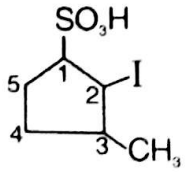
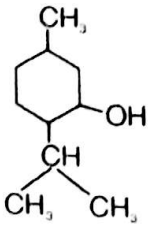


2-Iodo-3-methyl + cyclo + pent + ane + 1-sulphonic acid

Secondary prefix | Primary prefix | Word root | Primary suffix | Secondary suffix



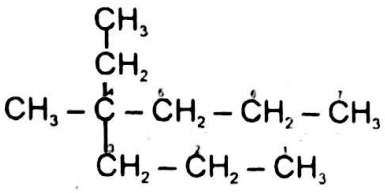
2 – Isopropyl – 5 – methylcyclohexanol

Here
Secondary prefix	=	2 – Isopropyl – 5 – methyl
Primary prefix	=	cyclo
Word root	=	hex
Primary suffix	=	an(e)
Secondary suffix	=	ol

Th7: IUPAC nomenclature of branched / complex alkanes

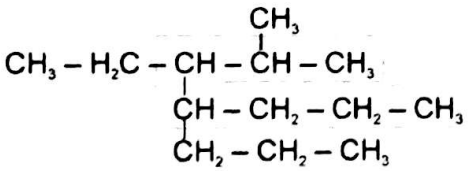
7.1 Parent carbon chain selection :

(a) Select the longest continous carbon chain in the molecule.



Longest chain has 7 carbons so word root is "Hept"

(b) When chains of equal lengths are competing for selection then that chain is selected which has more number of substituents/branches.



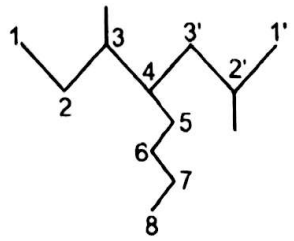
longest chain has 7 carbon & 3 substituents

(c) When the number of substituents are same then the substitutents at the nearest positions from the either end is prefer for parent chain selection.

Ex. Here , 2 choices for longest chain

Chain- (A) 1–2–3–4–5–6–7–8

Chain- (B) 1'–2'–3'–4–5–6–7–8



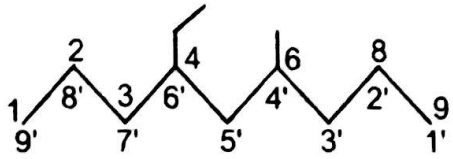
Chain- (A) & Chain- (B) both have 2 substituents but in chain-B substituent is nearer (at 2nd position) than in chain-A (at 3rd position). So, chain-B will be preferred.

(d) If the two substituents are found in equivalent positions the lower number is given to the one coming first in the alphabetical order.

Ex. Here , 2 choices for longest chain

Chain- (A) 1–2–3–4–5–6–7–8–9

Chain- (B) 1'–2'–3'–4'–5'–6'–7'–8'–9'



In both chain-A & chain-B, substituents are at same position (4th). In chain-A substituent is ethyl & in chain-B, it is methyl. Alphabetically ethyl will be preferred. So, chain-A is selected.

7.2 Numbering of the parent carbon chain :

The numbering is done in such a way that the branched carbon atoms get the lowest possible number :

Note :

(1) Write the substituents in place of secondary prefix with their appropriate locations in alphabetical order.

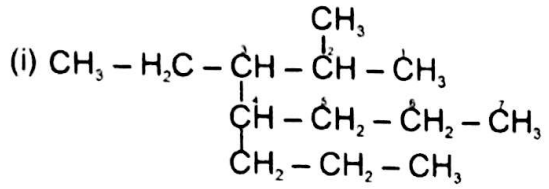
(2) If the same substituent occurs more than once in the molecule, the prefix di (for two), tri (for three), etc. are used to indicate how many times it appears.

(3) Prefixes di, tri, tetra etc. are not considered in deciding alphabetical order for simple substituents but considered for complex substituents.

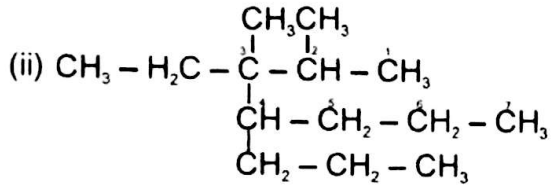
(4) Iso & Neo is considered for alphabetical seniority order.

(5) Numbers are separated from each other by commas(,).

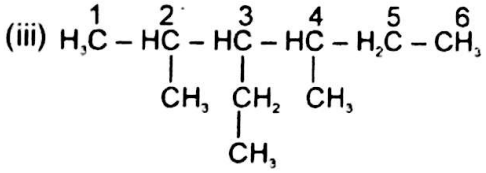
(6) Numbers are separated from words by hyphens and there is no break between name of substituents and word root.

Ex. (i) 

3–Ethyl–2–methyl–4–propylheptane

(ii) 

3–Ethyl–2,3–dimethyl–4–propylheptane

(iii) 

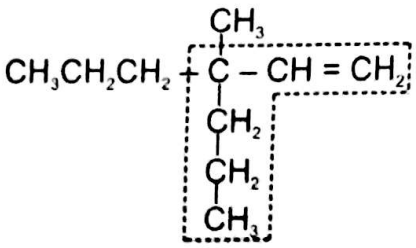
3–Ethyl–2,4–dimethylhexane

Th8: IUPAC nomenclature of Alkenes/Alkynes/Alkenyne

8.1 Alkenes :

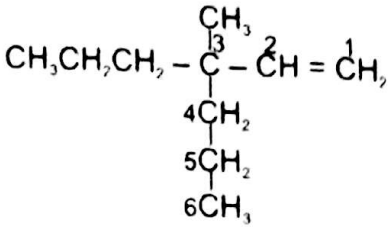
Functional group :

(1) Select the longest carbon chain containing carbon–carbon double bond. This need not be the longest chain in the compound as a whole. Parent name will be alkene corresponding to number of carbon atoms in the longest chain.

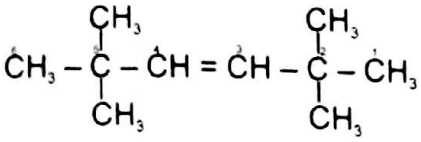
Ex. 

Longest chain has 6 atoms $\Rightarrow$ parent name = hexene

(2) Carbon atoms in the longest chain is numbered from that end in such a way that doubly bonded carbon atom gets the lowest number. The position of double bond is indicated by the smaller of the numbers assigned to two carbon atoms of double bond.

The above example can be numbered as, 

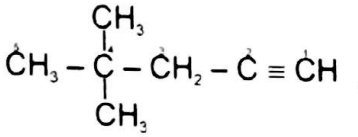
Position of double bond will be indicated as no. 1, Hence name will be 3–Methyl–3–propylhex–1–ene

Ex.  2,2,5,5-Tetramethylhex-3-ene

8.2 Alkynes

Parent chain selection and numbering of longest chain is exactly same as that for alkenes.

Ex. $CH_3C{\equiv}C{-}CH_3$ But-2-yne

 4,4–Dimethylpent–1–yne

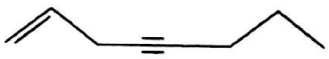
8.3 Alkenyne (containing both double and triple bonds)

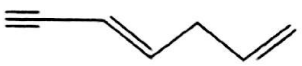
Numbering is done in a manner that double and triple bonds get the lowest possible number. If double bo and triple bond both have same number then double bond is prefer over triple bond.

Ex. $\mathbf{HC{\equiv}C-CH_2-CH=CH_2}$

1 2 3 4 5 (numbering is done from alkyne) **(wrong)**

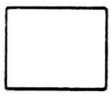
5 4 3 2 1 (numbering is done from alkene) **(Correct)**

 Oct-1-en-4-yne

 Hepta-3,6-dien-1-yne

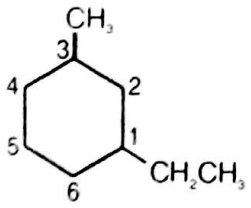
Th9: IUPAC nomenclature of alicyclic compounds

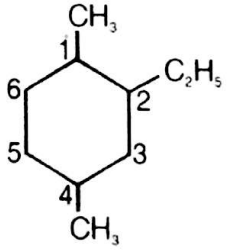
(1) The names of alicyclic compounds are obtained by adding the prefix "**cyclo**"

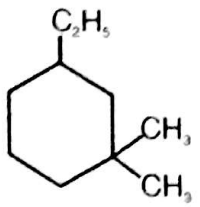
Ex.  Cyclobutane

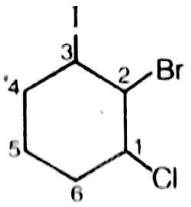
 Cyclopentene

(2) The numbering of the carbon atoms in the ring is done in such a way that the substituent which comes firs the alphabetical order is given the lowest possible number and it does not violate the lowest set of locants r

Ex.  1–Ethyl–3–methyl cyclohexane

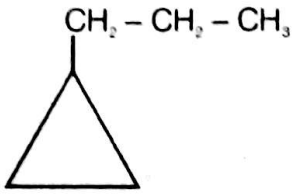
 2–Ethyl–1,4–dimethyl cyclohexane

 3–Ethyl–1,1–dimethyl cyclohexane

 2–Bromo–1–chloro–3–iodocyclohexane

(3) When the ring contains more or equal number of carbon atoms than the alkyl group attached to it, then it named as a derivative of cycloalkane and the alkyl group is treated as substituent

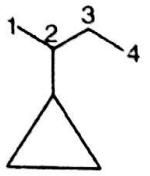
Ex.



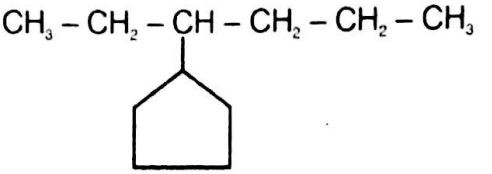
Propylcyclopropane

(4) The alkane chain contains greater number of carbon atoms than present in the ring, then the compound considered as the derivative of alkane and the ring is designated as substituent.

Ex.



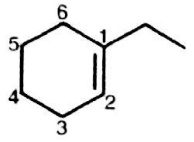
2–Cyclopropylbutane



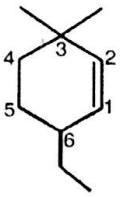
3–Cyclopentylhexane

(5) If ring has unsaturation and side chain is saturated then ring is selected as parent chain.
If side chain has unsaturation and ring is saturated then side chain is selected as parent chain.
If both have unsaturation the chain with maximum unsaturation has selected as parent chain.
If equal unsaturation then longest chain is selected as parent chain.
If unsaturation and number of carbon atoms both are equal then ring is selected as parent chain.

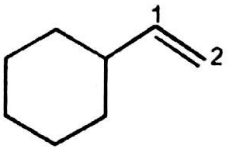
Ex.



1-Ethylcyclohex-1-ene



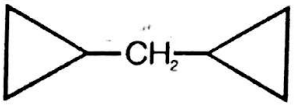
6-Ethyl-3,3-dimethylcyclohex-1-ene



Cyclohexyl ethene

(6) If more than one alicyclic ring is attached to a single chain then the compound is named as a derivative alkane and the ring are treated as a substituent group.

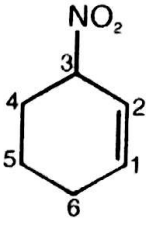
Ex.



Dicyclopropylmethane

(7) If a multiple bond and some other substitutents are present in the ring, the numbering is done in such a wa that the multiple bond gets the lowest number

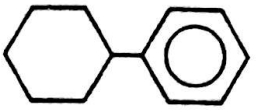
Ex.



3-Nitrocyclohex-1-ene

(8) If a compound contains an alicyclic ring directly linked to the benzene ring. It is named as a derivative benzene.

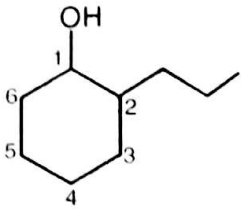
Ex.



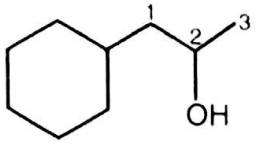
Cyclohexylbenzene

(9) If functional group is present in cyclic compounds then the main chain is taken in which principal functional lie's, if the principal functional group is present in ring also then main chain will be taken for the maximum no. of carbon atoms.

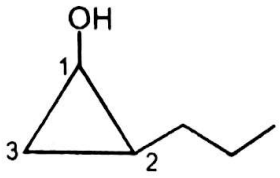
Ex.



2-Propylcyclohexan-1-ol



1-Cyclohexylpropan-2-ol

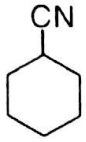


2-Propyl cyclopropan-1-ol

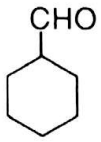
(10) When chain terminating functional group is directly attached with ring then ring is taken as parent chain & special suffix is used for this functional group.

Functional Group	Suffix
CHO	Carbaldehyde
COOH	Carboxylic Acid
COX	Carbonyl halide
COOR	Alkyl Carboxylate
$CONH_2$	Carboxamide
CN	Carbonitrile

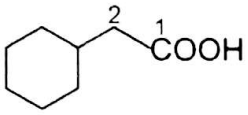
Ex.



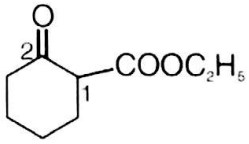
Cyclohexanecarbonitrile



Cyclohexanecarbaldehyde



2-Cyclohexyl ethanoic acid



Ethyl 2–oxocyclohexane–1–carboxylate

Th10: IUPAC nomenclature of compounds containing functional groups

10.1 Rules for non chain terminating functional groups

(1) **Parent chain :** Select the longest possible chain with maximum functional group and maximum unsaturation without caring whether it also denotes the longest possible chain or not.

Ex. $\overset{4}{CH_3} - \overset{3}{CH_2} - \overset{2}{CH}(\overset{1}{CH_2OH}) - CH_2 - CH_3$ 2-Ethyl butan-1-ol

(Parent chain contains four rather than five carbon atoms)

(2) **Lowest number for the functional group**

Numbering is done from that side of the chain which gives lowest locant to the principle functional group followed by double and triple bonds.

Ex.

$\overset{6}{CH_3} - \overset{5}{CH}(\overset{}{CH_3}) - \overset{4}{CH_2} - \overset{3}{C}(=O) - \overset{2}{CH_2} - \overset{1}{CH_3}$ (I) correct

5-Methyl hexan-3-one

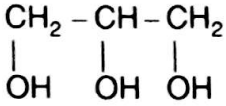
($>C=O$ group gets lowest number 3)

$\overset{1}{CH_3} - \overset{2}{CH}(\overset{}{CH_3}) - \overset{3}{CH_2} - \overset{4}{C}(=O) - \overset{5}{CH_2} - \overset{6}{CH_3}$ (II) wrong

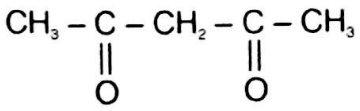
($>C=O$ group gets number 4 which is not lowest)

(3) If a compound contains two or more like groups, the numerical prefixes di, tri, tetra etc. are used

Ex.



Propane – 1,2,3 – triol

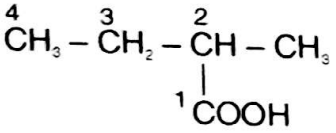


Pentane-2, 4-dione

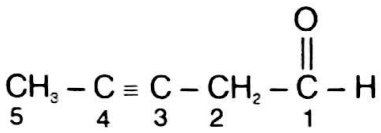
10.2 Rules for chain terminating functional groups

(1) When a chain terminating functional group such as – CHO, – COOH, –COOR, $-CONH_2$, –COCl, $-C\equiv N$ etc. is present, it is always given number 1 (one.)

Ex.

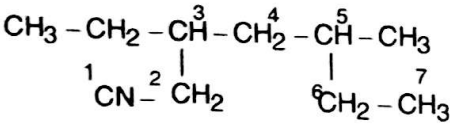


2-Methylbutan-1-oic acid



Pent-3-yn-1-al

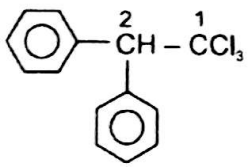
Que. Write the IUPAC name of



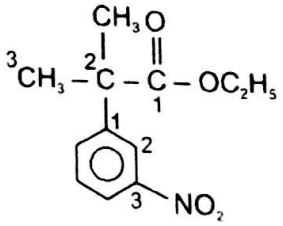
Sol.

1. The longest chain containing functional group is of **7** carbon atoms. Therefore, the word root is hept & the chain is numbered as shown.
2. There is no multiple bond in it. Hence, the primary suffix is **ane**.
3. The functional groups is –CN. Hence, secondary suffix is **nitrile**
4. Moreover, there is a methyl group on carbon 5 and ethyl group on carbon 3.
5. The IUPAC name is, therefore, **3-Ethyl-5-methylheptanenitrile**

(2) The name for benzene as substituent is phenyl. In case the phenyl ring is further substitued, the carbon atoms of the ring directly attached to the parent chain in such a ways that the substituent on the ring gets the least possible number. For example



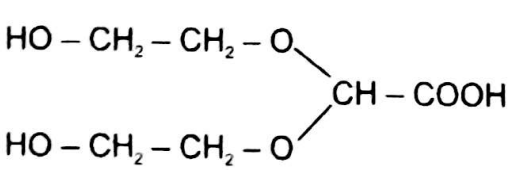
1,1,1-Trichloro-2,2-diphenylethane



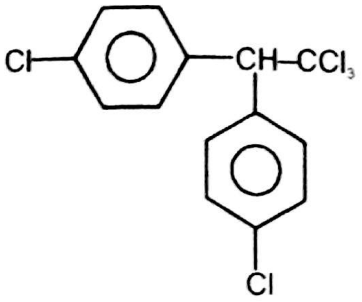
Ethyl- 2-methyl-2-(3-nitrophenyl) propanoate

(3) If the organic molecule contains more than one similar complex substitutents, then the numeral prefixes such as di, tri, tetra etc. are replaced by bis, tris, tetrakis etc. respectively.

Ex.



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

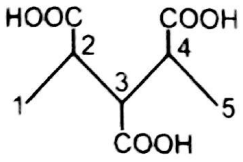
Ex. 

(IUPAC NAME)

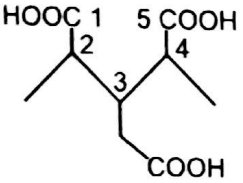
1,1,1–Trichloro–2,2–bis(4–chlorophenyl)ethane

Common name is D.D.T. (Dichloro diphenyl trichloro ethane) & is used as insecticide.

(4) When 3 or more principle functional groups are directly attached with an open chain, then special suffix is used.

Ex. 

Pentane- 2,3,4–tricarboxylic acid.

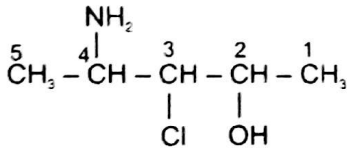
Not true for 

3-Carboxymethyl-2,4- dimethylpentanedioic acid

10.3 Rules for IUPAC nomenclature of polyfunctional compounds :

(1) When an organic compound contains two or more different functional groups then senior functional group is selected as the principal functional group while other functional groups are treated as substituents.

(2) Some functional group such as all halo groups (fluoro, bromo, chloro, iodo), nitroso (NO) nitro ($-NO_2$) and alkoxy (–OR) are always treated as substituent groups.

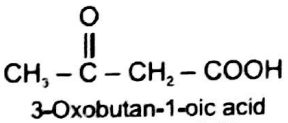
Ex. 

4-Amino-3-chloropentan-2-ol

(– NH_2 & – Cl group treated as substituent)

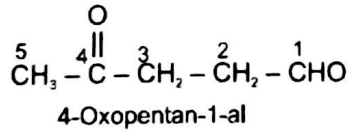
Numbering the principal chain order is

[Principal functional group > double bond > triple bond > substituents]

Ex. 

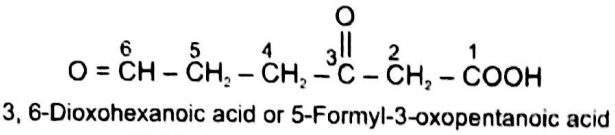
3-Oxobutan-1-oic acid

[– COOH > – CO]



4-Oxopentan-1-al

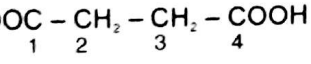
[– CHO > C=O]



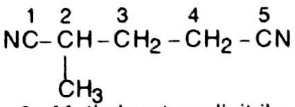
3, 6-Dioxohexanoic acid or 5-Formyl-3-oxopentanoic acid

[COOH > C & CHO]

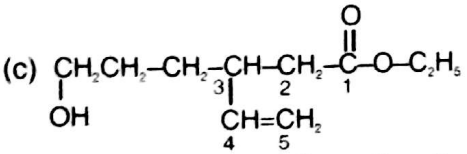
(3) If more than one same chain terminating group are present then the principal chain is selected including the functional groups and numbring is done from that side which gives lowest locant to unsaturation and substituents.

Ex. (a) 

Butane-1, 4-dioic acid

(b) 

2 – Methylpentanedinitrile

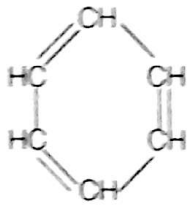
(c) 

Ethyl-3-(3-hydoxy propyl) pent-4-enoate

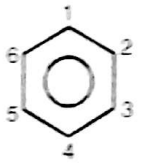
Parent chain contains five rather than six carbon atoms.

Th11: Nomenclature of aromatic compounds

The aromatic compounds are cyclic compounds which contain one or more benzene type rings. Benzene is the simplest hydrocarbon of aromatic series which has planar cyclic ring of six carbon atoms having three double bonds in alternate positions as shown below.



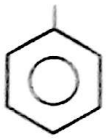
or



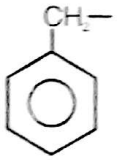
(i) Nuclear substituted : The functional group is directly attached to the benzene ring, in the IUPAC system they are named as derivatives of benzene. The position of the substituents in disubstituted benzenes are indicated either by prefixes such as o-(ortho) for 1,2,m-(meta) for 1, 3 and p-(para) for 1, 4 positions. However, many of their common names have also been adopted by the IUPAC system.

(ii) Side chain substituted : If functional group is present in the side chain of the benzene ring in the IUPAC system, these are usually named as phenyl derivatives of the corresponding aliphatic compounds. The IUPAC and common names of a few important members of each family are given below.

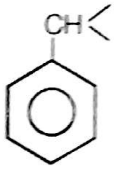
1. Aryl groups :



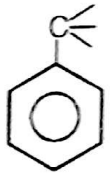
Phenyl



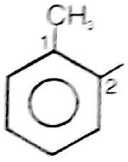
(Benzyl)



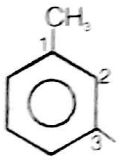
(Benzal)



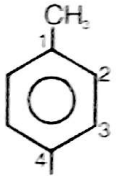
(Benzo)



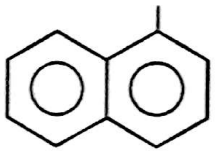
2 – Tolyl
or (o – Tolyl)



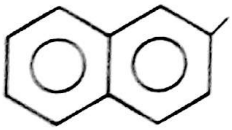
3 – Tolyl
or (m – Tolyl)



4 – Tolyl
or (p – Tolyl)

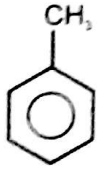
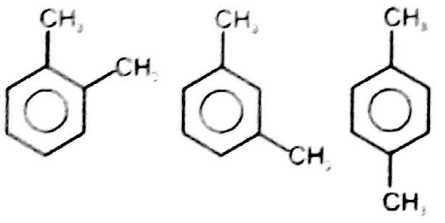


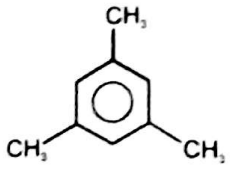
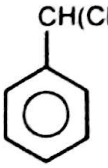
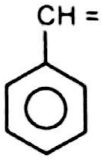
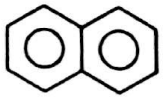
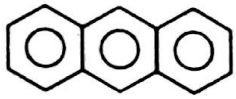
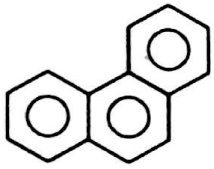
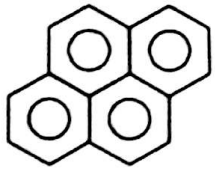
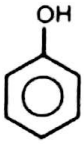
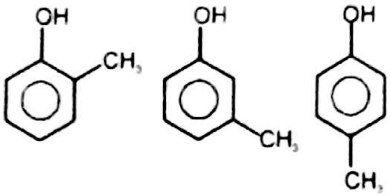
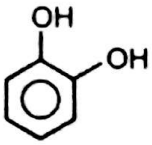
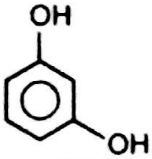
α-Naphthyl

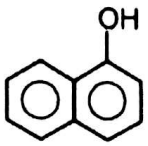
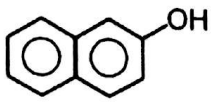
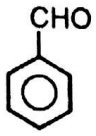
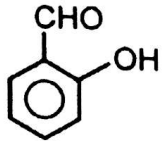
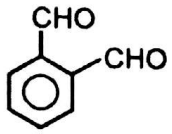
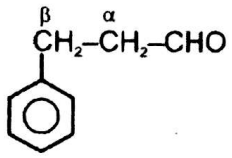
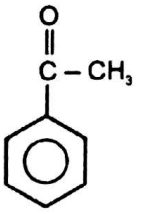
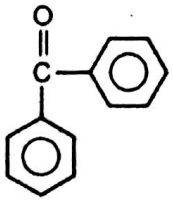
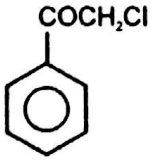


β-Naphthyl

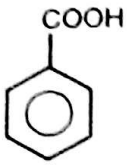
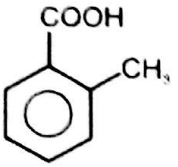
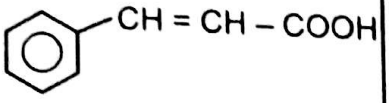
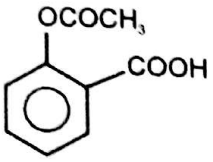
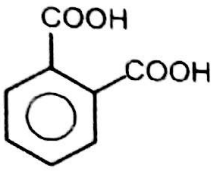
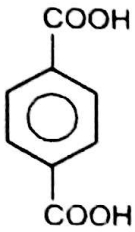
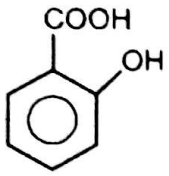
2. Other aromatic examples

S.No.	Compounds	Common Name	IUPAC Name
	Aromatic Hydrocarbons :		
1.		Toluene	Methylbenzene or Toluene
2.		Xylene (o,m,p)	(o,m,p) Dimethylbenzene

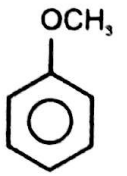
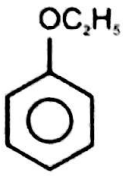
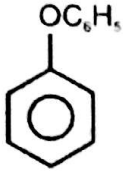
S.No.	Compounds	Common Name	IUPAC Name
3.		Mesitylene	1,3,5 – Trimethyl benzene
4.		Cumene	Isopropylbenzene
5.		Styrene	Phenyl ethene or Ethenylbenzene
6.		Naphthalene	Naphthalene
7.		Anthracene	Anthracene
8.		Phenanthrene	Phenanthrene
9.		Pyrene	Pyrene
	Aromatic Alcohols :		
10.		Carbolic acid	Phenol
11.		(o, m, p) cresol	Methylphenol
12.		Catechol	Benzene-1,2-diol
13.		Resorcinol	Benzene-1,3-diol

14.		Hydroquinol	Benzene-1,4-diol
15.		α-Naphthol	Naphthalen-1-ol
16.		β-Naphthol	Naphthalen-2-ol
	Aromatic Aldehydes :		
17.		Oil of bitter almonds	Benzenecarbaldehyde
18.		Salicylaldehyde	2 – Hydroxy benzaldehyde (2 – Hydrobenzene carbaldehyde)
19.		Phthalaldeyde	Benzene-1, 2-dicarbaldehyde
20.		β-phenylpropionaldehyde	3-Phenylpropanal
	Aromatic Ketones :		
21.		Acetophenone	Acetophenone
22.		Bennzophenone	Benzophenone (Diphenylketone)
23.		Phenacyl chloride	Chloroacetophenone

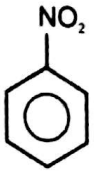
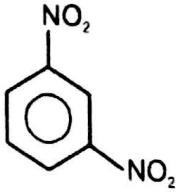
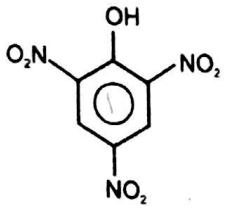
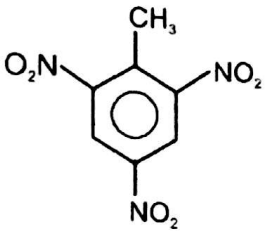
Aromatic Acids :

24.		Benzoic acid	Benzenecarboxylic acid (Benzoic acid)
25.		o-toluic acid	2 – Methylbenzene carboxylic acid
26.		Cinnamic acid	3–Phenylprop–2–enoic acid
27.		Aspirin (Acetyl salicylic acid)	2-Ethanoyloxybenzene carboxylic acid
28.		Pthalic acid	Benzene 1,2–dicarboxylic acid
29.		Terephthalic acid	Benzene 1,4–dicarboxylic acid
30.		Salicylic acid	2-Hydroxybenzene carboxylic acid

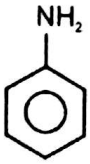
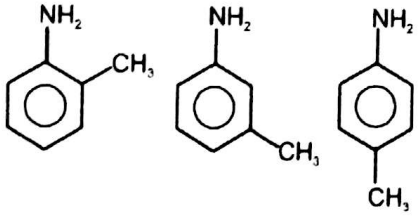
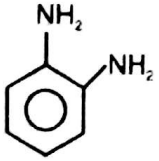
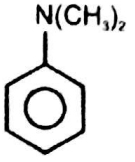
Aromatic Ethers :

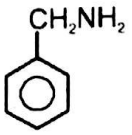
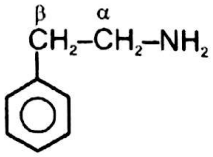
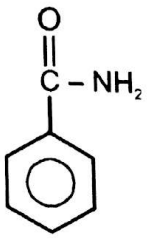
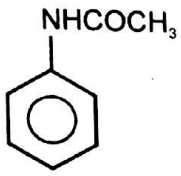
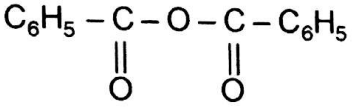
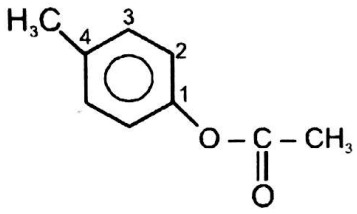
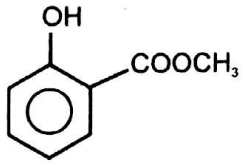
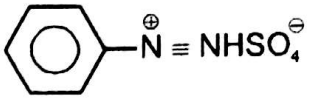
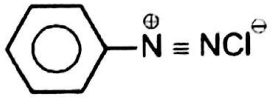
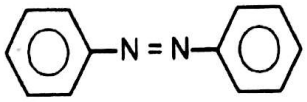
31.		Anisole	Methoxybenzene
32.		Phenetol	Ethoxybenzene
33.		Diphenyl ether	Phenoxybenzene

Aromatic Nitro Compounds :

34.		Oil of mirbane	Nitrobenzene
35.		—	1,3 – Dinitrobenzene (m – Dinitrobenzene)
36.		Picric acid	2,4,6 –Trinitrophenol
37.		—	2,4,6 – Trinitrotoluene(TNT) an explosive

Aromatic Amines :

38.		Aniline	Aniline (Benzenamine)
39.		(o, m, p) Toluidine	Methylaniline
40.		o-Phenylenediamine	Benzene-1,2-diamine
41.		N,N–Dimethylaniline	N,N–Dimethylbenzenamine

	Aromatic Alkyl Amines :		
42.		Benzylamine	Phenylmethanamine
43.		β-Phenyl ethyl amine	2-Phenylethanamine
	Aromatic Amides :		
44.		Benzamide	Benzenecarboxamide
45.		Acetanilide	N-Phenylethanamide
	Aromatic Anhydrides :		
46.		Benzoic anhydride	Benzenecarboxylic anhydride
	Aromatic Esters :		
47.		—	4–Methylphenyl ethanoate
48.		Oil of winter green (Methyl salicylate)	Methyl 2 – hydroxy benzenecarboxylate
	Arenediazonium Salts :		
49.		—	Benzene diazonium hydrogen sulphate
50.		—	Benzene diazonium chloride
51.		—	Diazobenzene