01 Classification and Nomenclature

Vital Force Theory (VFT) : By Berzelius in 1815

Upto 1815, any organic compound could not be synthesized in laboratory. So Berzelius suggested that there is a mysterious force in living organisms which was named as Vital Force and said that organic compounds cannot be synthesized in laboratory. This theory was called as vital force theory (VFT).
But in 1828 a German scientist Wohler synthesized an organic compound in laboratory which was 'urea', so VFT was failed. Urea was synthesized in lab by heating of ammonium cyanate (NH_4CNO).

$$\underset{\text{Ammonium cyanate}}{NH_4CNO} \xrightarrow[\text{Rearrangement}]{\Delta} \underset{\text{Urea}}{NH_2-\overset{\overset{O}{\|}}{C}-NH_2}$$

Organic Compounds

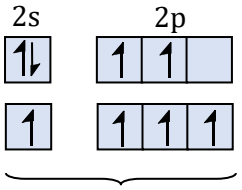
Hydrocarbons and their derivatives are called as organic compounds.

Tetravalency of Carbon

Atomic number of carbon atom is 6 and it has four valence electrons so C-atom is tetravalent.

In ground state **(here covalency of carbon is 2)**

First excited state **(here covalency of carbon is 4)**



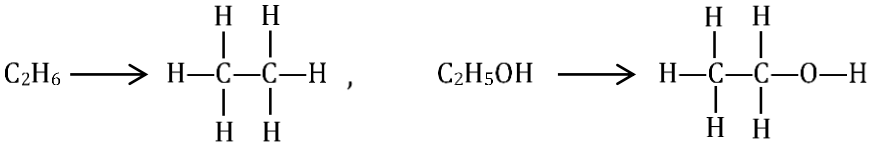
Available for bond formation

Representation of Organic Compound

(i) Molecular Formula:

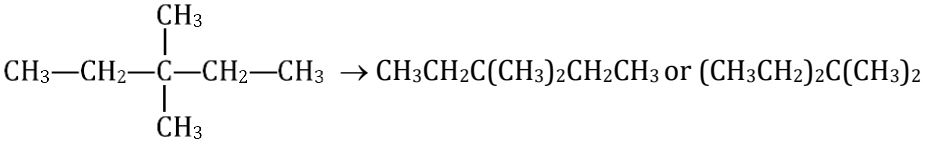
C_2H_6, C_2H_6O

(ii) Structural Formula:



(iii) Condensed Structural Formula:

$CH_3CH_2CH_2CH_2CH_3 \rightarrow CH_3(CH_2)_3CH_3$



$\rightarrow CH_3CH_2C(CH_3)_2CH_2CH_3$ or $(CH_3CH_2)_2C(CH_3)_2$

(iv) Bond-Line Formula:

In this system C-H bond and C–C bond are represented by lines.

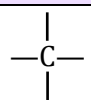
(1) $CH_3-\underset{}{\overset{}{CH_2}}-CH_3$ ⇒ 

(2) $CH_3—C\equiv C—CH_3$ ⇒ 

(3) $CH_3-CH=CH-Cl$ ⇒ 

(4) $CH_3-CH_2-CH_2-C\equiv CH$ ⇒ 

Hybridisation

Structure	σ and π bonds	Hybridisation	Bond angle	Shape
	4, 0	sp^3	109°28'	Tetrahedral
	3, 1	sp^2	120°	Planar (Trigonal)
—C≡	2, 2	sp	180°	Linear
=C=	2, 2	sp	180°	Linear

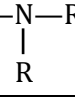
Type of Carbon and Hydrogen

(i) **1° or Primary Carbon/1° Hydrogen :-** Carbon atom attached to no other carbon or to only one carbon is called primary carbon. Hydrogen atom attached with 1° or primary carbon.

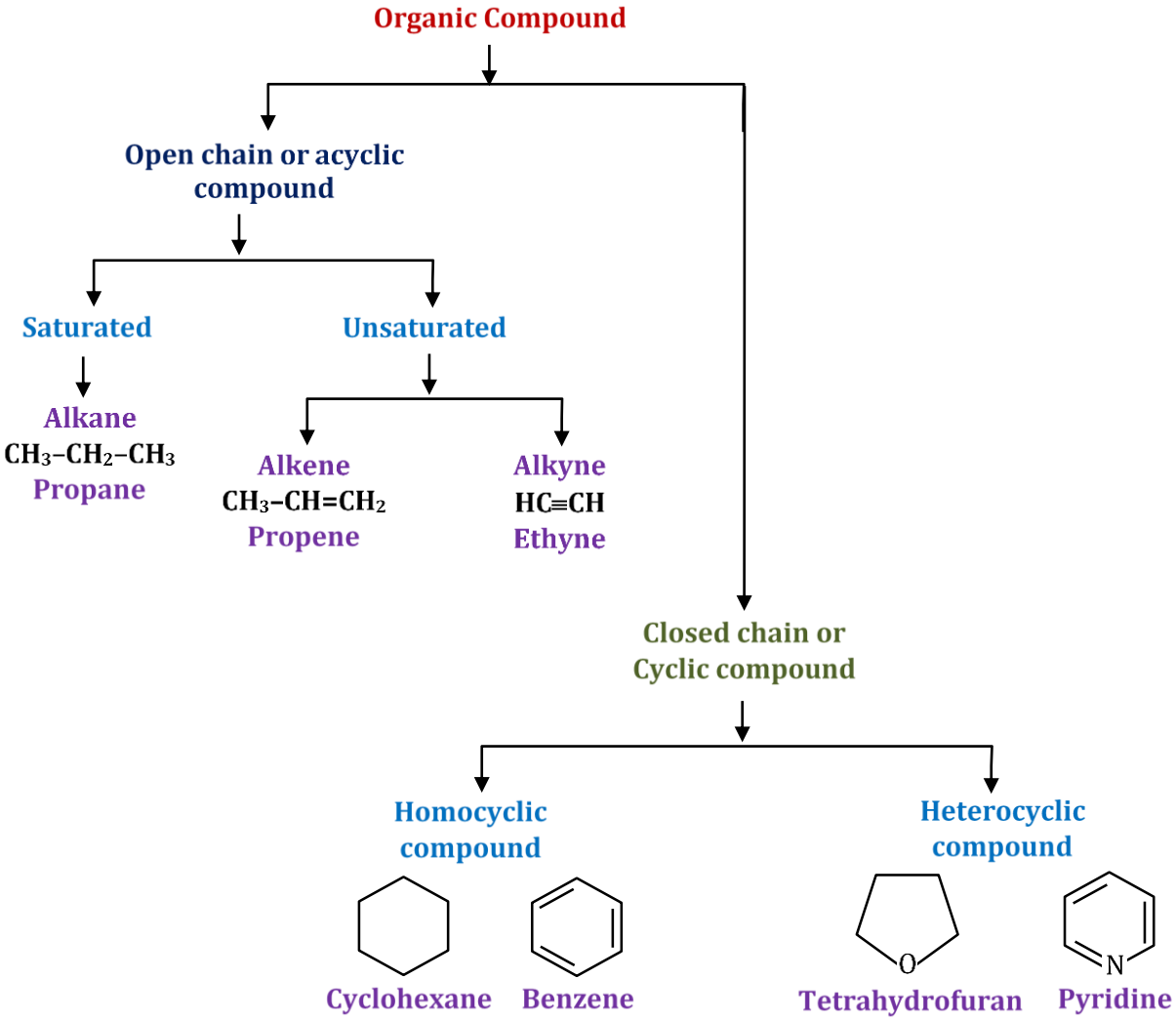
(ii) **2° or Secondary Carbon/2° Hydrogen :-** Carbon atom directly attached to two carbon atoms is known as 2° or secondary carbon. Hydrogen atom attached with 2° or secondary carbon.

(iii) **3° or Tertiary Carbon/3° Hydrogen :-** Carbon atom directly attached to three other carbon atoms is known as 3° or tertiary carbon. Hydrogen atom attached with 3° or tertiary carbon.

(iv) **4° or Quaternary Carbon :-** Carbon atom directly attached with four other carbon is known as 4° or quaternary carbon.

S.No.	Functional Group	(Common name)
1.	R—X	Alkyl halide
2.	R—OH	Alkyl alcohol
3.	$R—NH_2$	Alkyl amine
4.	R—CN	Alkyl cyanide
5.	R—NC	Alkyl isocyanide
6.	R—O—R	Dialkyl ether
7.	R—NH—R	Dialkyl amine
8.		Trialkyl amine
9.		Dialkyl ketone

Classification of Organic Compounds



Homologous Series

A group or class of organic compounds which containing same functional group with increasing molecular weight, constitutes a homologous series.

(a) The various members are called homologue.

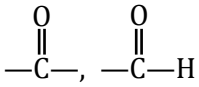
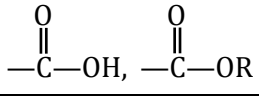
(b) Two successive homologues differ by $>CH_2$ group or 14 molecular weight.

(c) All the homologues can be prepared by similar methods.

(d) Homologues have similar chemical properties but there is a regular change in physical properties like melting point, boiling point etc.

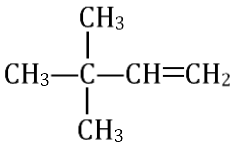
(e) All the members can be represented by same general formula.

Table: Homologous series and functional group

S.No.	Homologous series	General formula	Functional group
1.	Alkanes	C_nH_{2n+2}	—
2.	Alkenes (and Cycloalkane)	C_nH_{2n}	=
3.	Alkynes (and cycloalkene)	C_nH_{2n-2}	≡
4.	Alkylhalides	$C_nH_{2n+1}X$	—X
5.	Alcohol and Ether	$C_nH_{2n+2}O$	—OH, —O—
6.	Aldehyde and Ketone	$C_nH_{2n}O$	
7.	Carboxylic acid and Esters	$C_nH_{2n}O_2$	

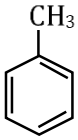
BEGINNER'S BOX-1

1. How many 1°C, 2°C, 3°C and 4°C are present in following compound?

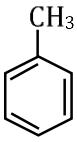


(1) 4, 1, 0, 1 (2) 3, 2, 0, 1 (3) 2, 2, 1, 1 (4) 3, 2, 1, 0

2. How many 1°C, 2°C, 3°C and 4°C are present in following compound?



(1) 1, 5, 1, 0 (2) 2, 4, 0, 1 (3) 4, 2, 1, 0 (4) 1, 5, 0, 1

3. How many 1°, 2° & 3° H atoms are present in  [Toluene] respectively :-

(1) 3, 0, 5 (2) 3, 5, 0 (3) 4, 3, 0 (4) 0, 5, 3

4. What is hybridisation of each carbon atom in following compound

$HC\equiv C-CH=CH-CH_3$

(1) sp, sp^2, sp^2, sp^2, sp^3 (2) sp, sp, sp^2, sp^2, sp^3

(3) sp, sp, sp^2, sp^3, sp^3 (4) sp, sp^2, sp^2, sp^3, sp^3

5. Which one is not correct for a homologous series –

(1) All members have a general formula

(2) All members have same chemical properties

(3) All members have same physical properties

(4) All members have same functional group

Common Name

1. Hydrocarbon

(i) Alkanes

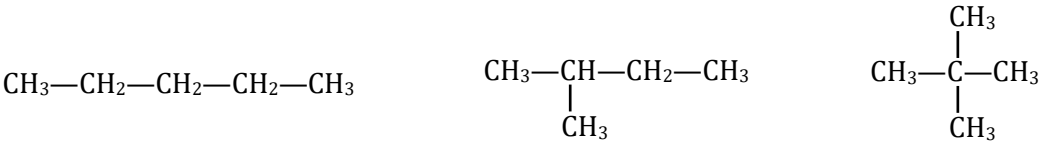
When more than one structure is possible from same molecular formula then we use n, iso, neo to distinguish between them.

'n' prefix – It is used for unbranched chain

'iso' prefix – If molecule has $CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}—$ unit with no further branching.

'neo' prefix – If molecule has $CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}—CH_2—$ unit with no further branching.

Note: Minimum 5C are required for 'neo' prefix. (4° C is must)



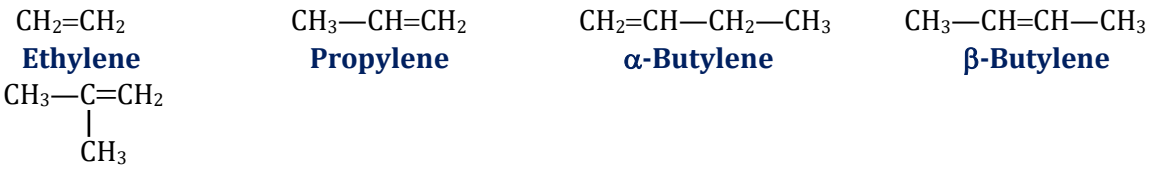
n-Pentane **Isopentane** **Neopentane**

(ii) Alkenes

Common name of Alkene $\longrightarrow$ Alk + ylene

$\downarrow$

No. of carbon



Ethylene **Propylene** **α-Butylene** **β-Butylene**

Isobutylene

Use α, β, γ, δ..... for position of double bond.

(iii) Alkynes

$HC\equiv CH$

Acetylene

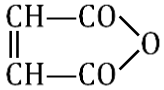
BEGINNER'S BOX-2

1. How many carbon atom are present in third homologue of methyl ether.

(1) 1 (2) 2 (3) 3 (4) 4

2. Which of the following is not a hetero cyclic compounds

(1) Thiophene (2) Furane (3) Benzene (4) Pyridine

3. In structure  , how many hetero atoms are present ?

(1) 1 (2) 2 (3) 3 (4) 4

2. Hydrocarbon Derivatives

(i) System A (Radical dependent)

(ii) System B (Radical independent) (Carbon containing functional group mainly)

Note: Cyanides and isocyanides can be named through both system

Radical ⟶ Removal of hydrogen from a hydrocarbon forms a radical

Alkane $\xrightarrow{-H}$ Alkyl

$CH_4 \xrightarrow{-H} H_3C-$ **Methyl**

$CH_3-CH_3 \xrightarrow{-H} CH_3-CH_2-$ **Ethyl**

$CH_3-CH_2-CH_3 \xrightarrow{-H} CH_3-CH_2-CH_2-$ **n-Propyl**

$CH_3-CH_2-CH_3 \xrightarrow{-H} CH_3-\underset{|}{CH}-CH_3$ or $CH_3-\underset{|}{\overset{|}{CH}}-CH_3$ **Isopropyl**

Unsaturated radical

$-CH=CH_2$ **Vinyl**

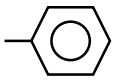
$-CH_2-CH=CH_2$ **Allyl**

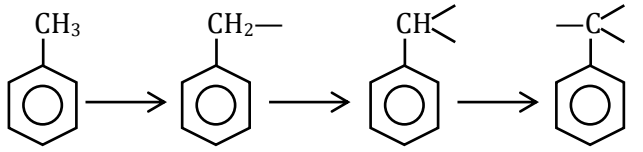
Some other radicals and their names

$CH_3-CH<$ **Ethylidene**

$-\underset{|}{CH_2}-\underset{|}{CH_2}-$ **Ethylene**

$CH_2<$ **Methylidene/ Methylene**

 **Phenyl**



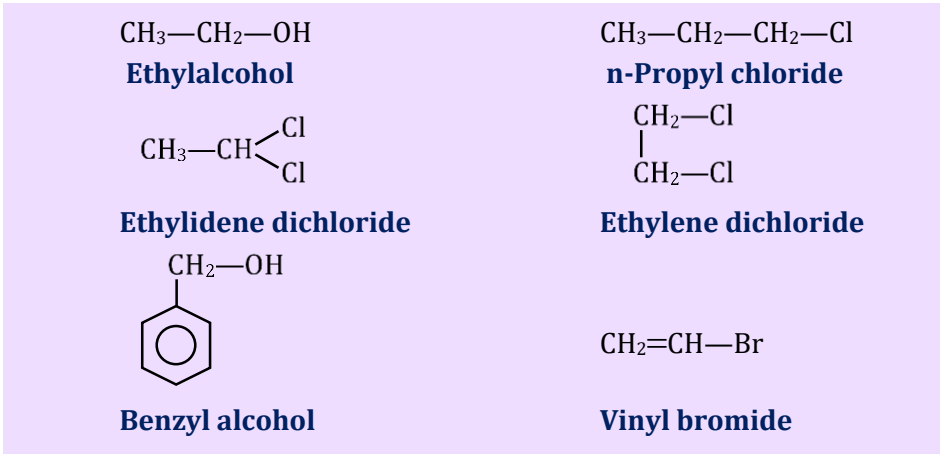
Toluene **Benzyl** **Benzal** **Benzo**

(i) System A (Radical dependent)

(Mainly non-carbon containing functional groups except ketone)

Functional Group	Suffix
—X	halide
—OH	alcohol
$-NH_2$ / —NH— / $-\overset{|}{N}-$	amine
—O—	ether
$-\overset{\|\|}{C}-$ O	ketone
—CN	cyanide
—NC	isocyanide

Format : Radical + Suffix



BEGINNER'S BOX-3

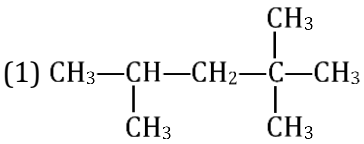
1. Which of the followings is incorrect name :-

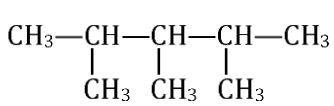
(1) Isopropyl (2) Ter. butyl (3) Neo butyl (4) Neo pentyl

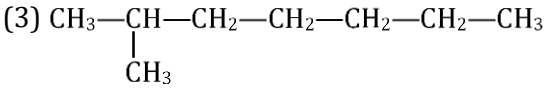
2. Which of the followings is secondary radical :-

(1) $CH_2=CH-$ (2) $(CH_3)_3C-$ (3) C_6H_5- (4) $CH_3-(CH_2)_2-CH_2-$

3. Which of the followings is isooctane :-

(1) 

(2) 

(3) 

(4) None

(ii) System B (Radical independent F.G.)

Functional Group	Suffix
—COOH	ic acid
—C(=O)—X	yl halide
—C(=O)—O—R	alkyl _ _ _ _ _ate
—C(=O)—O—C(=O)—	ic anhydride
—C(=O)—NH_2	amide
—C(=O)—H	aldehyde
—CN	onitrile
—NC	oisonitrile

Format : Prefix + suffix

↓

No. of carbon including functional group carbon

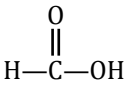
No. of carbon	Name
1	Form
2	Acet
3	Propion
4	Butyr
5	Valer

} Used for system-B

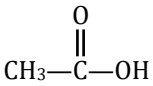
$CH_2=CH-\overset{*}{C}$ **Acryl**

$CH_3-CH=CH-\overset{*}{C}$ **Croton**

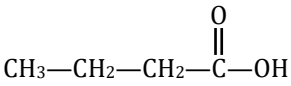
($\overset{*}{C}$ → Functional group containing carbon)



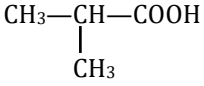
Formic acid



Acetic acid



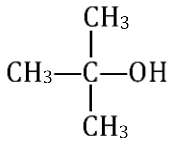
Butyric acid



Isobutyric acid

BEGINNER'S BOX-4

1. Common name of given compound is :-



(1) Neobutyl alcohol
(2) Isobutyl alcohol
(3) Tertiary butyl alcohol
(4) Secondary butyl alcohol

IUPAC Nomenclature

Format for IUPAC name :

s-prefix	+	p-prefix	+	word root	+	p-suffix	+	s-suffix
Substituents With locants		cyclo		Number of carbon atom present in parent carbon chain		– ane – ene – yne		Principal functional group according to priority table

(a) **Locant :** Locants are separated by (,) comma.

- Locants and alphabets are separated by hyphen (–). [2, 3 – Dimethylpentane]
- di, tri, iso, neo and cyclo are neither separated by comma nor by hyphen

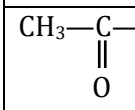
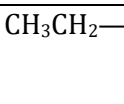
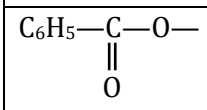
(b) **Prefix :-** According to substituents .

Prefix ← 1° or primary - prefix
Prefix ← 2° or secondary - prefix

Cyclo is 1° prefix and used for cyclic compound.

2° prefix is used for substituents and written before 1° prefix.

For acyclic compounds : 2° prefix + Root word + 1° suffix + 2° suffix.

Substituents	Prefix	Substituents	Prefix
— R	alkyl	— X	halo
— NH_2	amino		nitro
—O—NO	nitrite	— N = O	nitroso
— OCH_2CH_3	ethoxy	— CH_2 – OH	hydroxymethyl
— CH_2—Cl	chloro methyl	— NH – CH_3	methylamino
— S —	thio		
	acetoxy/ethanoyloxy		propanoyloxy
	benzoyloxy	–OR $-OC_6H_5$	alkoxy phenoxy

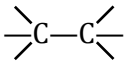
(c) **Word root :** According to number of carbon's in parent C–chain.

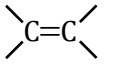
Number of carbons	Root word
1	Meth
2	Eth
3	Prop
4	But
5	Pent

Number of carbons	Root word
6	Hex
7	Hept
8	Oct
9	Non
10	Dec

Number of carbons	Root word
11	Undec
12	Dodec
13	Tridec

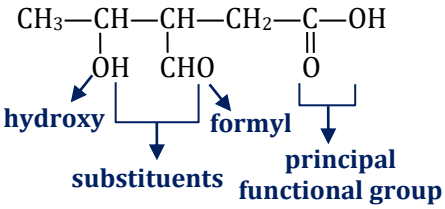
(d) **Primary suffix :-** According to saturation and unsaturation.

 ⟶ **ane**

 ⟶ **ene**

—C≡C— ⟶ **yne**

(e) **Secondary Suffix :-** According to principal functional group.



3-Formyl-4-hydroxypentanoic acid

S. NO.	Functional group	Prefix (2°)	Suffix (2°)
1.	R-COOH	carboxy	-oic acid
2.	R-SO_3H	sulpho	-sulphonic acid
3.	—C(=O)—O—C(=O)—	×	-oic anhydride
4.	—C(=O)—O—R	alkoxycarbonyl	-oate
5.	R-COX	halo formyl	-oyl halide
6.	R-$CONH_2$	carbamoyl	-amide
7.	R-CN	cyano	-nitrile
8.	R-CHO	oxo, formyl	-al
9.	—C(=O)—	oxo, keto	-one
10.	R-OH	hydroxy	-ol
11.	R-SH	Mercapto	-thiol
12.	R-NH_2	Amino	-amine

BEGINNER'S BOX-5

1. Which of the following is considered as primary prefix :-
(1) ene (2) ane (3) cyclo (4) alk

2. Which of the following is considered always as a substitutent :-
(1) Halo group (2) Nitro group (3) Alkyl group (4) All

IUPAC Name System

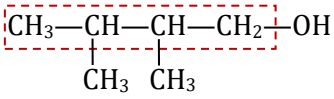
Rules : (A) Selection of longest continuous parent carbon chain.
(B) Numbering in selected parent carbon chain.

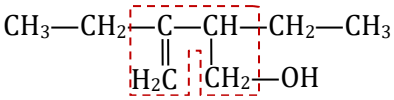
(A) **Selection of longest continuous parent C–chain :**

Subrule (i) : Selection of longest continuous parent C – chain containing functional group + multiple bond + substituents.

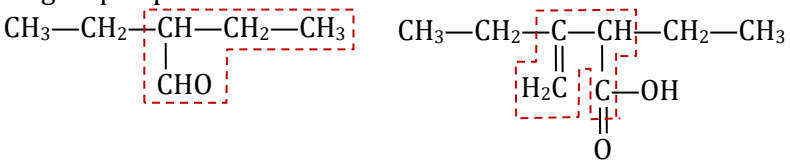
Priority order : Functional group > Multiple bond > Number of C-atom > substituents

Ex.

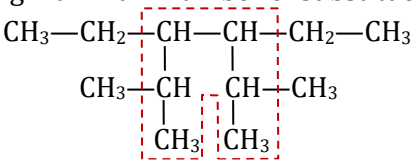




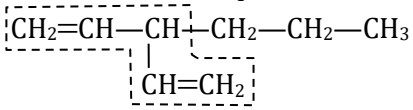
Subrule (ii) : If carbon containing functional group is present then include carbon of that functional group in parent chain.

Ex. 

Subrule (iii) : If more than one equal chains of carbon are possible then select one which containing maximum number of substituents.

Ex. 

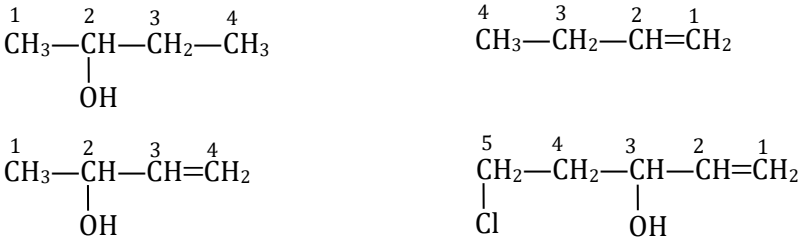
Subrule (iv) : If more than one multiple bonds are present then select one which containing maximum number of multiple bonds.

Ex. 

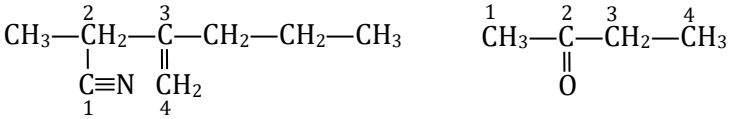
(B) Numbering in selected parent carbon chain :

Subrule (i) : Selected parent carbon chain is numbered from that side from which functional group or multiple bond or substituents gets lowest number.

Priority order : Functional group > Multiple bond > substituents

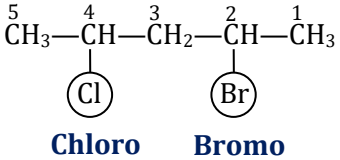
Ex. 

Subrule (ii) : If carbon containing functional group is present then give lowest possible number to carbon of that functional group.

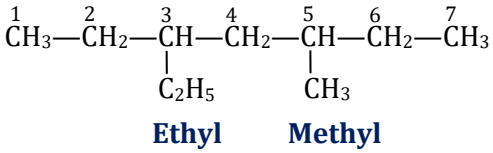
Ex. 

Subrule (iii) : Only for symmetrical conditions

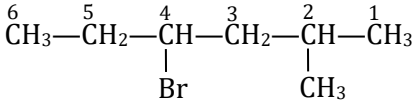
(a) When two or more substituents are present at symmetrical position then follow alphabetical order.

Ex. 

2-Bromo-4-chloropentane.

Ex. 

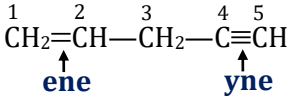
3-Ethyl-5-methylheptane

Ex. 

Not symmetrical position

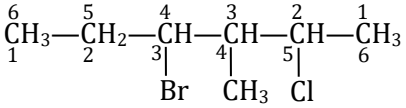
4-Bromo-2-methylhexane

(b) When double bond and triple bond are present at symmetrical position then priority is given to double bond.

Ex. 

Pent-1-en-4-yne

Subrule (iv) : If two or more than two substituents are present at unsymmetrical position then follow lowest number rule.

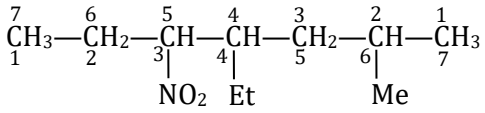
Ex. 

4-Bromo-2-chloro-3-methylhexane

2, 3, 4 right numbering

3, 4, 5 wrong numbering

Ex.



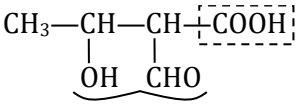
(NO₂ is substituent; not a principal functional group)

4-Ethyl-2-methyl-5-nitroheptane

2, 4, 5 right numbering

3, 4, 6 wrong numbering

Subrule (v) : If more than one functional groups are present then consider senior most as principal functional group and remaining are considered as substituents.

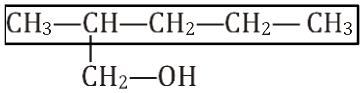
Ex. 

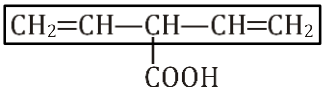
principal functional

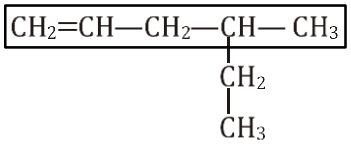
substituent

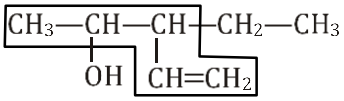
BEGINNER'S BOX-6

1. Which of the following selected chain is correct :-

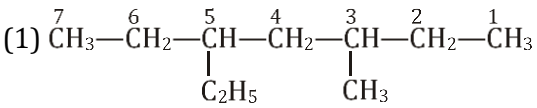
(1) 

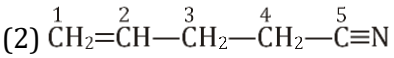
(2) 

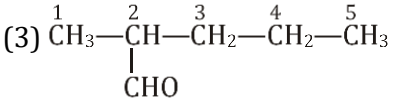
(3) 

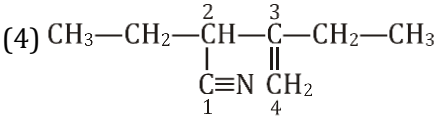
(4) 

2. Which of the following has correct numbering according IUPAC :-

(1) 

(2) 

(3) 

(4) 

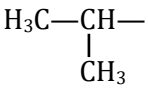
3. Which of the following functional group has highest priority according to priority table :-

(1) –COOR (2) $-CONH_2$ (3) –CHO (4) –OH

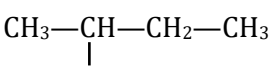
IUPAC Naming of Different Alkyl Groups

Naming of Alkyl Groups (Radical) :

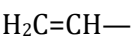
Alkane $\xrightarrow{-H}$ Alkyl Alkene $\xrightarrow{-H}$ Alkenyl Alkyne $\xrightarrow{-H}$ Alkynyl



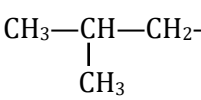
1-Methylethyl (Isopropyl)



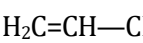
1-Methylpropyl (sec-Butyl)



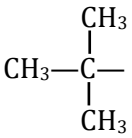
Ethenyl (Vinyl)



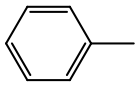
2-Methylpropyl (Isobutyl)



Prop-2-enyl (Allyl)



1,1-Dimethylethyl (tert-Butyl)



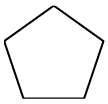
Phenyl

IUPAC Naming of Cyclic Compounds

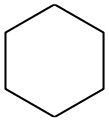
- Selection of parent carbon chain.
  Priority order:
  Principle Functional Group > Multiple bond > No. of carbon atoms > substitutents.
- **Numbering of parent carbon chain:**
  Priority order : Principal Functional group > Multiple bond > Substituents.

Rules of cyclic compounds

(1) IUPAC names of cyclic compounds are given by prefixing cyclo before their parent chain.

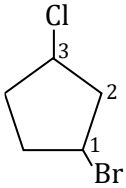


Cyclopentane



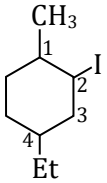
Cyclohexane

(2) If two substituents are present at symmetrical position in cyclic compounds then follow alphabetical order.



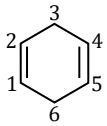
1-Bromo-3-chlorocyclopentane

(3) If more than two substituents are present at unsymmetrical position then numbering should be done according to lowest number rule.



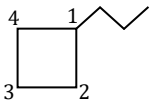
4-Ethyl-2-iodo-1-methylcyclohexane

(4) If multiple bonds are present then consider them between (a) and (a + 1).

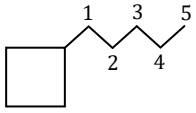


1,4-Cyclohexadiene or Cyclohexa-1,4-diene

(5) If number of C in ring ≥ number of carbon in side chain then parent chain according to ring.



n-Propylcyclobutane



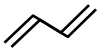
1-Cyclobutylpentane

BEGINNER'S BOX-7

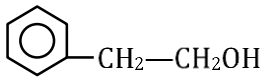
1. The correct triad of molecular formula, bond line notation and IUPAC name is :-

(1) C_2H_4O,  , 1,2-Epoxyethane

(2) C_3H_4O,  Cyclopropanone

(3) C_4H_6,  1,3-Butadiene

(4) C_4H_8,  Cyclobutene

2.  has the IUPAC name :-

(1) Benzyl alcohol

(2) 1-Phenyl ethanol

(3) Hydroxy methyl toluene

(4) 2-Phenyl ethanol

3.  has the name :-

(1) 1,4-Dimethyl cyclohexane

(2) 1,4-Dimethyl benzene

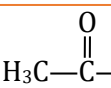
(3) Both the above

(4) None of the above

IUPAC Naming of Hydrocarbon Derivatives

(I) Carboxylic acids (–COOH)

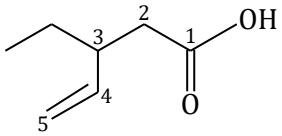
Suffix	**- oic acid**
Special suffix	**- carboxylic acid**
Prefix	**- carboxy**

Illustration 1:  (Acetic acid)

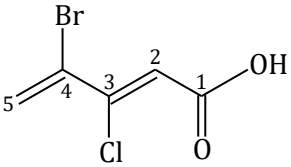
Solution: Ethanoic acid

Illustration 2: $H_3C - CH = CH—COOH$ (Crotonic acid)

Solution: But-2-enoic acid

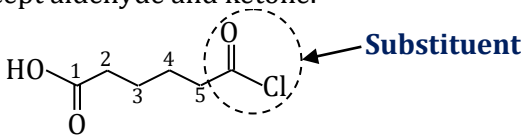
Illustration 3: 

Solution: 3-Ethylpent-4-enoic acid

Illustration 4: 

ion: 4-Bromo-3-chloropenta-2,4-dienoic acid

Note: If carbon containing functional group is used as a substituent then its 'C' is not included in PCC except aldehyde and ketone.

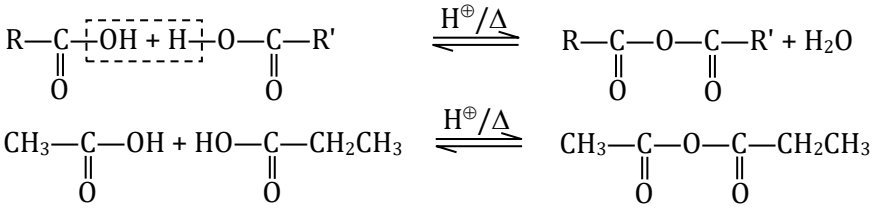


5-Chloroformylpentanoic acid
or
5-Chlorocarbonylpentanoic acid

(II) Acid Anhydride $(-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-)$

Suffix	–	**oic anhydride**
Special suffix	–	**carboxylic anhydride**

Formation of acid anhydride



Ethanoic acid Propanoic acid **Ethanoic propanoic anhydride**

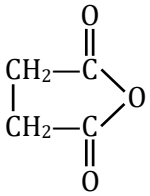
Illustration 5: $H-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-H$

Solution: Methanoic anhydride.

Illustration 6: $CH_3-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-CH_3$

Solution: Ethanoic anhydride.

Illustration 7:

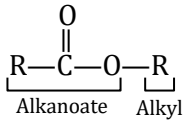


(Succinic anhydride)

Solution: Butane-1,4-dioic anhydride

(III) Ester $(-\overset{O}{\overset{\|}{C}}-OR)$

Suffix	–	**oate**
Special suffix	–	**carboxylate**
Prefix	–	**alkoxycarbonyl**



(Alkylalkanoate)

Illustration 8: $\overset{2}{CH_3}\overset{1}{COOCH_3}$

Solution: Methylethanoate

Illustration 9: $H-\overset{\overset{O}{\|}}{\underset{1}{C}}-O-CH_3$

Solution: Methylmethanoate

Illustration 10: $\overset{3}{CH_3}-\overset{2}{\underset{\underset{Br}{|}}{CH}}-\overset{\overset{O}{\|}1}{C}-O-CH_3$

Solution: Methyl-2-bromopropanoate

(IV) Acid Halide ($R-\overset{\overset{O}{\|}}{C}-X$)

Suffix	**–**	**oyl halide**
Special suffix	**–**	**carbonyl halide**
Prefix	**–**	**halocarbonyl/haloformyl**

Illustration 11: $\overset{2}{CH_3}-\overset{\overset{O}{\|}1}{C}-Cl$

Solution: Ethanoyl chloride

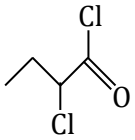
Illustration 12: $\overset{4}{CH_3}-\underset{\underset{OH}{|}}{\overset{3}{CH}}-\overset{2}{CH_2}-\underset{\underset{O}{\|}}{\overset{1}{C}}-Cl$

Solution: 3-Hydroxybutanoyl chloride

Illustration 13: $\overset{4}{CH_3}-\overset{3}{CH}=\overset{2}{CH}-\underset{\underset{O}{\|}}{\overset{1}{C}}-Br$

Solution: But-2-enoyl bromide

Illustration 14:



Solution: 2-Chlorobutanoyl chloride

(V) Amide ($-\overset{\underset{O}{\|}}{C}-NH_2$)

Suffix	**- amide**
Special suffix	**- carboxamide**
Prefix	**- carbamoyl/aminocarbonyl**

Illustration 15: $CH_3-\underset{\underset{O}{\|}}{C}-NH_2$

Solution: Ethanamide

Illustration 16: $H-\overset{\overset{O}{\|}}{C}-NH_2$

Solution: Methanamide

Illustration 17: $CH_3—NH—CHO$

Solution: N-Methylmethanamide

Illustration 18: $H_2N—\overset{\overset{\large O}{\|}}{C}—NH_2$

(Urea)

Solution: Aminomethanamide

(VI) Cyanide (-CN)

Suffix	-	**nitrile**
Special Suffix	-	**carbonitrile**
Prefix	-	**cyano**

Illustration 19: $\overset{2}{C}H_3—\overset{1}{C}N$

Solution: Ethanenitrile

Illustration 20: $\overset{4}{C}H_3—\overset{3}{C}H_2—\overset{2}{C}H_2—\overset{1}{C}N$

Solution: Butanenitrile

Illustration 21: $H—\underset{\underset{\large O}{\|}}{\overset{2}{C}}—\overset{1}{C}N$

Solution: 2-Oxoethanenitrile

(VII) Aldehyde (–CHO)

Suffix	-	**al**
Special Suffix	-	**carbaldehyde**
Prefix	-	**formyl/oxo**

Illustration 22: $H—\overset{\overset{\large O}{\|}}{C}—H$

Solution: Methanal

Illustration 23: $\overset{2}{C}H_3—\overset{\overset{\large O}{1\|}}{C}—H$

Solution: Ethanal

Illustration 24: $\overset{3}{C}H_2=\overset{2}{C}H—\overset{1}{C}HO$

(Acrylaldehyde)

Solution: Prop-2-enal

Illustration 25: $\overset{4}{C}H_3—\overset{3}{C}H=\overset{2}{C}H—\overset{1}{C}HO$

(Crotonaldehyde)

Solution: But-2-enal

Rules:

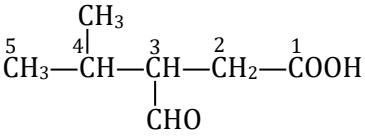
If –CHO group is treated as a substituent then

(i) If 'C' of –CHO is included in parent carbon chain (PCC) then 'oxo' prefix is used.

(ii) If 'C' of –CHO is not included in PCC then 'formyl' prefix is used.

Illustration 26: $\underset{\underset{^{4}CHO}{|}}{\overset{3}{C}H_2}—\overset{2}{C}H_2—\overset{1}{C}OOH$

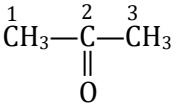
ion: 4-Oxobutanoic acid

Illustration 27: 

Solution: 3-Formyl-4-methylpentanoic acid

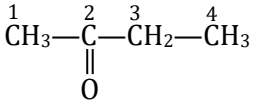
(VIII) Ketone 

Suffix - one
Prefix - oxo/keto

Illustration 28: 

(Acetone)

Solution: Propanone

Illustration 29: 

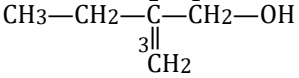
Solution: Butan-2-one

(IX) Alcohol (–OH)

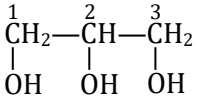
Suffix - ol
Prefix - hydroxy

Illustration 30: $CH_3—OH$

Solution: Methanol

Illustration 31: 

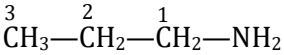
Solution: 2-Ethylprop-2-en-1-ol

Illustration 32: 

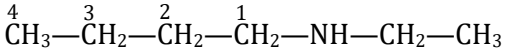
Solution: Propane-1,2,3-triol

(X) Amine ($–NH_2$)

Suffix - amine
Prefix - amino

Illustration 33: 

Solution: Propan-1-amine

Illustration 34: 

Solution: N-Ethylbutan-1-amine

(XI) Ether (R-O-R/R') [Alkoxyalkane]

Illustration 35: $CH_3—O—CH_3$

Solution: Methoxymethane

Illustration 36: $CH_3—O—\overset{1}{C}H_2—\overset{2}{C}H_3$

Solution: Methoxyethane

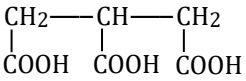
Illustration 37: $CH_3—O—\overset{1}{C}H_2—\overset{2}{C}H_2—O—CH_3$

Solution: 1,2-Dimethoxyethane

Rules for using special suffix

(a) If more than two same carbon containing functional groups are present then their carbons are not included in PCC and they are represented by their special suffix.

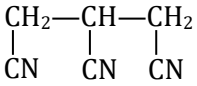
Illustration 38:



Solution: Old ⇒ 3–Carboxypentane-1,5-dioic acid

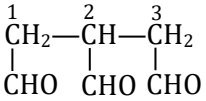
New ⇒ Propane-1,2,3-tricarboxylic acid

Illustration 39:



Solution: Propane-1,2,3-tricarbonitrile

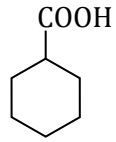
Illustration 40:



Solution: Propane-1-2,3-tricarbaldehyde

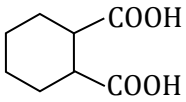
(b) Also if carbon containing principal functional group directly attached with cyclic chain then same rule is applicable.

Illustration 41:



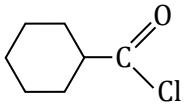
Solution: Cyclohexanecarboxylic acid

Illustration 42:



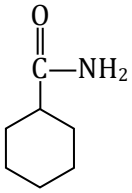
Solution: Cyclohexane-1,2-dicarboxylic acid

Illustration 43:



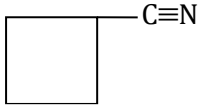
Solution: Cyclohexanecarbonyl chloride

Illustration 44:

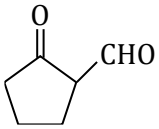


Solution: Cyclohexanecarboxamide

Illustration 45:



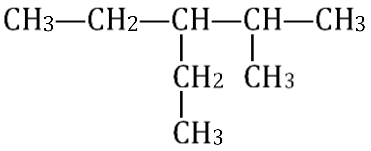
Solution: Cyclobutanecarbonitrile

Illustration 46: 

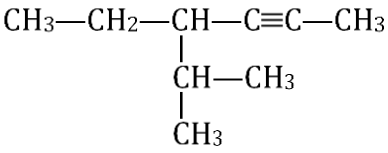
Solution: 2-Ketocyclopentanecarbaldehyde

BEGINNER'S BOX-8

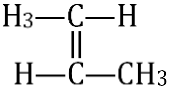
1. IUPAC name of :-



(1) 3-Ethyl-2-methylpentane
(2) 2-Methyl-3-ethylpentane
(3) 3-Isopropylpentane
(4) 3-(1-Methyl ethyl)-pentane

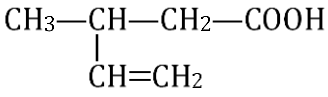
2. For the structural formula, 

what is the correct IUPAC name :
(1) 4-Isopropyl-2-hexyne
(2) 4-Ethyl-5-methyl-2-hexyne
(3) 3-Isopropyl-4-hexyne
(4) 2-Methyl-3-ethyl-4-hexyne

3. Correct IUPAC name for the structure  is :-

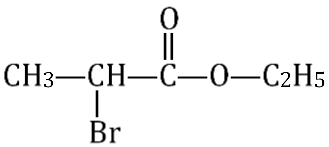
(1) Unsym. dimethyl ethylene
(2) Sym. dimethylethylene
(3) But-2-ene
(4) 1,3-Dimethylethene

4. Correct IUPAC name of compound is :-

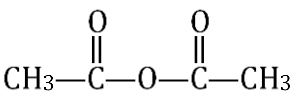


(1) 3-Ethenyl butanoic acid
(2) 3-Ethynyl butanoic acid
(3) 3-Methyl but-4-enoic acid
(4) 3-Methyl pent-4-enoic acid

5. Correct IUPAC name of compound is :-



(1) 2-Bromo-1-ethyl propanoate
(2) 1-Ethyl-2-bromopropanoate
(3) Ethyl-2-bromopropanoate
(4) Ethyl-3-bromo propanoate

6. IUPAC name of  is :-

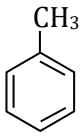
(1) Acetic anhydride
(2) Methanoic anhydride
(3) Ethanoic methanoic anhydride
(4) Ethanoic anhydride

Naming of Benzenoid Compounds

Most of the common names of benzenoid compounds are accepted in IUPAC.

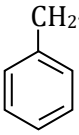
Illustration 47: 

Solution: Benzene

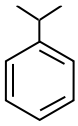
Illustration 48: 

(Toluene)

Solution: Methylbenzene

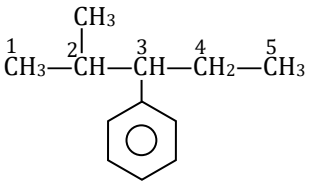
Illustration 49: 

Solution: Ethylbenzene

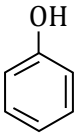
Illustration 50: 

(Cumene)

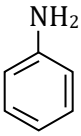
Solution: Isopropylbenzene or 2-Phenylpropane

Illustration 51: 

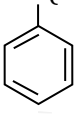
Solution: 2-Methyl-3-phenylpentane

Illustration 52: 

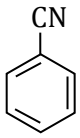
Solution: Phenol or Benzenol

Illustration 53: 

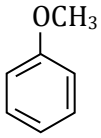
Solution: Aniline or Benzenamine

Illustration 54: 

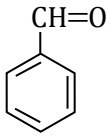
Solution: N,N-Dimethylbenzenamine or N,N-Dimethylaniline

Illustration 55: 

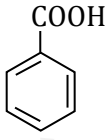
Solution: Benzonitrile or Benzenecarbonitrile

Illustration 56: 

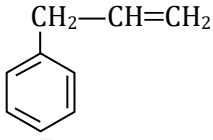
Solution: Methoxybenzene or Anisole

Illustration 57: 

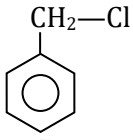
Solution: Benzaldehyde or Benzenecarbaldehyde

Illustration 58: 

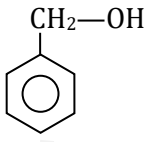
Solution: Benzoic acid or Benzenecarboxylic acid

Illustration 59: 

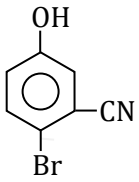
Solution: 3-Phenylprop-1-ene

Illustration 60: 

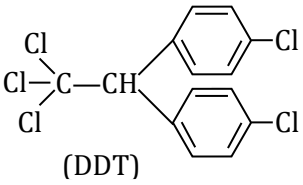
Solution: Chlorophenylmethane

Illustration 61: 

Solution: Phenylmethanol

Illustration 62: 

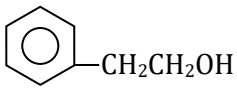
Solution: 2-Bromo-5-hydroxybenzonitrile or 2-Bromo-5-hydroxybenzenecarbonitrile

Illustration 63: 

(DDT)

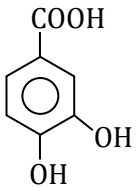
Solution: 1,1,1-Trichloro-2,2-bis(4'-chlorophenyl)ethane

BEGINNER'S BOX-9

1. 

has the IUPAC name :-

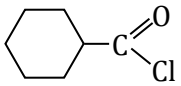
(1) Benzylalcohol
(2) 1-Phenylethanol
(3) Hydroxymethyltoluene
(4) 2-Phenylethanol

2. The IUPAC name of 

is :–

(1) 3,4–Dihydroxybenzoic acid
(2) 2,3–Dihydroxybenzoic acid
(3) 4–Carboxy–2–hydroxyphenol
(4) 4–Carboxybenzene–1,2–diol

3. The IUPAC name for the compound is :-



(1) Cyclohexanoyl chloride
(2) Cyclohexanecarbonyl chloride
(3) 1–Chlorocyclohexanal
(4) Chlorocyclohexylmethanol

BEGINNER'S BOX — ANSWERS KEY

BEGINNER'S BOX-1	Que.	1	2	3	4	5
	Ans.	1	1	2	2	3

BEGINNER'S BOX-2	Que.	1	2	3
	Ans.	4	3	1

BEGINNER'S BOX-3	Que.	1	2	3
	Ans.	3	3	1

BEGINNER'S BOX-4	Que.	1
	Ans.	3

BEGINNER'S BOX-5	Que.	1	2
	Ans.	3	4

BEGINNER'S BOX-6	Que.	1	2	3
	Ans.	4	4	1

BEGINNER'S BOX-7	Que.	1	2	3
	Ans.	3	4	1

BEGINNER'S BOX-8	Que.	1	2	3	4	5	6
	Ans.	1	2	3	4	3	4

BEGINNER'S BOX-9	Que.	1	2	3
	Ans.	4	1	2