with two substituent



Right

longest chain with three substituent

(2) Lowest Set of Locants :

* Number the carbon atom in the parent chain as 1, 2, 3, ... etc starting from the end which gives smallest number to the carbon atoms carrying the substituent.

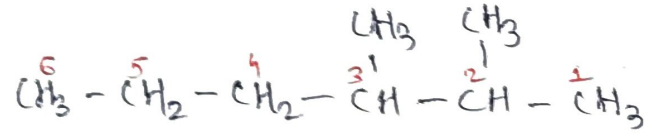
Exa :

The position of ~~the~~ locant in above exa is 2 and not 4.

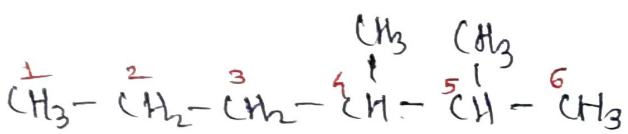
* The Number that indicates the position of the substituents attached / side chain is called locant.

* When there are two or more substituent attached to the parent chain, then the end of parent chain which gives lowest set of locants is preferred numbering

Exa :



Set of locant 2,3 (Right)

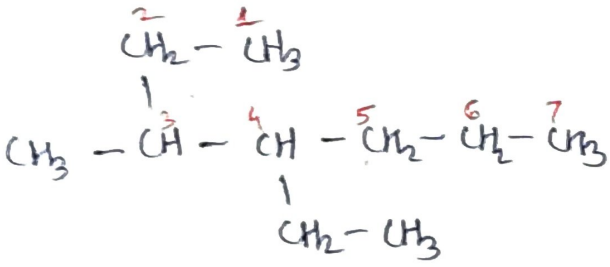


Set of locant 4,5 (Wrong)

* Lowest Sum rule :

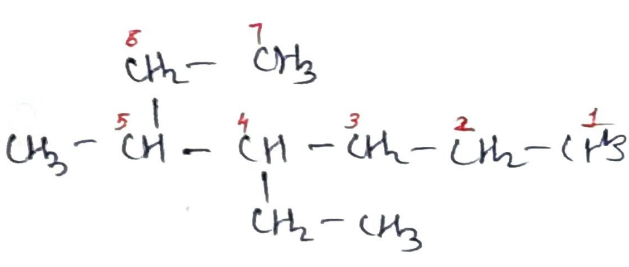
It may be noted that, the numbering of the parent chain containing two or more substituent was done in such a way that sum of the locant is lowest. This is lowest sum rule

Exa :



Correct

Sum of locant = 3 + 4 = 7

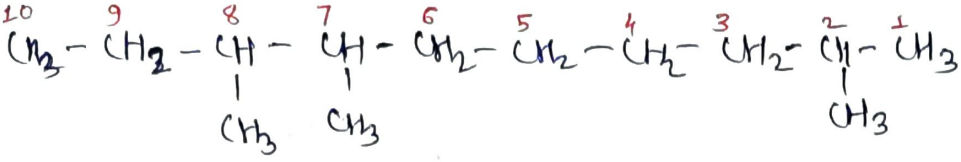


Wrong

Sum of locant = 4 + 5 = 9.

However, according to latest IUPAC system of Nomenclature, the lowest set of locant is preferred even if it violates the lowest sum rule.

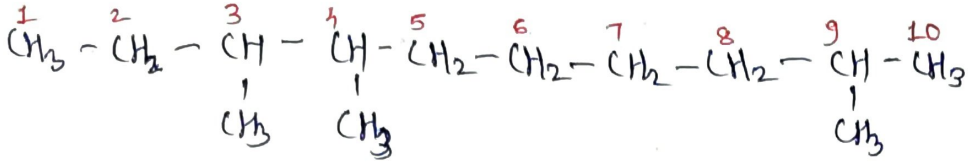
Eg



Set of locant = 2, 7, 8

Sum of locant = 2 + 7 + 8 = 17

Structure A



Set of locant = 3, 4, 9

Sum of locant = 3 + 4 + 9 = 16

Structure B

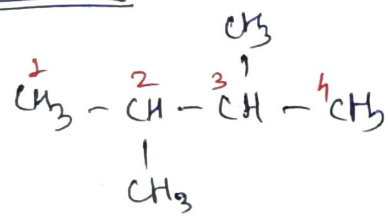
This Compound is 2,7,8-trimethyldecane & not 3,4,9-trimethyl decane

(3) Presence of more than one same substituent:

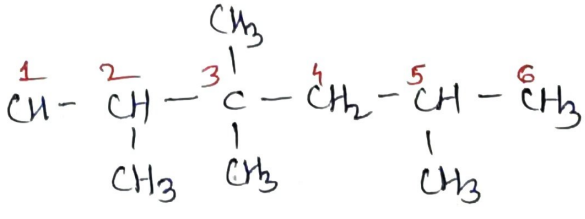
If same substituent occur more than once on the parent chain, it is indicated by prefixes such as di, tri, tetra, etc to indicate 2, 3, 4, etc same substituent

Position of each substituent wheather same or different indicate seperately and the numerals representing their position are seperated by commas.

Example



2,3-dimethylbutane



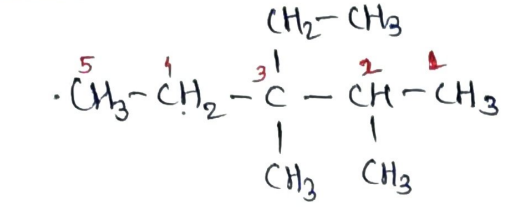
2,3,3,5-tetramethylhexane

④ Naming different Substituents :

If two or more substituents are present on parent chain, they are named in the alphabetical order along with their appropriate position.

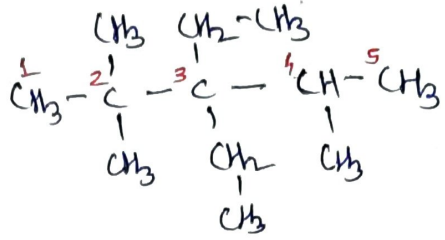
Exa :

(I)



3-Ethyl-2,3-dimethylpentane

(II)

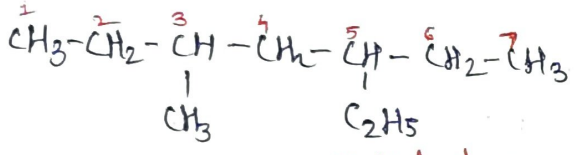


3,3-diethyl-2,2,4-trimethylpentane

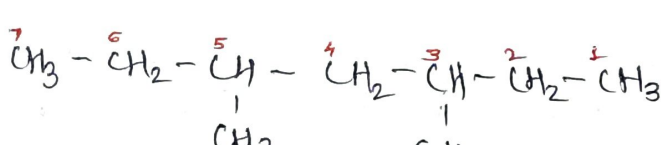
⑤ Naming different Substituents at equivalent position:

If two different substituents are present at equivalent position from two end of the chain, then numbering of the chain is done in such a way that the substituent which come first in the alphabetical order get lower number.

Exa



Methyl at C-3



ethyl at C-3

The Name will be

3-ethyl-5-methylheptane

(not 3-methyl-5-ethylheptane)

⑤ ~~Presence of more than one same substituent~~ :

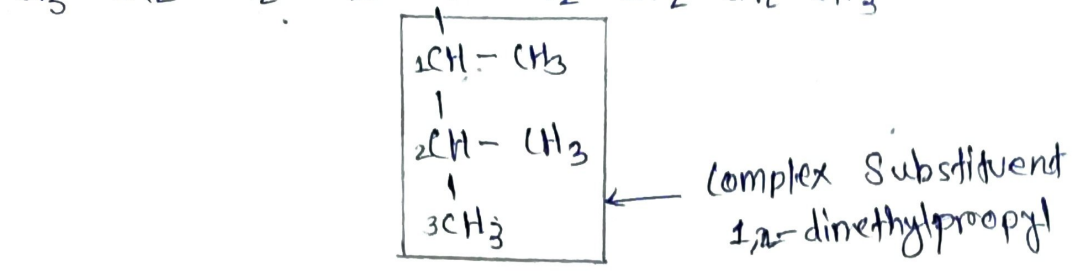
~~If the same substituent occur at~~

⑥ Naming the complex substituent (or substituted substituent):

If the substituent on the parent chain is complex (ie. it is branched), it is named as a substituted alkyl group by numbering the carbon atom of this group attached to the parent chain as 1.

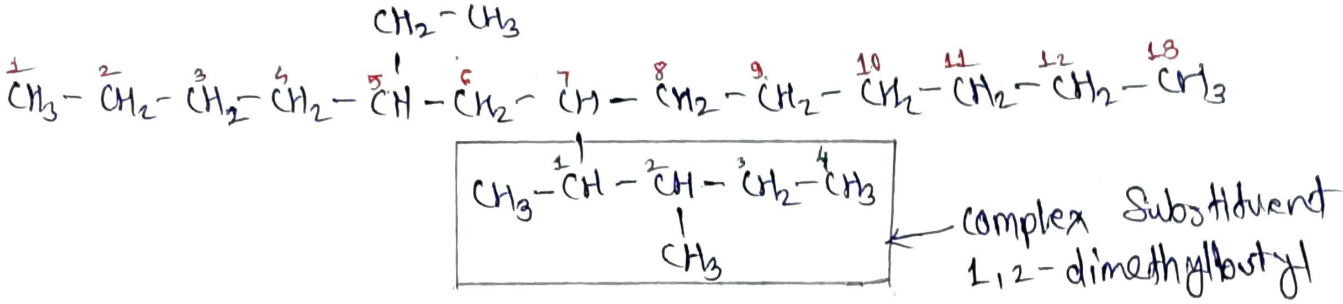
Examples :

(I)



Name → 5-(1,2-dimethylproopyl) noname.

(II)



Name : 7-(1,2-dimethylbutyl)-5-ethyltridecane

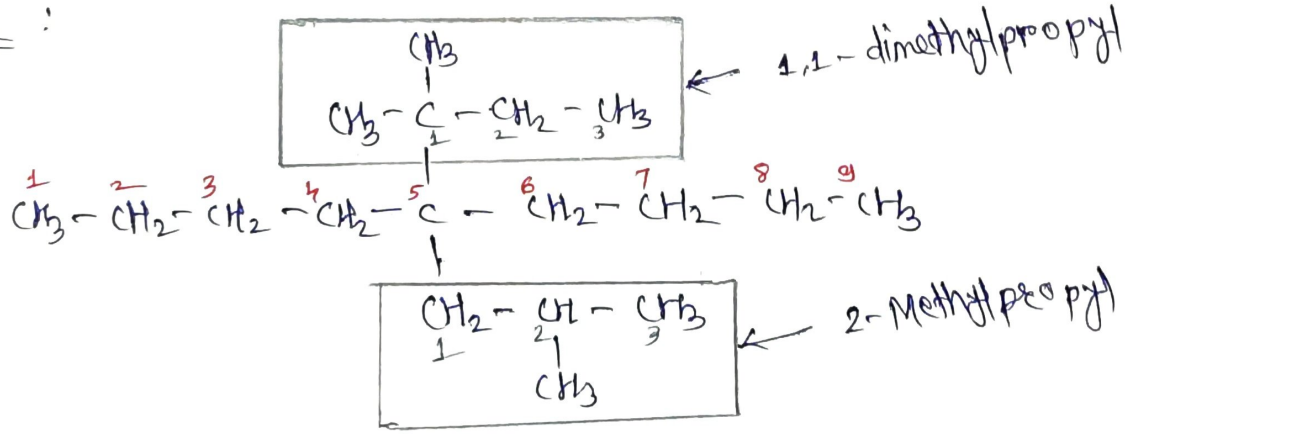
* While deciding the alphabetic order of various substituent, the name of complex substituent is considered to begin with the first letter of complex. As in above exa II.

However in simple substituent, the multiplying prefix are not considered.

Note : Name of complex substituent is always written in bracket.

Note : dimethylbutyl (as a complete substituent) is alphabetized under 'd' and not 'm'.

Exa :

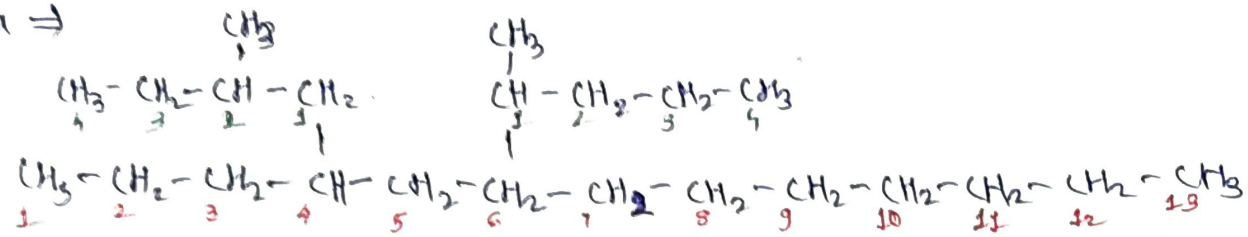


Name:

5-(1,1-dimethylproopyl)-5-(2-methylpropyl) nonane.

Note : When name of two or more complex substituent are composed of same words, priority for citation is given to substituent which as lowest locant at first citated point of difference within the complex substituent.

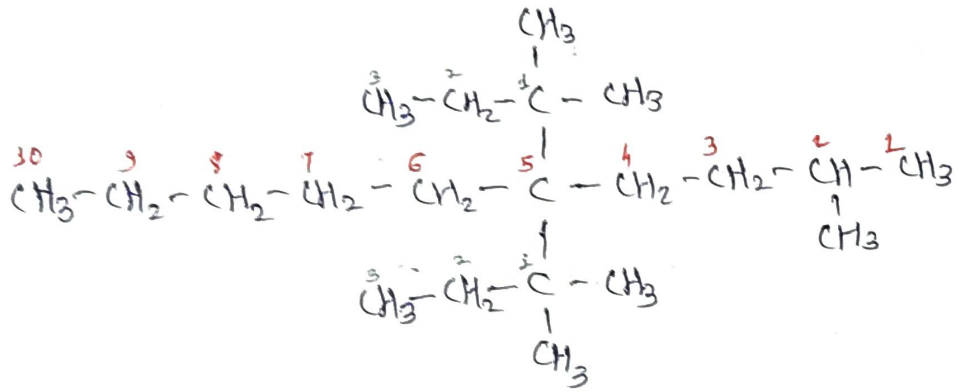
Exa ⇒



Name ⇒ 4-(2-methylbutyl)-6-(1-methylbutyl) tridecane

Note : When more than one same complex substituent occur ; it is indicated by multiplying prefix bis-(for two), tris-(for three), tetrakis (for four) etc.

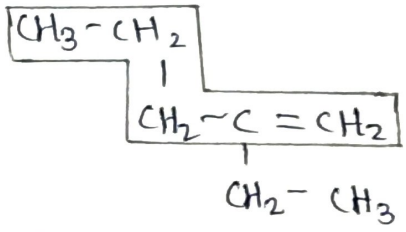
Exa ⇒



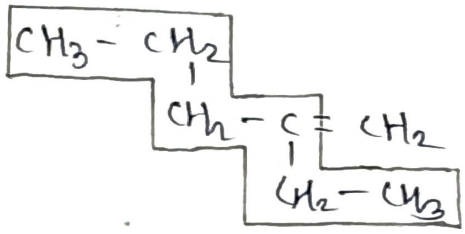
Name ⇒ 5,5-Bis(1,1-dimethylpropyl)-2-methyldecane

II] Nomenclature of Unsaturated Hydrocarbons (containing double, Triple bond) :

① Longest chain : Select the longest continuous chain containing the carbon atom involved in the multiple bond.



Correct chain



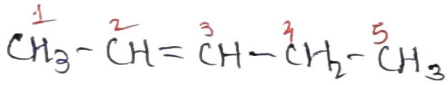
Wrong chain

② Suffix : While writing the alkene or alkyne, suffix 'ane' is replaced by 'ene' or 'yne' respectively.

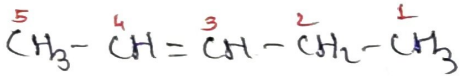
③ Multiple bond: If multiple bond occur twice in the parent chain, the alkene and alkyne are called 'diene' or 'diyne' respectively.

④ Numbering of atoms in parent chain is done in such a way that the carbon atom containing double or triple bond get the lowest number.

Example :



Pent-2-ene



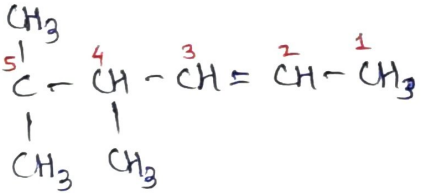
not Pent-3-ene

* Position of double bond may be indicated by three ways 2-Pentene, Pent-2-ene, Pentene-2

Mostly first two are used but in latest IUPAC convection Pent-2-ene is recommended.

⑤ Naming the side chain or Substituents :

All the rules for naming the side chains or substituent are then followed (as in alkanes)



Name : 4,5,5-trimethylhex-2-ene

Imp. Notes :

(i) The terminal 'e' in the name is dropped when it is followed by the suffix beginning with 'a', 'i', 'e', 'o', 'u' and 'y'. However, 'e' is not dropped in case of other alphabets.

Exp : $\overset{5}{C}H \equiv \overset{4}{C} - \overset{3}{C}H_2 - \overset{2}{C}H = \overset{1}{C}H_2$

Pent-1-en-4-yne.

[Preference of lower locant for ene]

$\overset{1}{C}H \equiv \overset{2}{C} - \overset{3}{C}H = \overset{4}{C}H - \overset{5}{C}H_3$

Pent-3-en-1-yne

The name of second compound cannot be Pent-2-en-4yne as, because lowest set 1,3 rather than 2,4.

(ii) Preference to lower locard is given to double bond.

Some More Exp :

$\overset{1}{C}H_3 - \overset{2}{C}H = \overset{3}{C}H - \overset{4}{C}H = \overset{5}{C}H - \overset{6}{C}H_3$

Hexa-2,4-diene

$\overset{6}{C}H \equiv \overset{5}{C} - \overset{4}{C}H = \overset{3}{C}H - \overset{2}{C}H = \overset{1}{C}H_2$

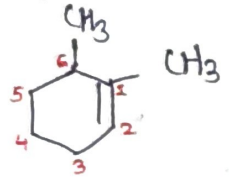
Hexa-1,3-dien-5-yne

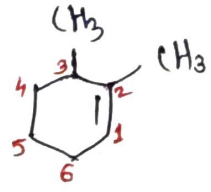
$H\overset{1}{C} = \overset{2}{C} - \overset{3}{C}H - \overset{4}{C} = \overset{5}{C}H$

CH_3

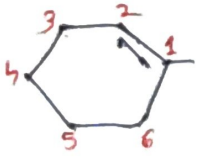
3-Methylpenta-1,4-diyne

(iii) In Cyclic Case :





1,6-dimethylcyclohex-1-ene is correct name and not 2,3-dimethylcyclohex-1-ene



$\overset{1}{C}H - \overset{2}{C}H = \overset{3}{C}H - \overset{4}{C}H_3$

Name : 1-(2-butenyl) cyclohex-1-ene

III] Nomenclature of Compound Containing One functional group or Secondary Suffix :

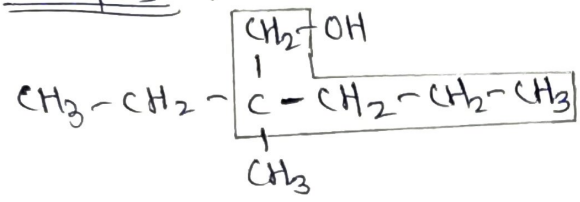
(1) Select the longest continuous chain containing the carbon atom having the functional group.

(2) The Numbering of atom in the parent chain is done in such a way that carbon atom bearing the functional group get the lowest number.

(3) All the rules for naming side chain or substituents are then followed as discussed in case of alkanes.

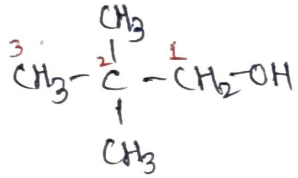
Examples :

(I)



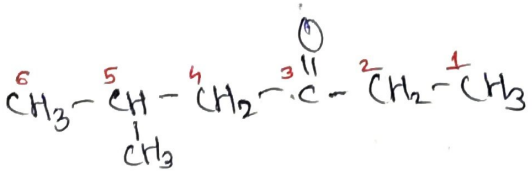
2-ethyl-2-methylpentan-2-ol

(II)



2,2-dimethylpropan-1-ol

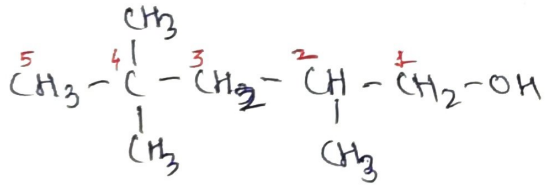
(IV)



5-methylhexa-3-one

Note : Functional Group should get lowest number even if it violetes the lowest set rule or lowest sum rule.

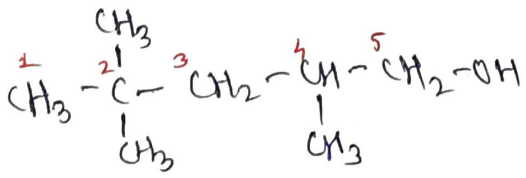
Exa :



(Correct)

Set of Position = 2,4,4

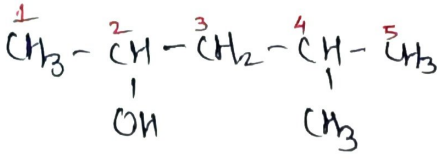
Name : 2,4,4-trimethylpentan-1-ol



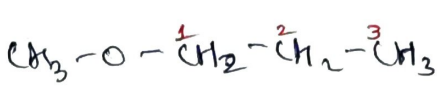
Set of Position = 2,2,4

(Wrong)

* Preference should be given to functional Group.

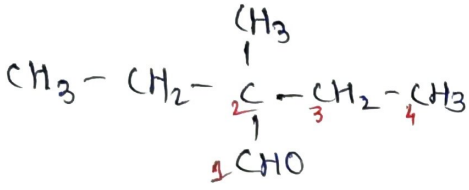


4-Methylpentan-2-ol

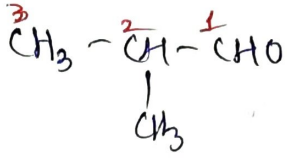


1-Methoxy propane

* If the functional Groups such as $-CHO$, $-COOH$, $-CONH_2$, $-COOR$, $-COCl$, $-CN$ are present in the molecule, the number of parent chain must start from the carbon atom of the functional Group. The position of functional group will always be number 1.



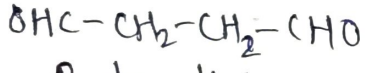
2-ethyl-2-methyl butanal



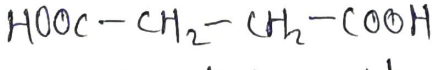
2-Methylproparal.

* If a compound contains the same functional groups, the the number prefix di, is used before the name of secondary suffix.

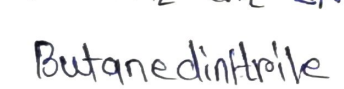
Examples :



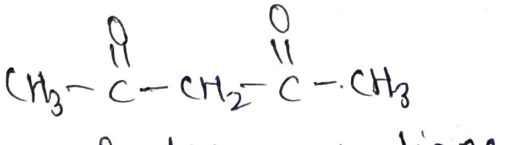
Pentanedial



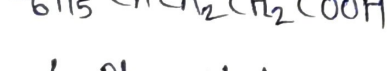
Butanedioic acid.



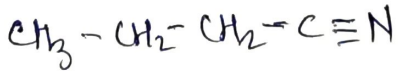
Butanedinitrile



Pentane-2,4-diane



4-Phenylbutanoic acid



Butanenitrile

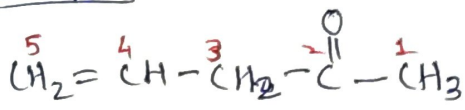
IV Nomenclature of Compound having Functional Group, Multiple bond, Side Chain / Substituent.

The Order of Preference,

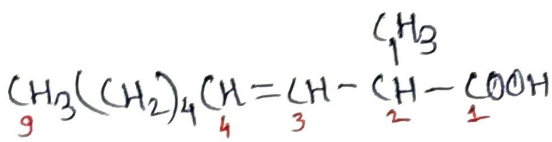
Functional Group > Double bond > Triple bond > Substituent/Side Chain

The name of benzene substituent is phenyl. If the phenyl ring is further substituted, the carbon atom of the ring are also numbered starting from the carbon atom of the ring directly attached to parent chain in such a way that the substituent on the ring get the lowest possible number.

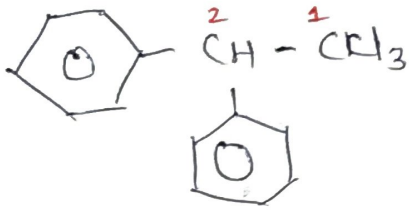
Examples :



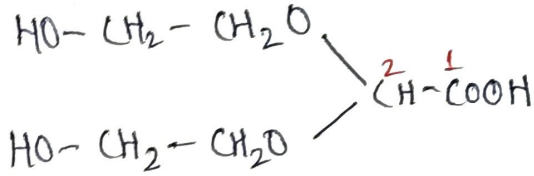
Pent-4-en-2-one



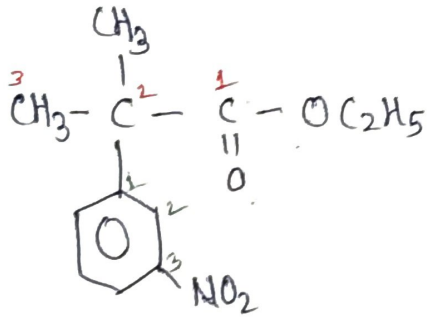
2-methylnon-3-enoic acid



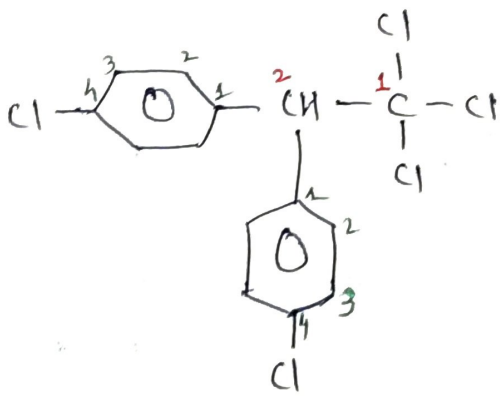
1,1,1-trichloro-2,2-diphenylethane



2,2-bis(2-hydroxyethoxy) ethanoic acid



Ethyl-2-methyl-2-(3-nitrophenyl) propanoate



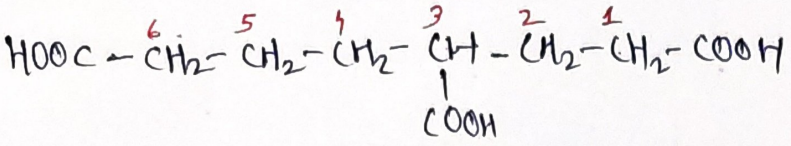
1,1,1-trichloro-2-bis(4-chlorophenyl) ethane

Some Important functional Group and their nomenclature

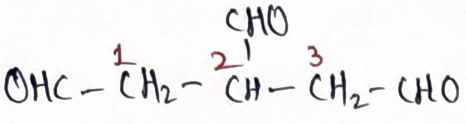
Class of compound	Functional Group	Method of Writing IUPAC Name	Example
Alkene	$-\overset{|}{C}=\overset{|}{C}-$	Replace ane by ene	$CH_2=CHCH_2CH_3$ But-1-ene
Alkyne	$-C\equiv C-$	Replace ane by yne	$CH\equiv CH$ ethyne
Alcohol	$-OH$	Replace e of alkane by -ol	CH_3-CH_2-OH Ethanol
Ether	$-\overset{|}{C}-O-\overset{|}{C}-$	Written as alkoxy alkane	$CH_3-CH_2-O-C_2H_5$ ethoxy ethane
Alkyl Halide	$-X$ (X = F, Cl, Br, I)	named as Haloalkane	C_4H_9Br 1-Bromobutane
Aldehyde	$-\overset{|}{\underset{H}{C}}=O$	Replace e by al	$CH_3-CH_2-CH_2-CHO$ Butanal
Ketone	$-\overset{||}{\underset{O}{C}}-$	Replace e by one	$CH_3-CH_2-CH_2-\overset{O}{\overset{||}{C}}-CH_3$ Pentan-2-one
Carboxylic acid	$-COOH$	Replace e by oic acid	$CH_3-CH_2-CH_2-COOH$ Butanoic acid
Acid Anhydride	$-\overset{||}{\underset{O}{C}}-O-\overset{||}{\underset{O}{C}}-$	Replace e by oic anhydride	CH_2CO-O CH_2CO ethanoic anhydride
Acid Halide	$-\overset{||}{\underset{O}{C}}-X$	Replace oic acid of corresponding acid by oyl chloride	$CH_3-CH_2-CH_2-\overset{O}{\overset{||}{C}}-Cl$ Butanoyl chloride
Amide	$-\overset{||}{\underset{O}{C}}-NH_2$	Replace oic acid of corresponding acid by amide	$CH_3-CH_2-CH-\overset{O}{\overset{||}{C}}-NH_2$ Butanamide
Ester	$-\overset{||}{\underset{O}{C}}-OR$	Naming alkyl group (R) & change oic acid by oate	$C_3H_7COOCH_3$ methyl butanoate
Amine	$-NH_2$	Naming alkanamine	$CH_3-CH_2-CH_2-NH_2$ propanamine
Nitro	$-NO_2$	Naming as Nitroalkane	
	$-N\overset{\rightarrow}{\equiv}C$	Naming as carbylamines	
	$-C\equiv N$	Naming as alkanenitrile	

Note : Compound containing more than two like functional group.

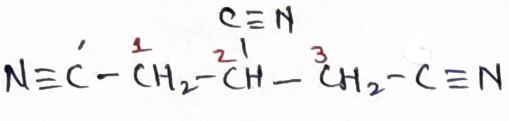
Example



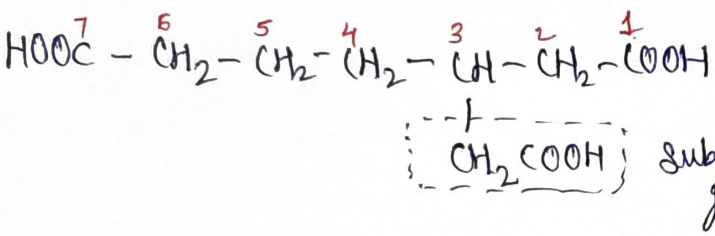
Hexane-1,3,5-tricarboxylic acid.



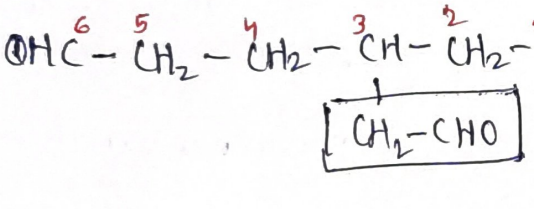
Propane-1,2,3-tricarbaldehyde.



Propane-1,2,3-tricarbonitrile.



3-(carboxymethyl) heptane-1,7-dioic acid



3-(Formylmethyl) hexane-1,6-dial.

V Nomenclature of Poly-Functional Organic Compounds :

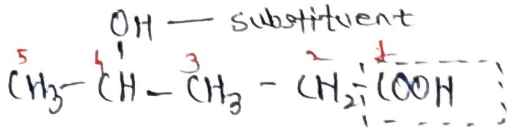
One group is treated as principal functional group.
Other group is regarded as secondary functional group & may be treated as substituent.

Preference of functional Groups is as :

Sulphonic acid > Carboxylic acid > acid anhydride > esters > acid chloride > amides > nitriles > aldehydes > ketones > Alcohol > amines > ethers.

All the remaining groups such as halo (fluoro, chloro, Bromo, Iodo), Nitro ($-NO_2$), Nitroso ($-NO$) and alkoxy ($-OR$) are always treated as substituent groups.

Exq :

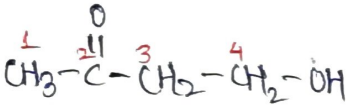


Name ⇒ 4-Hydroxypentanoic acid.

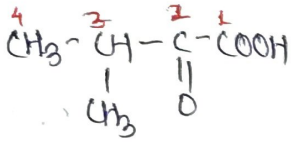
↳ Primary functional Group.

Secondary Functional Group	Prefix	Secondary Functional Group	Prefix.
$-COOH$	Carboxy	$>C=O$	Oxo or keto
$-COOR$	Alkoxy carbonyl or Carbalkoxy	$-OH$	Hydroxy
		$-SH$	Mercapto
$-COCl$	Chloroformyl	$-NH_2$	Amino
$-CONH_2$	Carbamoyl	$=NH$	Imino
$-CN$	Cyano		
$-OR$	R-oxy	$R-CH=CH-$	Alkenyl
$-CHO$	Formyl	$R-C\equiv C-$	Alkynyl

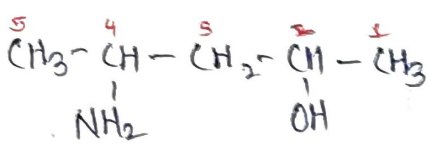
Examples :



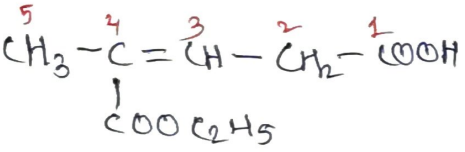
4-Hydroxybutan-2-one



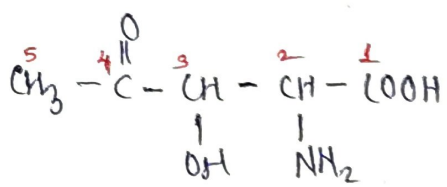
3-Methyl-2-oxobutanoic acid



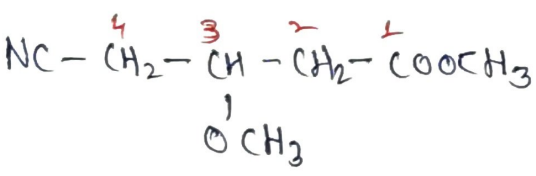
4-Aminopentan-2-ol



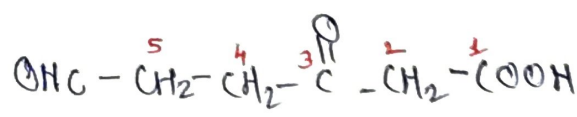
4-Ethoxycarbonylpent-3- acid or
4-Carbethoxypent-3-enoic acid



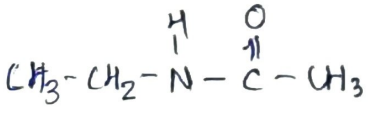
2-Amino-3-hydroxy-4-oxopentanoic acid



Methyl-4-cyano-3-methoxybutanoate



5-Formyl-3-oxopentanoic acid

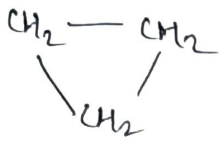


N-ethyl acetamide

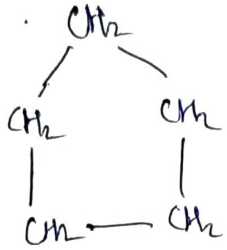
2] Nomenclature of Alicyclic Compounds (IUPAC)

Rules with Example :

(1) The name of the alicyclic compound is obtained by adding the prefix "cyclo" to name of corresponding straight chain hydrocarbons (alkane, alkene, alkyne).

(I)  or 

Cyclopropane

(II)  or 

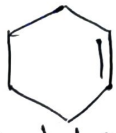
Cyclopentane

(III) 

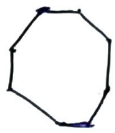
Cyclohexane

(IV) 

Cyclopentene

(V) 

Cyclohexene

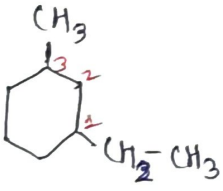
(VI) 

Cyclooctane

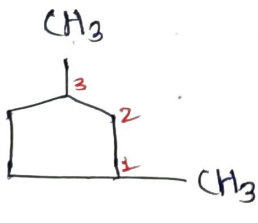
(2) → If only one substituent is present ; no need to designate its position.

→ If two or more substituent are present ; position are indicated by arabic number (1,2,3,---) ; while numbering the ring, substituent which come first in alphabetic order get lowest number and ring is numbered in direction that gives next substituent the lower number possible.

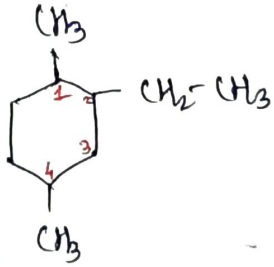
→ Must follow rule of lowest set locant.



1-ethyl-3-methyl cyclohexane.



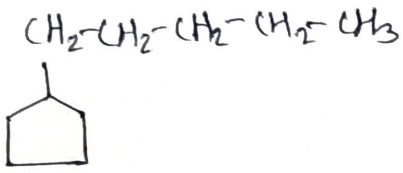
1,3-Dimethyl cyclopentane



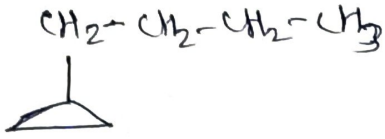
2-Ethyl-1,4-dimethyl cyclohexane

(3) If Ring contain equal or more number of carbon atom than alkyl group attached to it then it is derivative of cycloalkane; If Ring contain less number of carbon than alkyl group attached to it then it is derivative of alkane.

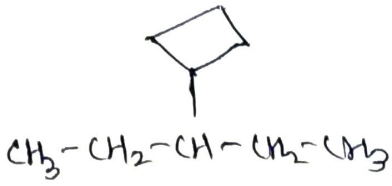
Eg :



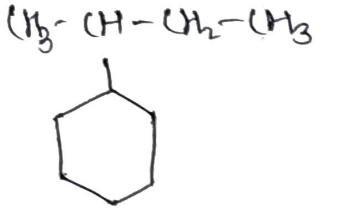
pentyl cyclopentane



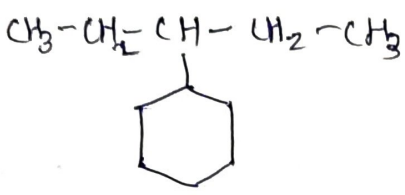
1-cyclopropyl butane



3-cyclobutylpentane

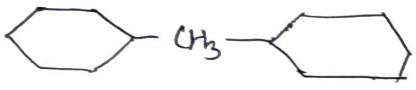


(2-Butyl) Cyclohexane

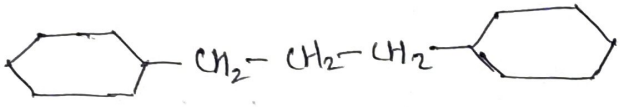


(2-Pentyl) Cyclohexane

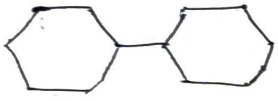
* When more than one cyclic ring are attached to a single chain, then it is named as derivative of alkane



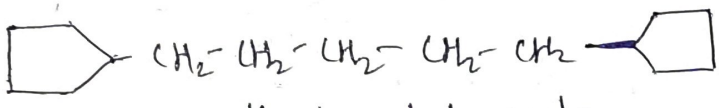
Dicyclohexylmethane



1,3 - dicyclohexane propane

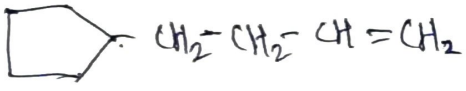


cyclohexyl cyclohexane

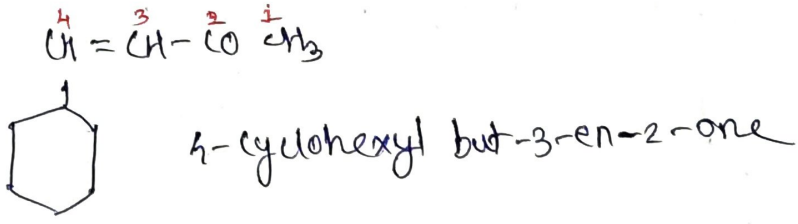


1,5-dicyclopentyl pentane

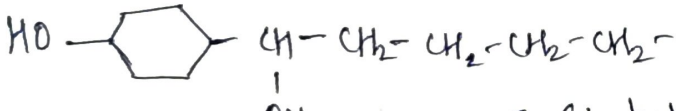
* If side chain contain multiple bond or functional group,



4-Cyclopentyl but-1-ene



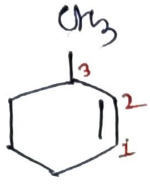
4-cyclohexyl but-3-en-2-one



5-(4-hydroxyl cyclohexyl) pentane-1,5-diol.

* If there is multiple bond (double / triple) & substituent, Preference should given to multiple bond

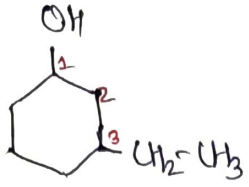
Example



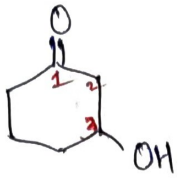
3-methyl cyclohex-1-ene

(4) If some functional group & some other substituent are present in the ring, preference should be given to functional groups.

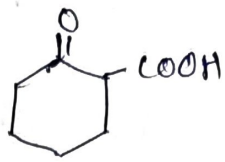
Examples:



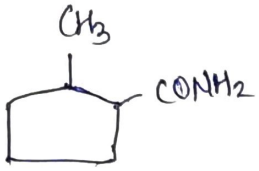
3-Ethylcyclohexanol



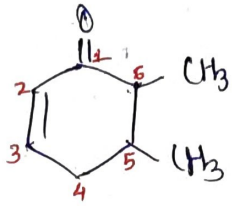
3-Hydroxycyclohexan-1-one



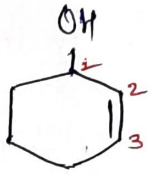
2-Oxo-cyclohexan-1-carboxylic acid
(-COOH is principle group)



2-Methyl cyclopentane-1-carboxamide

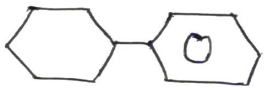


5,6-dimethyl cyclohex-2-en-1-one

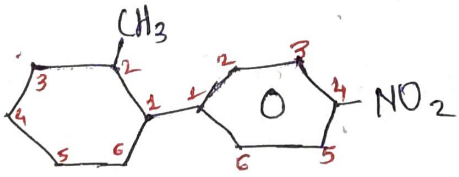


Cyclohex-2-en-1-ol

(5) If a compound contain an alicyclic ring linked to benzene, it is named as derivative of benzene

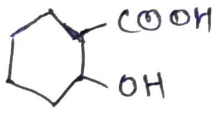


Cyclohexyl benzene

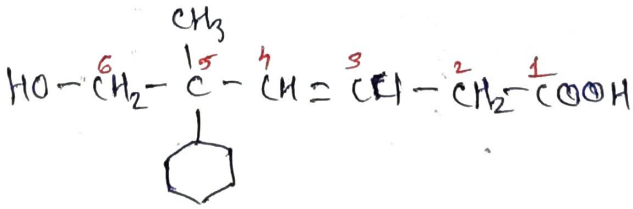


1-(2-methyl cyclohexyl)-4-nitrobenzene

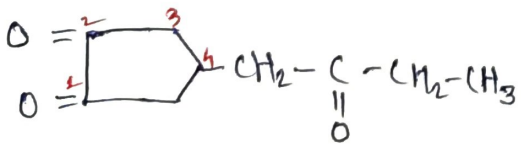
Other Examples:



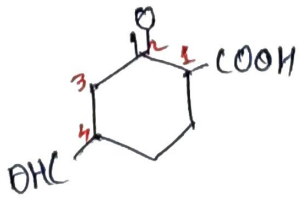
3-hydroxy cyclohexane-1-carboxamide



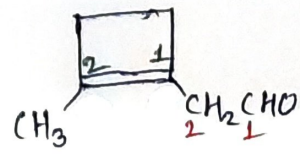
3-Chloro-5-cyclohexyl-6-hydroxy-5-methyl hex-3-enoic acid



4-(Oxobutyl)-cyclopentane-1,2-dione



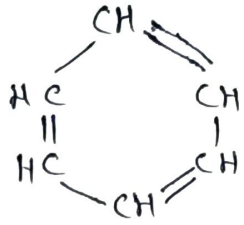
4-Formyl-2-oxo cyclohexene-1-carboxylic acid



2-(2-Methyl cyclobut-1-enyl) ethanal

3] Nomenclature of Aromatic Compound (IUPAC)

Compound having one or more benzene ring in compound or compound which follows Huckel's rule are aromatic.



Benzene

Two main part : (I) Nucleus (II) Side chain

(I) Nucleus : It is benzene ring

(II) Side chain : Alkyl or any other aliphatic group containing at least one carbon atom attached to nucleus is called Side chain.

When two side chain appear then position are,

(i) Ortho : Substituent are on adjacent carbon atoms. they are either ortho or given number as 1,2

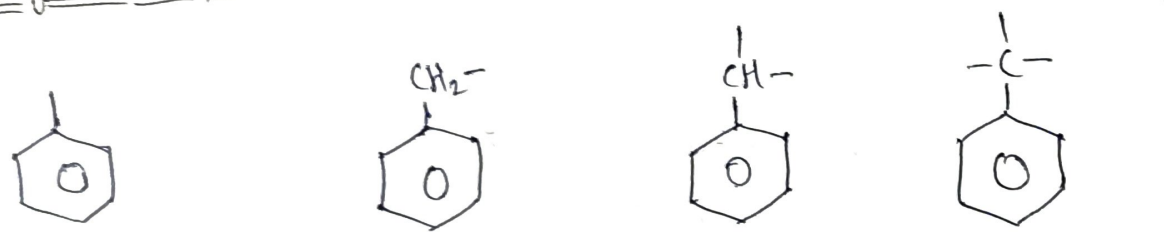
(ii) Meta : Substituent are on alternative carbon atom, they are either meta or given number 1,3.

(iii) Para : Substituent are on diagonally situated carbon atoms, they are either para or given number as 1,4.

* If Benzene ring is named as substituent on other molecule, it is named as phenyl.

* Preference should given to principal group. Should follow rule of lowest set locant.. Substituent should written in alphabetical order.

* Aryl Group :



Phenyl (From nucleus)

Benzyl

Benzal

Benzo

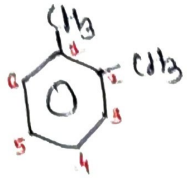
From the side chain

Nomenclature of Different Aromatic Compound.

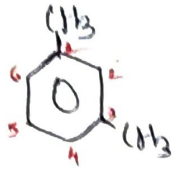
Hydrocarbon :

Benzene

Toluene

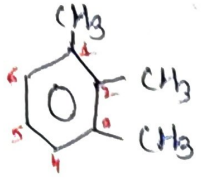


1,2-dimethylbenzene
(o-Xylene)

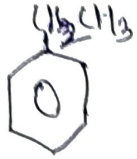


1,3-dimethylbenzene
(m-xylene)

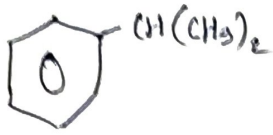
p-dimethylbenzene
(p-xylene)



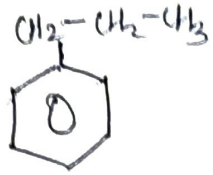
1,2,3-trimethylbenzene
(1,2,3-Mesitylene)



Ethyl benzene



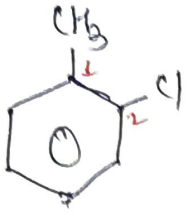
Isopropyl
benzene



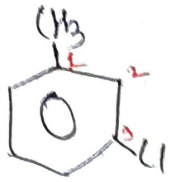
n-propyl
benzene.

Halogen Derivative :

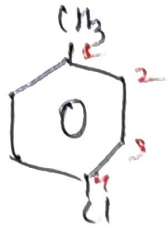
Chlorobenzene



2-Chlorotoluene
(o-Chlorotoluene)



3-Chlorotoluene
(m-Chlorotoluene)

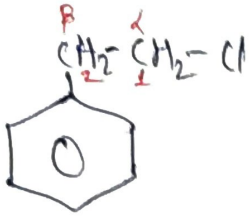


4-Chlorotolvene
(p-Chlorotolvene)

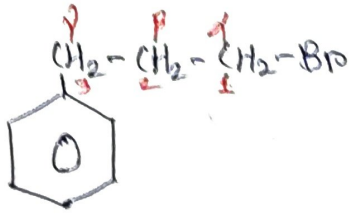
Chlorophenylmethane
(Benzyl Chloride)

Dichlorophenylmethane
(Benzal Chloride)

Trichlorophenylmethane
(Benzochloride)

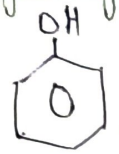


1-chloro-2-phenyl ethane
(β-phenyl ethyl chloride)

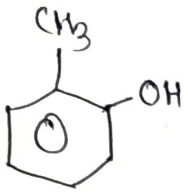


1-Bromo-3-phenyl propane
(γ-phenyl propyl bromide)

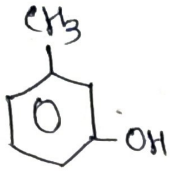
Hydroxy Derivative:



Phenol



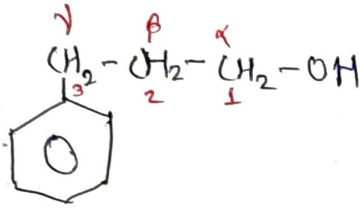
2-methyl phenol
(o-cresol)



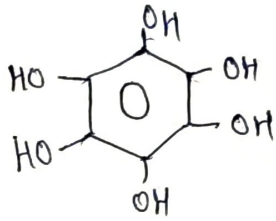
3-methyl phenol
(m-cresol)

4-methyl phenol
(p-cresol)

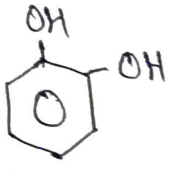
Phenyl methanol
(Benzyl alcohol)



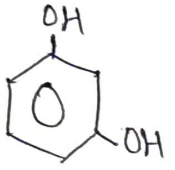
3-Phenyl-1-propanol
(β-phenyl propyl alcohol)



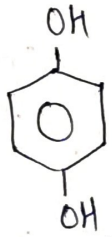
Hexahydroxybenzene
(Benzenehexol)



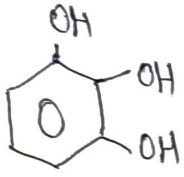
1,2-dihydroxybenzene
(catechol)



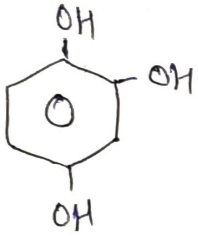
1,3-dihydroxybenzene
(Resorcinol)



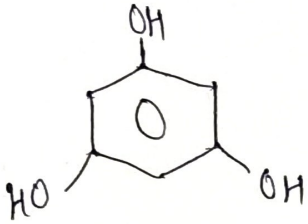
1,4-dihydroxybenzene
(Quinol)



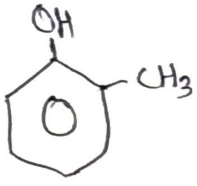
Pyrogallol
(1,2,3-trihydroxy benzene)



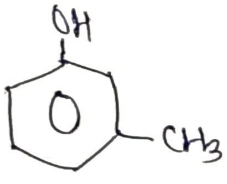
Hydroxyquinol
(1,2,4-trihydroxy benzene)



Phloroglucinol
(1,3,5-trihydroxy benzene)



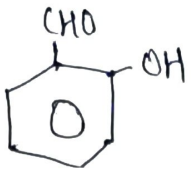
o-cresol



m-cresol

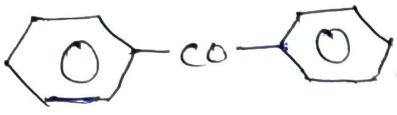
Aldehyde and ketones

Benzaldehyde

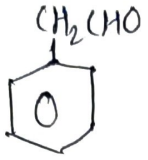


2-Hydroxy benzaldehyde
(O-salicylaldehyde)

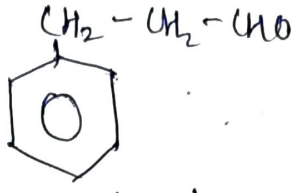
Methyl phenyl ketone
(Acetophenone)



Diphenyl ketone
(Benzophenone)

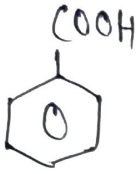


2-Phenylethanal
(Phenyl acetaldehyde)

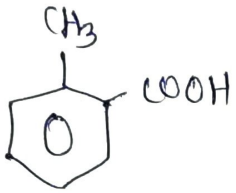


3-phenylpropanal
(β-Phenyl propionaldehyde)

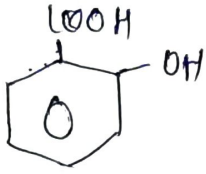
Caroboxylic acid :



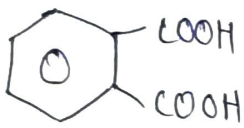
Benzoic acid



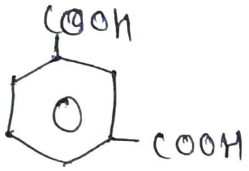
O-Toluic acid



2-Hydroxybenzoic acid
(O-salicylic acid)

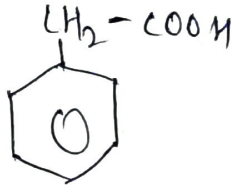


Phthalic acid



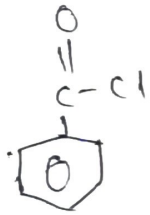
Isophthalic acid

Terephthalic acid

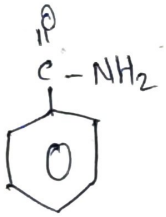


2-phenylethanoic acid
(α-phenyl acetic acid)

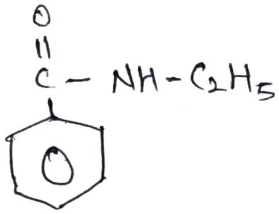
Acid Derivative :



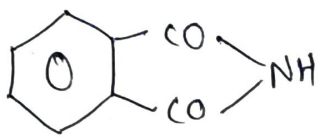
Benzoyl chloride



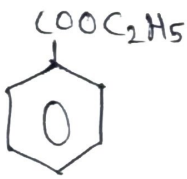
Benzamide.



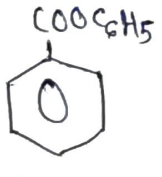
N-ethylbenzamide



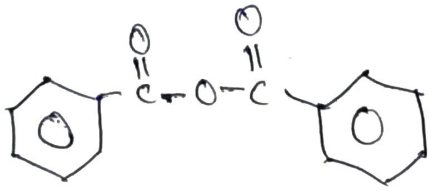
phthalimide



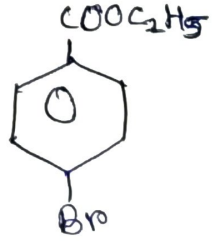
Ethyl Benzoate



Phenyl Benzoate



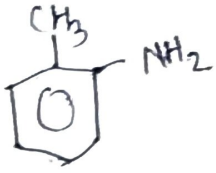
Benzoic anhydride



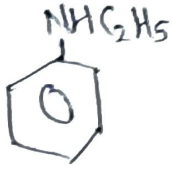
Ethyl-4-bromobenzoic acid

Amino Derivative :

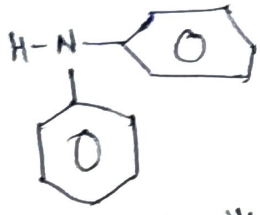
Aniline



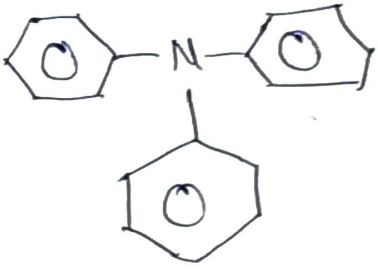
2-Amino Aniline
(o-Toluidine)



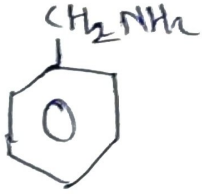
N-Ethylaniline



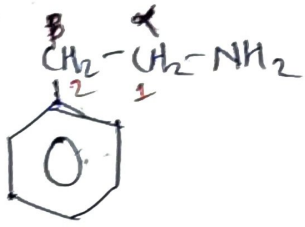
N-Phenylaniline
(diphenylamine)



N,N-diphenylaniline
(triphenylamine)



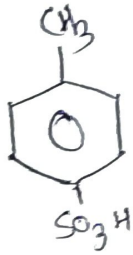
Benzyl amine



β-phenyl ethylamine

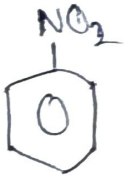
Sulphonic Acid

Benzene sulphonic acid

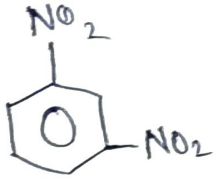


4-Methylsulphonic acid
(p-toluene sulphonic acid)

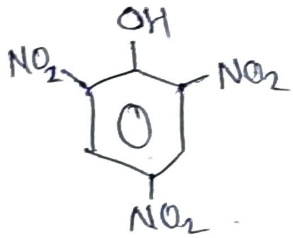
Nitro derivative :



Nitrobenzene



1,3-Dinitrobenzene
(m-dinitrobenzene)



picric acid

Cyanides & Isocyanides :

Benzonitrile or
Benzene carbylamine

phenyl
isocyanide

4] Nomenclature of Heterocyclic Compounds.

(1) Combination of Prefix with stem.

Prefix indicates heteroatoms present in heterocyclic systems. Stems are used to indicate size of ring, saturation or unsaturation in heteromonocyclic system.

Heteroatom	Symbol	Prefix
Oxygen	O	Oxa
Sulfur	S	Thia
Selenium	Se	Selena
Tellurium	Te	Tellura
Nitrogen	N	Aza
phosphorous	P	Phospha
Arsenic	As	Arsa
Antimony	Sb	Stiba
Bismuth	Bi	Bisma
Silicon	Si	Sila
Germanium	Ge	Germa
Tin	Sn	Stanna
Lead	Pb	Plumba
Boron	B	Bora
Mercury	Hg	Mercuna

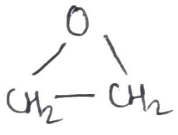
Table 1

Ring Size	Unsaturated	Saturated
Three membered	-irene	-irane
Four membered	-ete	-etane
five membered	-ole	-olane
Six membered	-ine	-inane / -ane
Seven membered	-epine	-epane
Eight membered	-ocine	-ocane
Nine membered	-onine	-onane
Ten membered	-ecine	-ecane

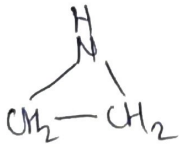
Table 2

Few exceptions are there like trivial names eg. pyrrole, pyrazole, imidazole, pyridine, pyridazine, etc permited over systemic name by IUPAC

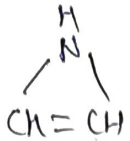
Examples :



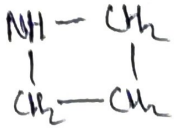
Oxa + irane = Oxirane



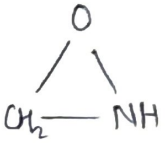
Aza + iridine = Aziridine



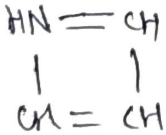
Aza + irine = Azirine



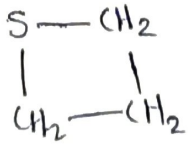
Aza + elidine = Azetidine



Oxa + Aza + iridine = Oxaziridine



Aza + ete = Azete



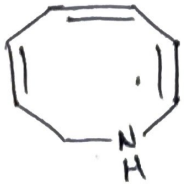
Thia + etane = Thietane

Thia + olane = Thiolane

phosphole

Oxolane

Thiepane



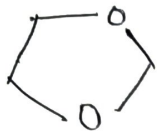
Azepine

Oxepine

Azocine

(2) Presence of Identical Heteroatom.

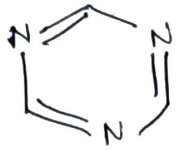
When two or more heteroatom of same type are present in a ring, prefix like di, tri, etc are placed before prefix of considered heteroatom.



1,3 - Dioxolane

1,2,4 - Triazole

1,3 - Diazine



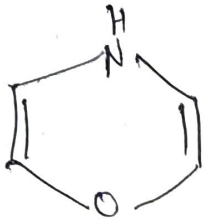
1,3,5 - Triazine

(3) Presence of different heteroatoms.

When two or more different atoms are present in same ring, prefix of Heteroatoms are combined in order of priority as given in Table 1. (Priority given in decreasing order)

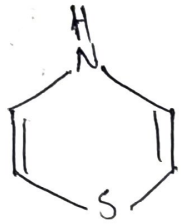
Thia + aza + ole = Thiazole

(1,3 - Thiazole)



Oxa + aza + ine = Oxazine

(1,4 - Oxazine)

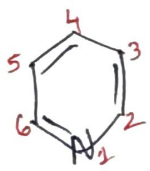


Thia + aza + ine = Thiazine

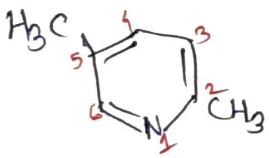
(1,4 - Thiazine)

(4) Numbering :

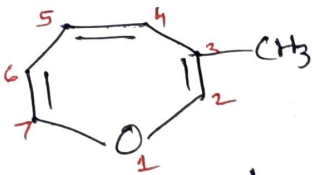
(A) With one Heteroatom : Heteroatom assign the position 1 and proceeds in such a way as to give the lowest possible locant to substitute if present.



Pyridine



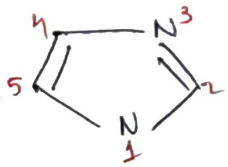
2,5 - Dimethylpyridine



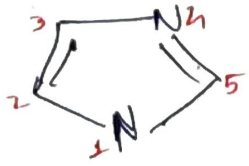
3 - methyloxepin

(B) With two or more identical Heteroatoms : In this case heteroatom are assigned lowest set of number locant.

Eg



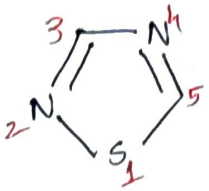
Correct



Wrong

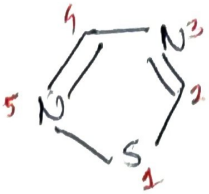
(c) With Multiple Different Heteroatoms :

Start with Heteroatom with highest priority. & lowest set locant.



Correct one

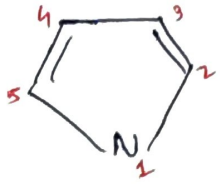
1,2,4 – Thiadiazole



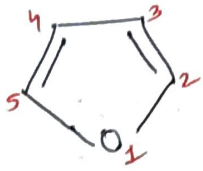
Wrong one

1,3,5 – Thiadiazole

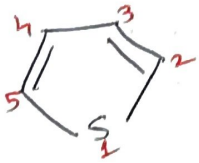
Based on trivial System names of Important Heterocyclic Compound.



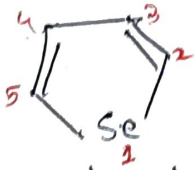
Pyrrole



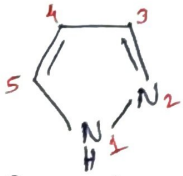
Furan



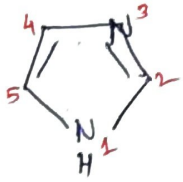
Thiophene



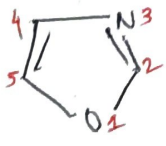
Selenophene



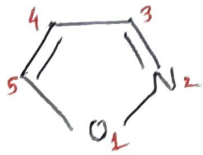
Pyrazole



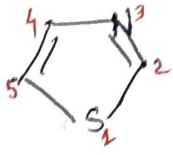
Imidazole



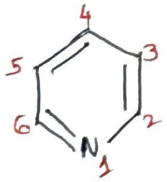
Oxazole



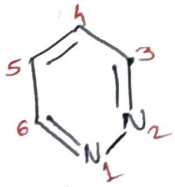
Isoxazole



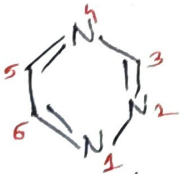
Thiazole



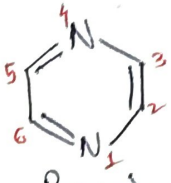
Pyridine



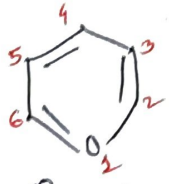
Pyridazine



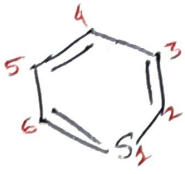
Pyrimidine



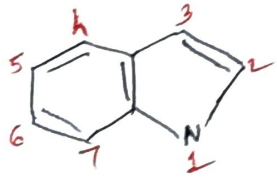
Pyrazine



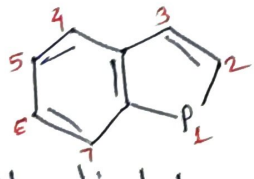
Pyran



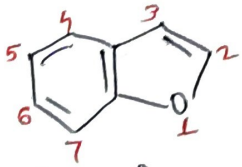
Thiopyran



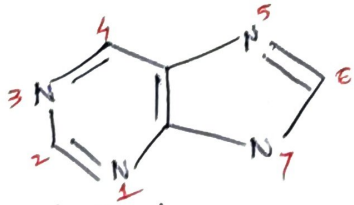
Indole.



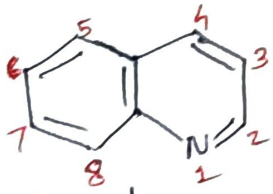
Phosphindole



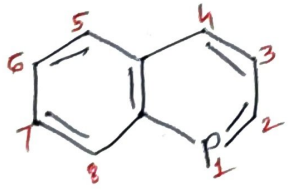
Benzofuran



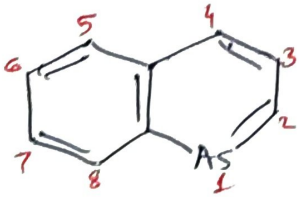
Purine



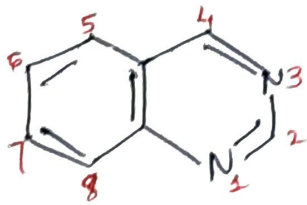
Quinoline



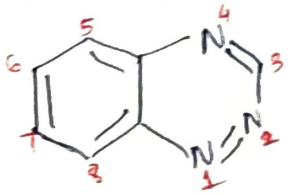
Phosphinoline



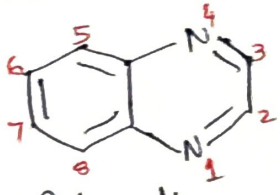
Arsinoline



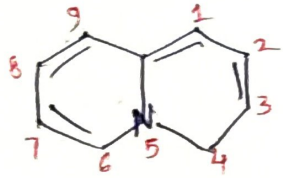
Quinazoline



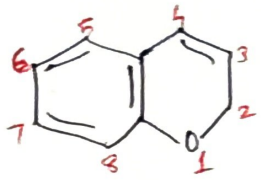
Cinnoline



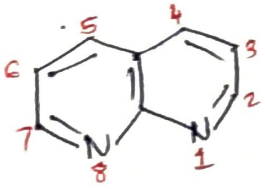
Quinoxaline



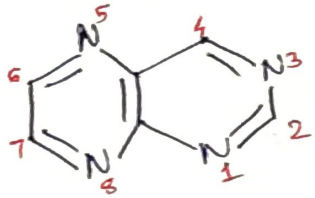
Quindolizine



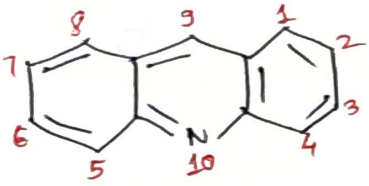
Chromene



1,8 - Napthyridine

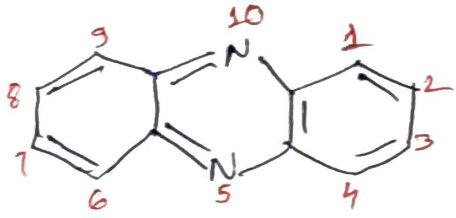


Pteridine

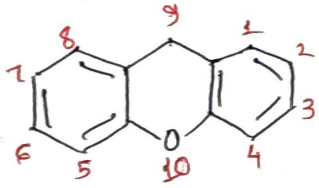


Acridine

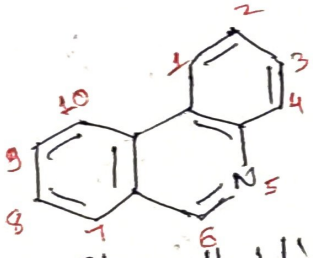
(exception to systemic numbering)



Phenazine



Xanthene

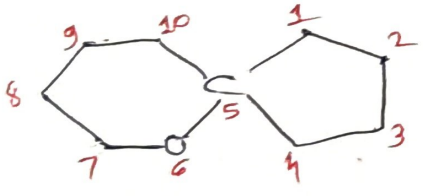


Phenarsthridine

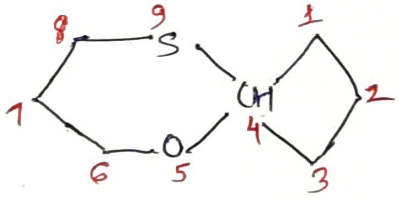
Spiro Heterocycles : Compound in which two rings are fused at a common point are known as spiro compounds and the common atom which is quaternary in nature is designated as spiro atom.

According to number of spiro atom, spiro compounds are classified into monospiro, dispiro, and trispiro ring system.

Eg :



6 - Oxaspirodecane

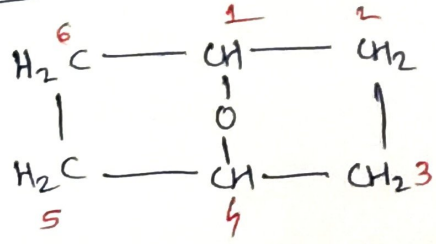


5 - Oxa - 9 - thiaspiro nonane

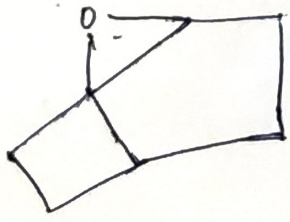
Bridged Heterocycles :

Heterocyclic system in which two rings with two or more common atoms is known as Bridged Heterocycles.

Eg :



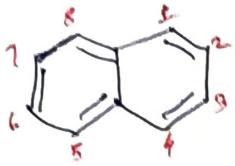
≡



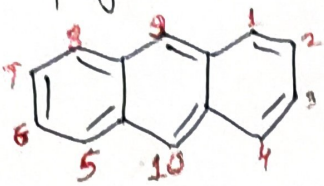
7 - oxabicyclo heptane

5]. Nomenclature of Polynuclear Hydrocarbons.

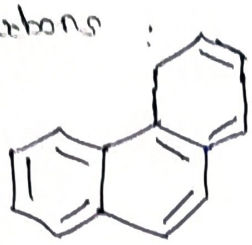
(1) Names of some polynuclear Hydrocarbons :



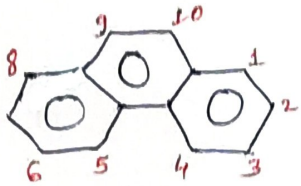
Naphthalene



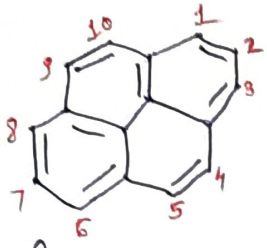
Anthracene



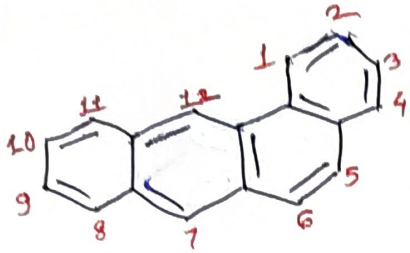
or



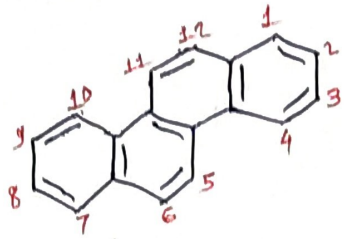
Phenanthrene



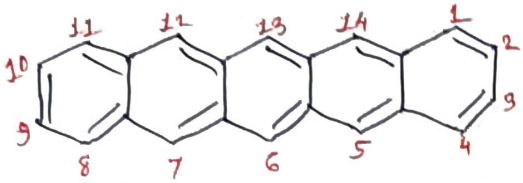
Pyrene



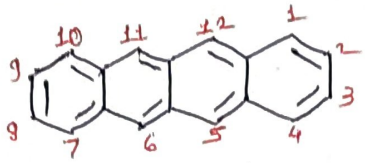
Benz(a)anthracene



chrysene



Pentacene



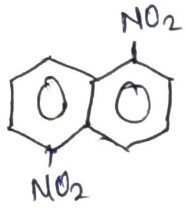
naphthacene (CAS)
tetracene (IUPAC)

(2) Position in the polynear hydrocarbon system are designated as above.

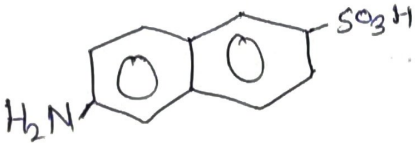
(3) Preference given to primary function group.

(4) Substituted hydrocarbons are differentiated by prefix 1- & 2- or α- and β-

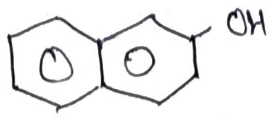
Examples :



1,5-dinitronapthalene



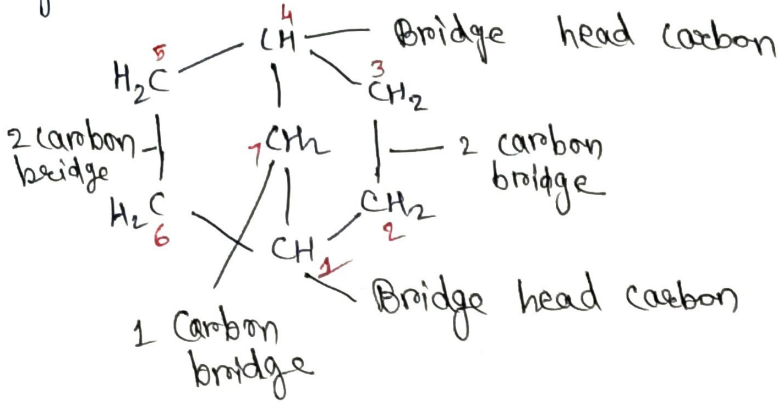
6-Amino-2-napthalene sulphonic acid

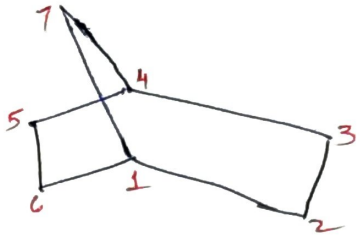


2-Napthol
β-Napthol

5] Nomeclature of Cycloalkanes Containing Two Rings Or Bicyclic Compounds.

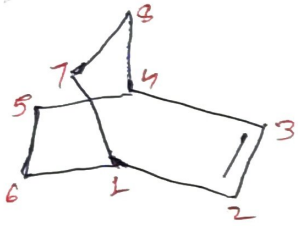
We can illustrated the naming system with norbornane, whose systemic name is bicyclo [2.2.1] heptane.



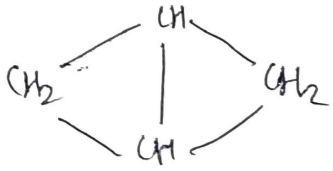


bicyclo [2.2.1] heptane
norboronane

(a) Heptane, since it contain a total seven carbon atoms.
(b) bicyclo since it contain two ring, that is, breaking two carbon-carbon bonds converts it into an open-chain compound.
(c) [2.2.1], since the number of carbon between bridge head is two (C-2 and C-3), two (C-5 and C-6) and one (C-7).

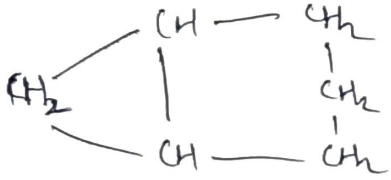


Bicyclo [2.2.2] octa-2-ene

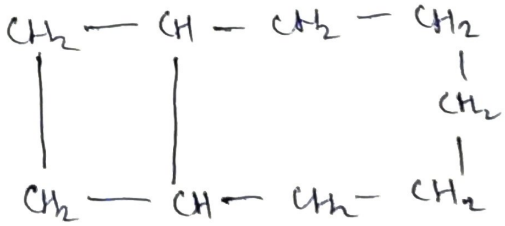


Bicyclo [1,1,0] butane

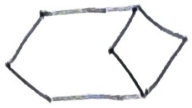
(d) Square bracket written between prefix bicyclo and name of alkane.
Number should written in descending order.



Bicyclo [3.1.0] hexane



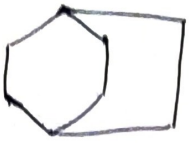
Bicyclo [5.2.0] nonane



Bicyclo [3.1.1] heptane

Bicyclo [4.1.0] heptane

Bicyclo [4.4.0] decane (Decalin)

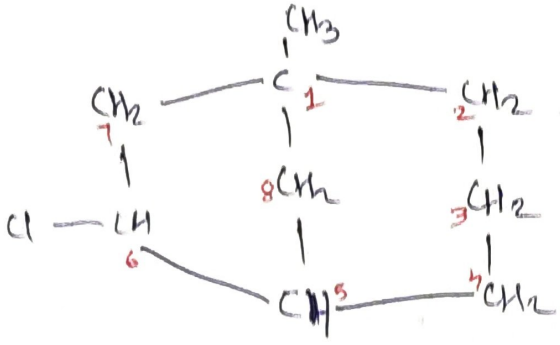


Bicyclo [2.2.2] octane

Bicyclo [3.1.0] hexane

Bicyclo [3.2.0] heptane

(e) Numbering is started from one of the bridge head carbon atom & is done for longest ring system to second head carbon atom. Finally completed by shortest ring system.

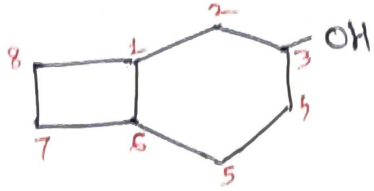


longest system : 1,2,3,4,5

Next longest system : 5,6,7,1

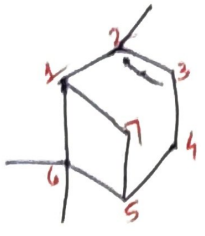
Shortest system : 1,8,5

6-Chloro-1-methyl bicyclo [3.2.1] octane

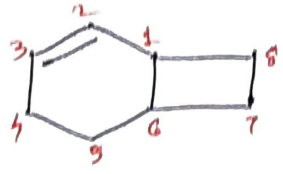


(f) Primary substituent group get shortest number.

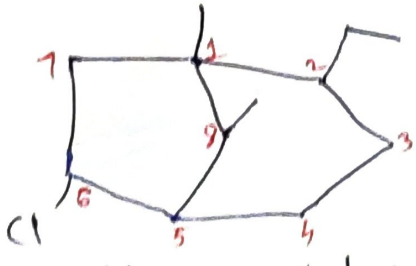
Bicyclo [4.2.0] octan-3-ol



2,6,6 - Trimethyl bicyclo [3.1.1] hept-2-ene



7-Chlorobicyclo [4.2.0] oct-2-ene



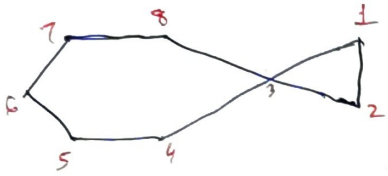
6-Chloro-2-ethyl-1,8-dimethylbicyclo [3.2.1] octane

7] Nomenclature of Spiro Compounds

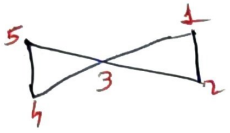
(A) Name is Prefixed by word spiro, followed by bracket containing number of carbon atom in ascending order, in each ring connecting to carbon atom & then the name of parent atom.

(B) Numbering is done from smaller ring to larger.

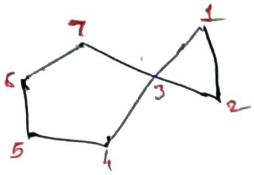
(C) When double or triple bond, preference should given to multiple bonds (double or triple) in accordance with general rule



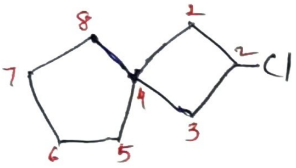
Spiro [2.5] octane



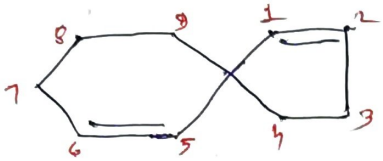
Spiro [2.2] pentane



Spiro [2.4] heptane



2-Chlorospiro [3.4] octane

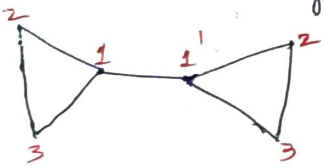


Spiro [4.5] deca-1,6-diene

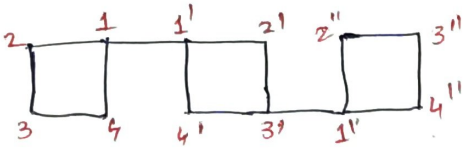
Ring System (Two or more identical cyclic hydrocarbon joined by Single bond)

(A) System are named by suitable Numerical prefix as bi (for two) tri (for three), quater (for four), quinque (for five), sexi (for six) etc. before the name of repetitive Hydrocarbon unit.

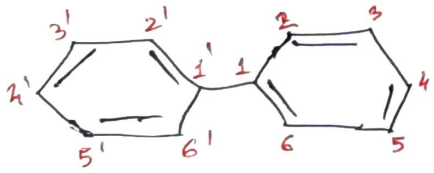
(B) Starting with either end, each carbon atom are numbered with unprimed & primed numbers. One unit is assigned unprimed & other unit by primed, double primed, etc.



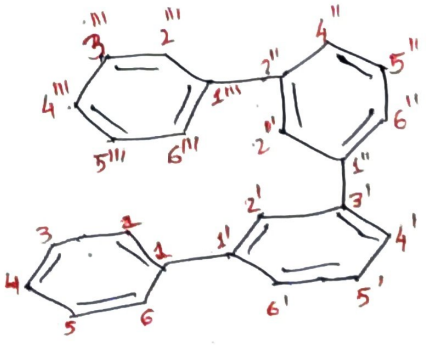
1,1'-Bicyclopropane



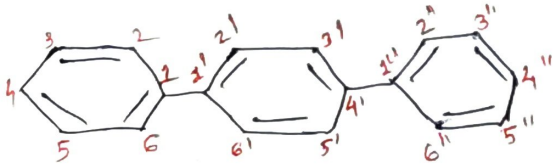
1,1',3',1''-tricyclobutane



1,1'-Biphenyl



1,1':3',1'':3'',1'''-Quaterphenyl



1,1':4',1''-triphenyl