

(Organic Chemistry) Classification and Nomenclature**ORGANIC CHEMISTRY**

It is a branch of chemistry which involves detail study of carbon and its compound.

Organic chemistry is basically a life of chemistry.

Initially it is believed that organic compound can't be prepared in laboratory and it is found in animal and plants or living organism.

According to Berzelius, the compound which is made from living organism called organic compound.

Vital force theory: (given by Berzelius) organic compound only be derived living organism and can't be synthesized by inorganic compound in laboratory.

After some time

Wohler Prove that organic compound can also made by Inorganic material



(Ammonium cyanate)

(Urea)

(Inorganic compound)

(organic compound)

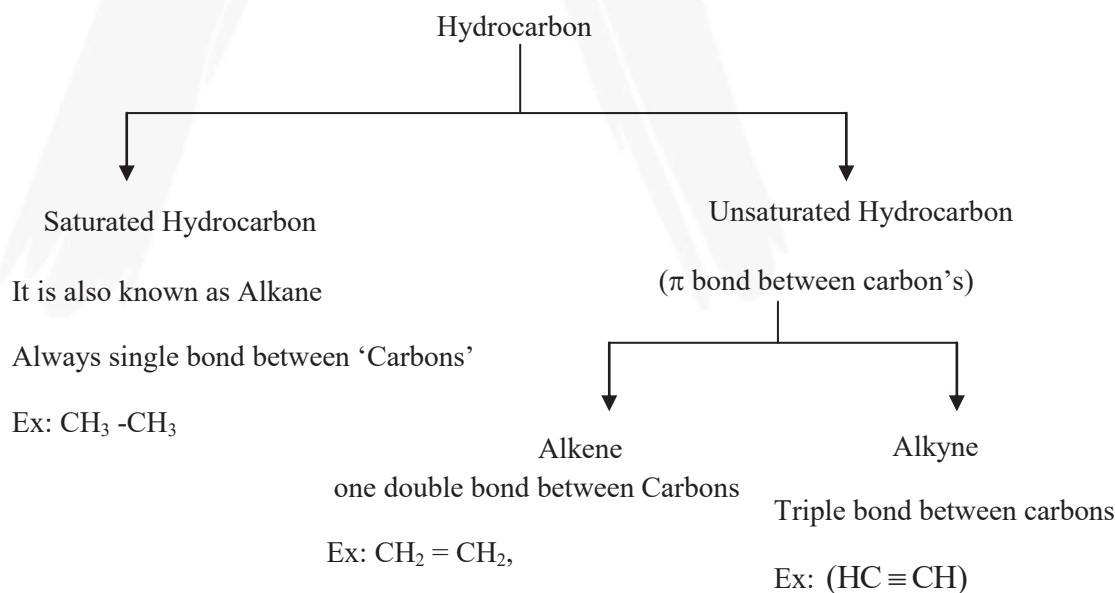
Many organic compound made from inorganic material so finally vital force theory was collapse.

Modern Definition of Organic compound

Organic Compound: Hydrocarbon and their derivatives are known as organic compound.

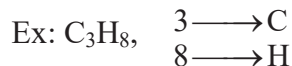
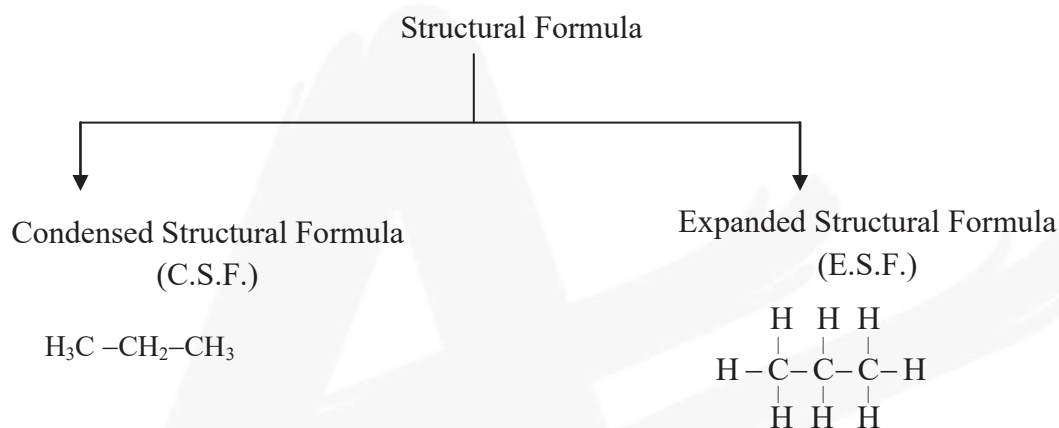
Hydrocarbon (H.C.): The compound which contain hydrogen (H) and carbon (C) or made of H and C called hydrocarbon.

CLASSIFICATION



(Organic Chemistry) Classification and Nomenclature**REPRESENTATION OF ORGANIC MOLECULES:****(1) Molecular Formula (M.F.):**

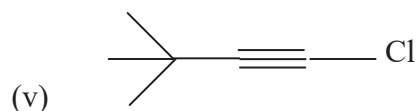
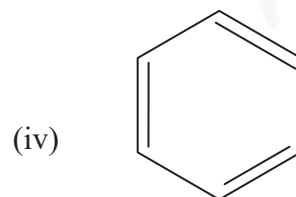
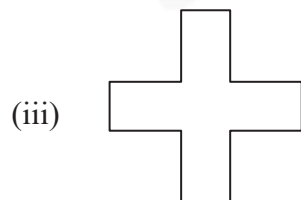
It gives information of number of atoms like (C, O, S, P etc.) in a compound.

**(2) Structural Formula:****(3) Bond Line Notation (B.L.N.):** Modern Technology to represent organic molecule.

Draw all bond except C-H bond.

DO YOURSELF – 1

Draw complete structural formula of following bond line notation



(Organic Chemistry) Classification and Nomenclature**DEGREE OF CARBON AND HYDROGEN**

Types of carbon and hydrogen: There are four types of degree of carbon.

- (1) Primary carbon (1° C):- The carbon which is directly connected to only one 'C'.
- (2) Secondary carbon (2° C):- The carbon which is directly connected to two other 'C'.
- (3) Tertiary carbon (3° C):- The carbon which is directly connected to three other 'C'.
- (4) Quaternary carbon (4° C):- The carbon which is directly connected four other 'C'.

Note: (CH_4 - Super primary carbon)

Degree of Hydrogen

1° H (Primary Hydrogen) \rightarrow The H present at 1° Carbon

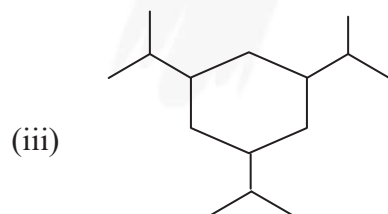
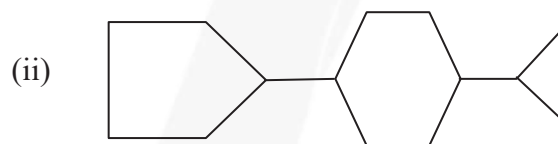
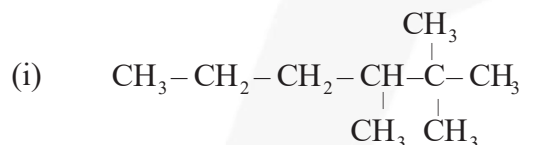
2° H (Secondary Hydrogen) \rightarrow The H present at 2° Carbon

3° H (Tertiary Hydrogen) \rightarrow The H present at 3° Carbon

4° H \rightarrow Does not exist because 'Carbon' have no valancy for H.

DO YOURSELF – 2

Count the 1° , 2° , 3° & 4° carbon atoms

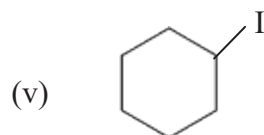
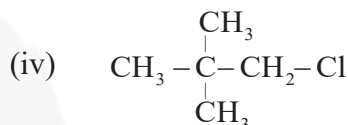
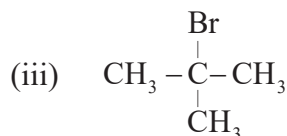
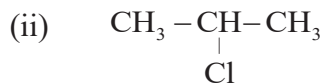
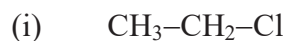


(Organic Chemistry) Classification and Nomenclature**DEGREE OF ALKYL HALIDE**

Degree of alkyl halide is determined by the degree of carbon containing Halogen atom.

DO YOURSELF – 3

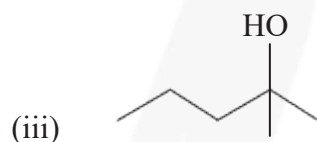
Define the degree of following alkyl halide

**DEGREE OF ALCOHOL**

Degree of alcohol is determined by the degree of carbon which contain (—OH) group.

DO YOURSELF – 4

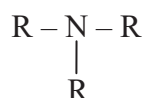
Define the degree of following alcohol

**DEGREE OF AMINES**

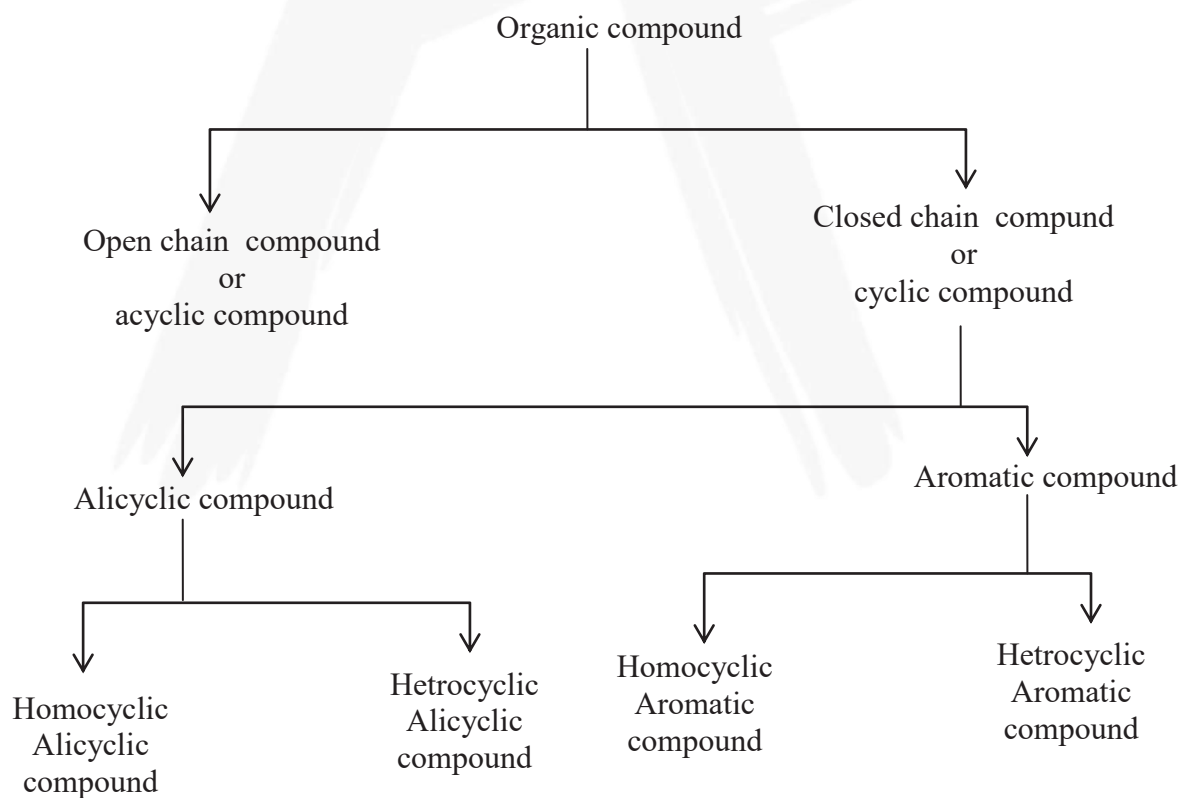
1° amine (Primary Amine)



2° amine (Secondary Amine)



3° amine (Tertiary Amine)

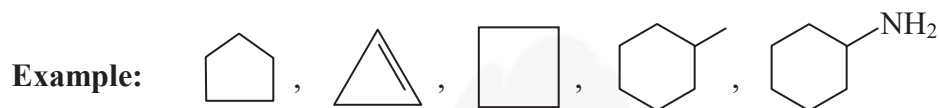
(Organic Chemistry) Classification and Nomenclature**CLASSIFICATION OF ORGANIC COMPOUND**

(Organic Chemistry) Classification and Nomenclature

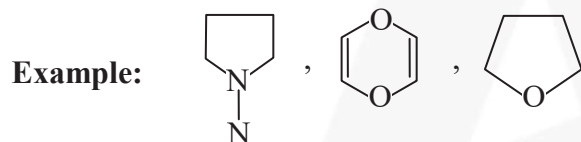
1. **Alicyclic Compound** :- The compound which is cyclic but not Aromatic known as alicyclic compound.



2. **Homocyclic Compound** :- When each member of the ring is Carbon Known as homocyclic compound



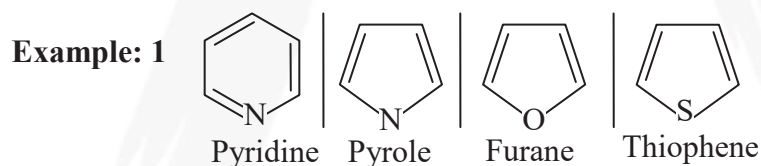
3. **HETEROCYCLIC ALICYCLIC**:- When only one atom in a cyclic ring is hetroatom like O, P, S, N etc is known as Hetrocyclic compound.



4. **HOMOCYCLIC AROMATIC COMPOUND**:- In a compound when ring is aromatic and all atoms in ring is carbon known as Homocyclic Aromatic Compound.



5. **HETEROCYCLIC AROMATIC COMPOUND**:- In a compound when ring is aromatic but only one atom in a ring is other than carbon known as Hetrocyclic Aromatic Compound.



- Example: 2. which one is Hetrocyclic Alicyclic compound ?



Ans. (d)

(Organic Chemistry) Classification and Nomenclature**DOUBLE BOND EQUIVALENT (DBE) OR DEGREE OF UNSATURATION (DU) OR INDEX OF HYDROGEN DEFICIENCY (I.H.D.)**

→ It is defined as the number of moles of hydrogen required to make an unsaturated compound to saturated or to convert a cyclic structure into a cyclic structure (open chain structure) is known as degree of unsaturated.

Alkane (G.F.) → $C_n H_{2n+2}$ [full of H so saturated]

Alkene (G.F.) → $C_n H_{2n}$ [Deficiency of 2H unsaturated]


D.B.E = 1

Alkyne (G.F.) → $C_n H_{2n-2}$ [Deficiency of 4H unsaturated]

Note :-

(1) Each double bond ($C = C$, $C = O$, $C = N$) D.B.E = 1

(2) Each triple bond ($C \equiv C$, $C \equiv N$) D.B.E = 2

(3) Each Ring (\triangle \hexagon \square ) D.B.E = 1

CALCULATION OF D.B.E

(1) If structure is given

$$DU = \text{No of } \Pi \text{ bond} + \text{No. of ring}$$

(2) If Molecular formula is given

$$DU = (C + 1) - \left(\frac{H + X - N}{2} \right)$$

Where C → Number of carbon atom

H → Number of Hydrogen atom

X → Number of Halogen atom

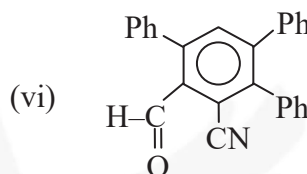
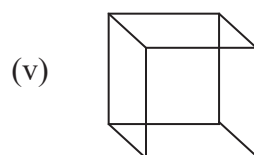
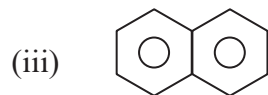
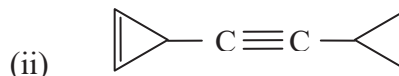
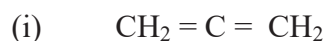
N → Number of Nitrogen atom

Note : – (i) Divalent atom neglected, Monovalent atom added, trivalent atom subtract.

(ii) No. of oxygen and sulphur are neglect.

(Organic Chemistry) Classification and Nomenclature**DO YOURSELF – 5**

Define the double bond equivalent of following compounds



Q. write all possibilities for a compound having D.B.E = 3

Ans. 6

Case- (i) When three double bond present .

(ii) When one triple bond and one double bond.

(iii) When three ring.

(iv) Two ring and 1 double bond.

(v) 1 ring & 2 double bond

(vi) 1 ring & one triple.

IUPAC (INTERNATIONAL UNION OF PURE & APPLIED CHEMISTRY)

It is International Scientific Organization.

FUNCTIONAL GROUP

The atom or groups of atoms which explained the property of whole compound is called functional group.

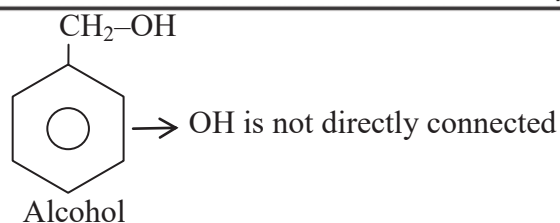
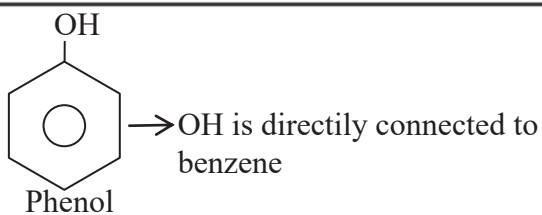
(Organic Chemistry) Classification and Nomenclature

A functional group is the part of molecule where most of its chemical reaction occur.

Sr. No	NAME	STRUCTURE	PREFIX	SUFFIX	SPEC. SUFFIX
1	Carboxylic Acid	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R} - \text{C} - \text{OH} \end{array}$	Carboxy	Oic Acid	Carboxylic Acid
2	Sulphonic Acid	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R} - \text{S} - \text{OH} \\ \parallel \\ \text{O} \end{array}$	Sulpho	Sulphonic acid	
3	Carboxylic acid anhydride	$\begin{array}{c} \text{O} \quad \text{O} \\ \parallel \quad \parallel \\ -\text{C} - \text{O} - \text{C}- \end{array}$		-oic anhydride	
4	Ester	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R} - \text{C} - \text{O} - \text{R}' \\ \text{R}' \neq \text{H} \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R} - \text{C} - \text{O} - \text{PC} \\ \text{Alkonyloxy} \end{array}$ $\begin{array}{c} \text{O} \\ \parallel \\ \text{PC} - \text{C} - \text{O} - \text{R}' \\ \text{Alkoxycarbonyl} \end{array}$	-Oate	Carboxylate
5	Acid Halide	$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C} - \text{X} \end{array}$	Halocarbonyl	-Oyl halide	Carbonyl Halide
6	Acid amide	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R} - \text{C} - \text{NH}_2 \\ \text{all 1, 2 \& 3}^\circ \end{array}$	Carbamoyl	Amide	Carboxamide
7	Cyanide	$-\text{C} \equiv \text{N}$	Cyano	Nitrile	Carbonitrile
8	Isocyanide	$\text{R}-\text{NC}$	Isocyano	Isonitrile	
9	Aldehyde	$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C} - \text{H} \end{array}$	Formyl or oxo	-al	Carbaldhyde
10	Ketone	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R} - \text{C} - \text{R}' \\ \text{R \& R}' \neq \text{H} \end{array}$	Oxo	One	
11	Alcohol	$-\text{OH}$	Hydroxy	ol	
12	Thioalcohol	$-\text{SH}$	Mercapto	thiol	
13	Amine	$-\text{NH}_2$ 1° $\text{R}-\text{O}-\text{R}'$	Amino	Amine	
14	Ether	$\text{R} \neq \text{H}, \text{R}' \neq \text{H}$ $\text{CH}_3 - \text{O} - \text{CH}_3$	OXY	Ane	
15	Nitro	$\text{R}-\text{NO}_2$	Nitro	Ane	
16	Nitrite	$\text{R}-\text{ONO}$	Nitrito		
17	Halide	$\text{R}-\text{X}$	Halo	Ane	

Note :- (i) Primary, Secondary and tertiary amine are different functional group.
(ii) Primary, Secondary and tertiary acid amide also different functional group.
(iii) Phenol & alcohol are two different functional group.

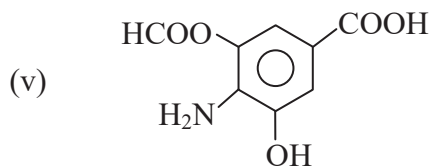
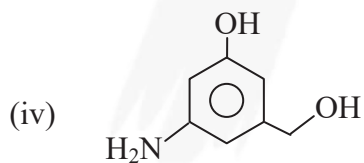
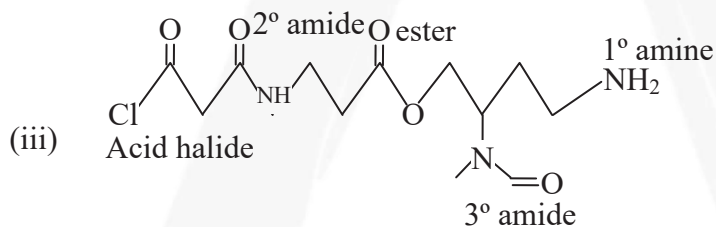
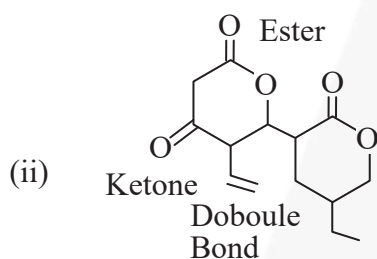
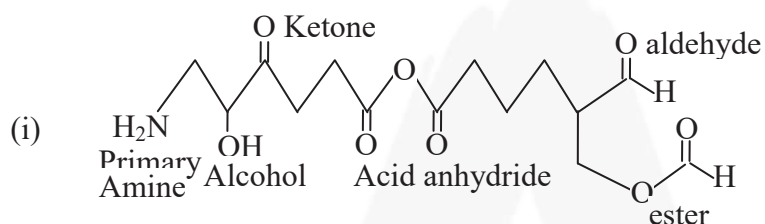
(Organic Chemistry) Classification and Nomenclature



(iv) Double and triple bonds are different functional group.

DO YOURSELF – 6

Total number of different functional group?



(Organic Chemistry) Classification and Nomenclature**HOMOLOGOUS SERIES**

A series of organic compound which can be represented by same general formula, containing same functional group Known as Homologous series.

CHARACTERISTIC :

- (i) Two consecutive member of homologous series differ by $-\text{CH}_2$ group (14gm)
- (ii) Homologous series must have same functional group.
- (iii) Must have same general formula.
- (iv) Two consecutive member differ in molecular weight by 14 unit.
- (v) H.S have similar chemical property (Due to same functional group).
- (vi) H.S have similar physical property (Molecular wt.)

Example :-

- (1) Alkane $\text{CH}_3 - \text{CH}_3$ & $\text{CH}_3 - \text{CH}_2 - \text{CH}_3$ are homologous series
- (2) Alkene C_2H_4 & C_3H_6 a homologous series
- (3) Alkyne C_2H_2 & C_3H_4 are homologous series
- (4) Alcohol $\text{CH}_3 - \text{OH}$ & $\text{CH}_3 - \text{CH}_2 - \text{OH}$ are homologous series

FEW ALKYL GROUP

Alkane $\xrightarrow{-\text{H}}$ alkyl

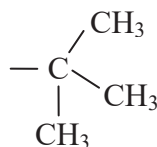
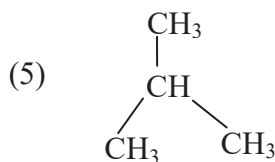
- (1) $\text{CH}_4 \xrightarrow{-\text{H}} -\text{CH}_3$ (Methyl)

Methane (Marsh gas)

- (2) $\text{CH}_3 - \text{CH}_3 \xrightarrow{-\text{H}} -\text{CH}_2 - \text{CH}_3$ (Ethyl)

- (3) $\text{CH}_3 - \text{CH}_2 - \text{CH}_3 \xrightarrow{-\text{H}} -\text{CH}_2 - \text{CH}_2 - \text{CH}_3$ (n-propyl)

- (4) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \xrightarrow{-\text{H}} -\text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$
n - Butyl (n - Bu)



t - Butyl

RETAINED NAME

n - (normal) \rightarrow straight c-atom (No branching)

c - c - c - c - c n - pentane

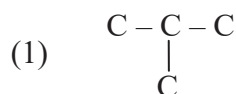
c - c - c - c - c n - hexane

(Organic Chemistry) Classification and Nomenclature**Iso** - 2 - Methyl is the only branch, No other branching

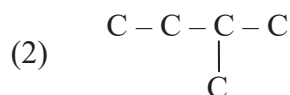
total no. of carbon = 4 to 7

Compound

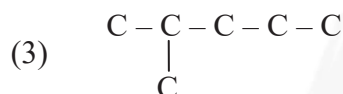
Retained Name



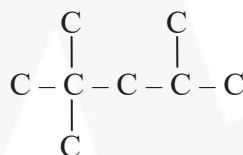
Isobutane



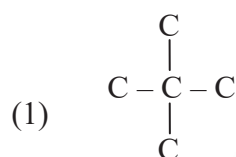
Isopentane



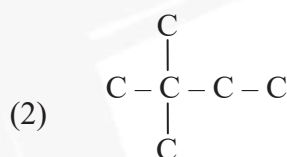
Isohexane

**Exception : Isooctane****NEO** - 2,2 - dimethyl branches (No other branching)

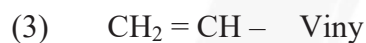
No of carbon = 5 to 7



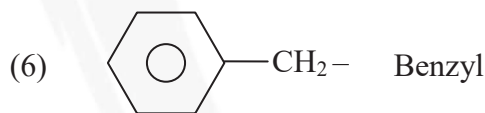
Neopentane



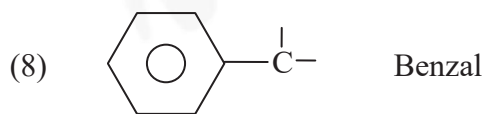
Neohexane



Phenyl

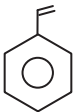
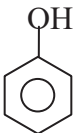
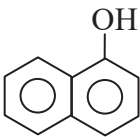
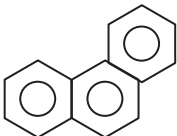


Benzo

**Geminal (gem) :****Vicinal (vic) :**

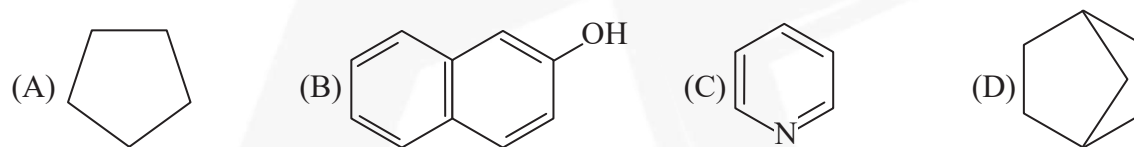
(Organic Chemistry) Classification and Nomenclature

Example-1

Compound	Properties
(A) 	(P) Homocyclic Hydrocarbon
(B) 	(Q) Even no. of D.B.E
(C) 	(S) Homocyclic Compound
(D) 	(T) Odd number of D.B.E

Ans. (A) → P,T,S; (B) → Q,S; (C) → T,S; (D) → P,Q,S

Example -2 Which one of the following is/are homocyclic compound ?



Ans. A,B,D

	M.F.	Isomer		alkyl group
(1)	CH ₄	CH ₄	$\xrightarrow{-H}$	-CH ₃ (Me)
(2)	C ₂ H ₆	CH ₃ -CH ₃	$\xrightarrow{-H}$	-CH ₂ -CH ₃ (Et)
(3)	C ₃ H ₈	CH ₃ -CH ₂ -CH ₃	$\xrightarrow{-H}$	-CH ₂ -CH ₂ -CH ₃ (n - propyl) -CH(CH ₃)-CH ₃ (Isopropyl)
(4)	C ₄ H ₁₀	CH ₃ -CH ₂ -CH ₂ -CH ₃	$\xrightarrow{-H}$	-C(CH ₃)(CH ₂) ₂ -CH ₃ (n - Butyl)

Note : - The straight chain alkanes are called normal alkane.

Name of organic compound :-

- (i) Common name (ii) Trivial name
(iii) Derived name (iv) IUPAC name

(Organic Chemistry) Classification and Nomenclature

IUPAC

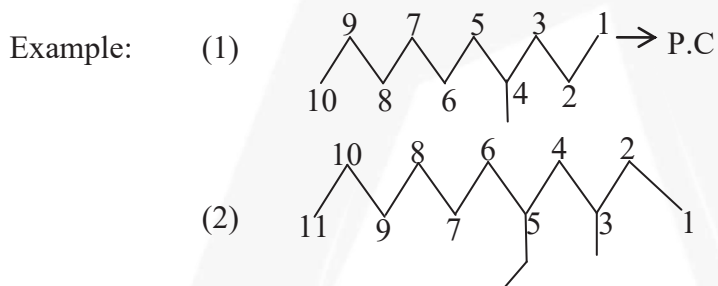
SCHEME

2° PREFIX - 1° PREFIX - WORD ROOT - 1° SUFFIX - 2° SUFFIX

Word Root → It is used to explain number of carbon atom in principal or parent chain.

No. of Carbon atom	word root
1	Meth
2	Eth
3	Prop
4	But
5	Pent
6	Hex
7	Hept
8	Oct
9	Non
10	Dec
11	Undec
12	Dodec

PARENT CHAIN : Longest possible carbon chain is called parent chain and the number of carbon present in the Parent chain is known as word root.



Secondary suffix : It is use for senior most functional group present in parent chain.

Primary suffix : It gives information about Saturation or unstauration of the compound.

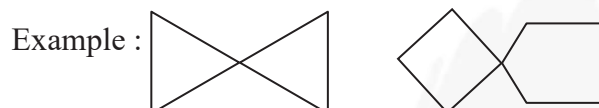
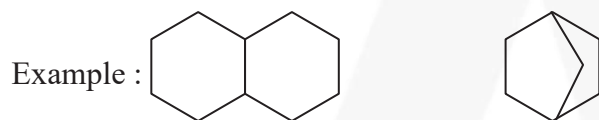
Example: for all single bond → ane
 for one double bond → ene
 for one triple bond → yne

Note : - (i) It always written in alphabetical order.
 (ii) Always written with position.

In the compound	i suffix
(i) all c – c bond	ane
(ii) one c = c bond	ane
(iii) two c = c bond	diene
(iv) three c = c bond	triene
(v) one c ≡ c bond	yne
(vi) two c ≡ c bond	diyne
(vii) one c = c + one c ≡ c	enyne

(Organic Chemistry) Classification and Nomenclature**Primary prefix (i) :** - It gives the information about cyclic or acyclic nature of compound.

If compound has	1° prefix
(i) Open chain or acyclic	No prefix
(ii) One ring or cyclic	cyclo
(iii) Two ring	Bicyclo
(iv) Spiro	Spiro

Spiro compound : Spiro compounds are that compound In which exactly one atom is common between two ring.**Bicyclo compound :** - The compound which contain atleast 2 common atom between two rings.**Secondary prefix (2°) :-** It is always use to naming of side chain, substituent .

Example:	- Cl	→	chloro	-NO ₂	→	Nitro
	- Br	→	Bromo	-CH ₃	→	Methyl
	- I	→	Iodo	-CH ₂ - CH ₃	→	Ethyl
	- F	→	Fluro	-N=O	→	Nitroso
	- OH	→	Hydroxy			

Note :- (i) Always written in alphabetical order.

(ii) Always written with their position.

(iii) If repetition of side chain then use

2 - di 3 → Tri 4 → tetra 5 → penta

(iv) If side chain is complex and already contain Di. Tri. etc. then in case of repetition of such side chain use

Di → Bis Tri → Tris Tetra → Tetrakis Penta → Pentakis

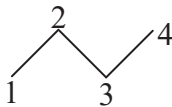
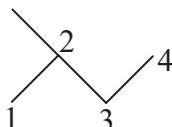

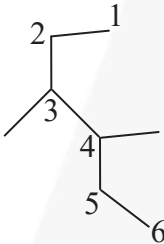
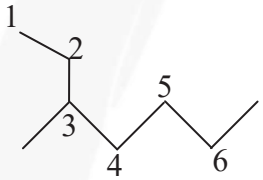
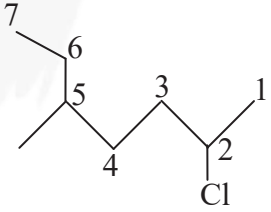
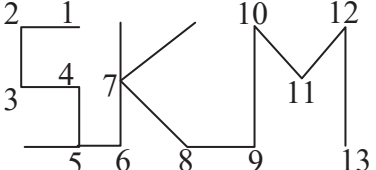
Note :- (i) $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{CH} = \text{CH}_2 \rightarrow$ Isolated alkadiene(ii) $\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$ Alternate bond \rightarrow Conjugated alkadiene(iii) $\text{CH}_2 = \text{C} = \text{CH}_2$ Continous band \rightarrow Cummulated alkadiene

(Organic Chemistry) Classification and Nomenclature**RULES FOR SELECTION OF CHAIN**

(1) Functional Group → Multiple bond → Side chain

Select principal chain according to following order Functional > Multiple > Substitutement.

In absence of functional group and multiple bond then always select longest chain.

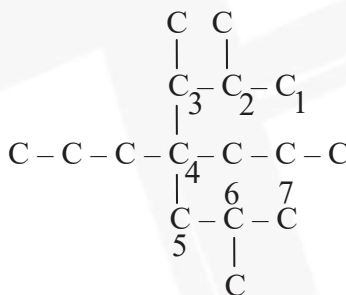
	No. of carbon in Parent chain	IUPAC
(1) 	4	Normal-butane
(2) 	4	2-methyl butane
(3) 	5	3-methyl pantane
(4) 	4	3,4-diamethyl hexane
(5) 	7	3-methyl heptane
(6) 	7	2-chloro-5-methylheptane
(7) 	13	5,7,7-trimethy tridecane

(Organic Chemistry) Classification and Nomenclature

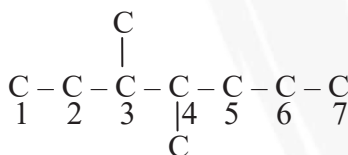
(8)		5	2,2-dimethyl propane
(9)		5	3,3-diethyl pentane
(10)		5	3,3-dimethyl pentane

Note : (I) Locants : The number that define the positions of the principal functional group and substituent is called locants.

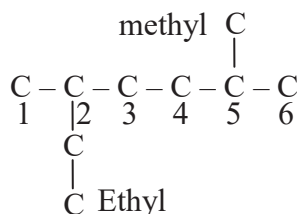
(II) If two or more longest carbon chain have equal number of carbon atoms, then select that chain which have greater number of branching.



(III) If two or more than two substituent are present in the compound then apply lowest locant Rule:



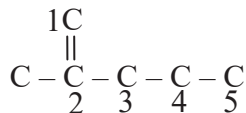
(iv) If two different substituents are present in the compound of the same position from the opposite end then select their alphabet which near to that end.



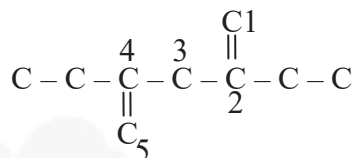
Note:- The name of the substituents are written in alphabetical order, prefix and position number of the substituent are separated by hyphen (-)

(Organic Chemistry) Classification and Nomenclature

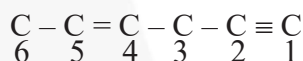
- (v) If double or triple bond present in the compound then main chain select in such a way that double or triple bond Included in main chain. (Parent Chain may or may not be longest)



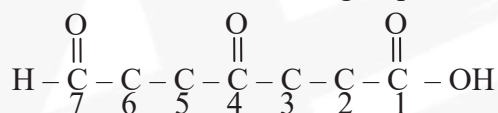
- (vi) If double or triple bond present in the compound at different position from opposite end then select that end which is nearest to double or triple bond.



- (vii) If two or more different functional groups are present in the compound then numbering of carbon atom will be start from most senior functional group.



- (viii) If two or more different functional groups are present in the compound then numbering of carbon atom will start from most senior functional group.



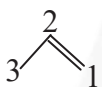
- (11) CClBrFI BromochlorofluoroIodomethane

NAMING OF ALKENES**COMPOUND**

- (1) $2=1$

IUPAC

ethene

- (2) 

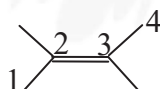
Propene

- (3) 

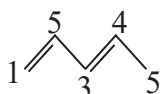
But - 1 - ene

- (4) 

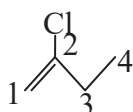
But - 2 - ene

- (5) 

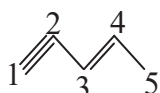
2, 3 - dimethyl but - 2 - ene

- (6) 

Penta - 1, 3 - diene

- (7) 

2 - chloro - but - 1 - ene

- (8) 

Pent - 3 - ene - 1 - yne

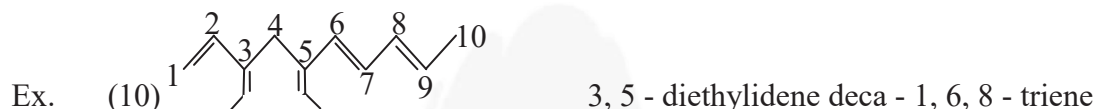
(Organic Chemistry) Classification and Nomenclature**ALKYLIDENE SUBSTITUENTS :**


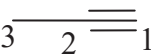
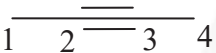
Parent Chain —CH_3 methyl

Parent Chain =CH_2 ylidene (methyldene)

Parent Chain =CH—CH_3 Ethylidene

Parent Chain $\text{=CH—CH}_2\text{—CH}_3 \rightarrow$ (Propylidene)

**NAMING OF ALKYNES**

- | | |
|--|-----------------------------|
| (1)  | Ethyne |
| (2)  | Propyne |
| (3)  | but-2-yne |
| (4) $\text{C} \equiv \text{C} - \text{C} \equiv \text{C}$
1 2 3 4 | Buta-1,3-diyne |
| (5) $\text{C} - \text{C} - \text{C} \equiv \text{C} - \text{C} = \text{C} - \text{C}$
7 6 5 4 3 2 1 | Hept-2-ene-4-yne |
| (6) $\text{C} \equiv \text{C} - \text{C} = \text{C}$
4 3 2 1 | Butenyne or but-1-ene-3-yne |

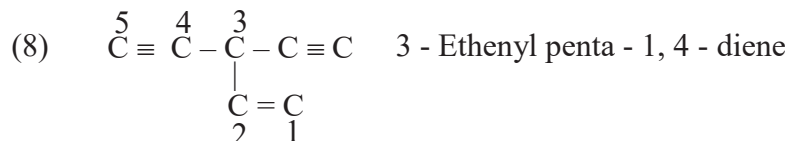
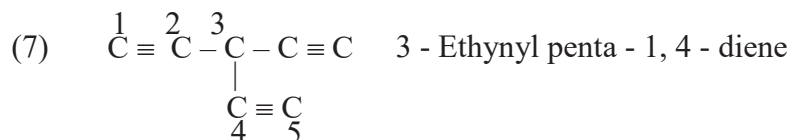
Note :- If the molecule have only one possible structure then locant are avoided.

ALKYNYL SUBSTITUENTS

$\text{HC} \equiv \text{C} -$ ethynyl

$\text{CH}_3 - \text{C} \equiv \text{C} -$ prop -1-ynyl
3 2 1

$\text{HC} \equiv \text{C} - \text{C} -$ prop -2-ynyl
3 1 1



(Organic Chemistry) Classification and Nomenclature

NAMING OF CYCLOALKANES



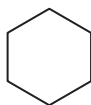
Cyclopropane



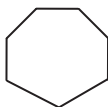
Cyclobutane



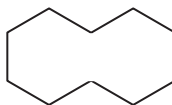
Cyclopentane



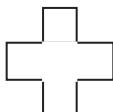
Cyclohexane



Cycloheptane



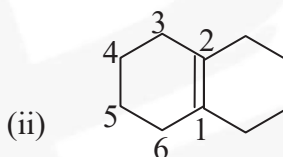
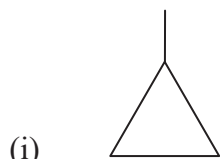
Cyclodecane



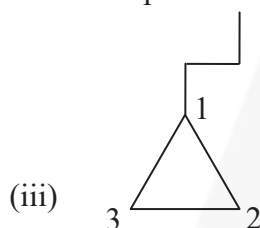
Cyclododecane

DO YOURSELF – 7

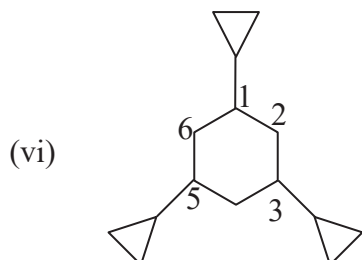
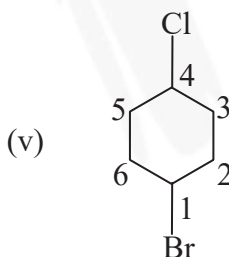
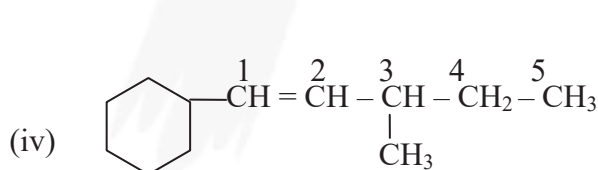
Write IUPAC names of following compounds ?



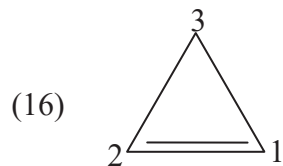
Hint : If the equal number of carbon atom present in the open chain & closed chain then the ring will be preferred.



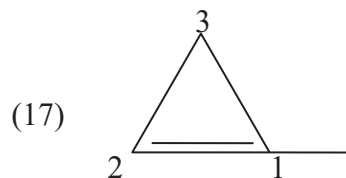
Hint :- If equal number of carbon atom present in open chain & closed chain and open chain have any functional group Multiple Bond or Substituent then prefer open chain.



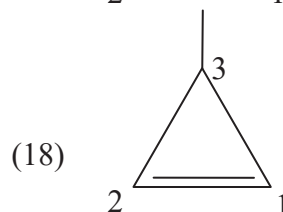
Note:- C = C must be give 1 and 2 position



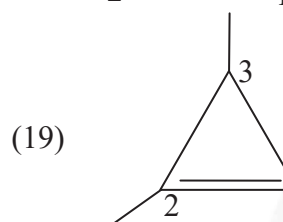
cyclopropene



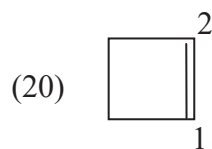
1-methy cycloprop-1-ene



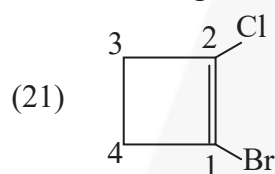
3 - methyl cycloprop-1-ene



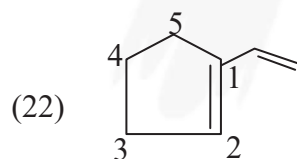
2,3-dimethyl cycloprop-1-ene



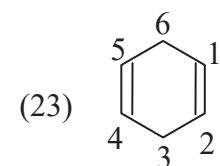
cyclobutene



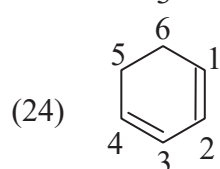
1 - bromo-2-chloro cyclobut-1-ene



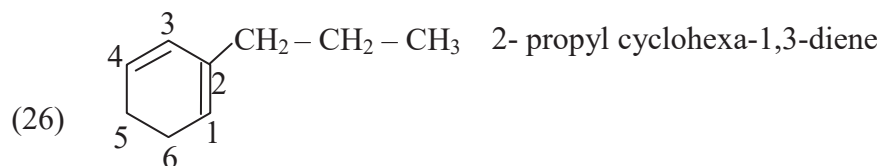
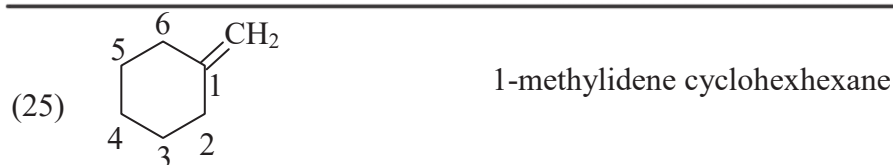
1 - ethenyl cyclopent-1-ene



cyclohexa - 1,4-diene



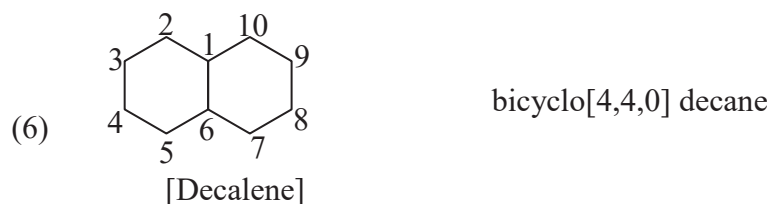
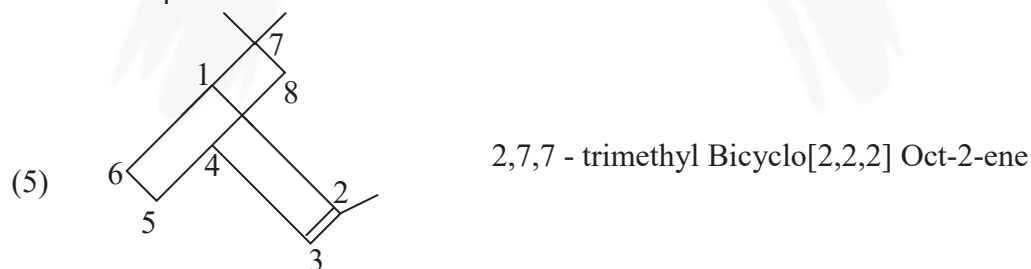
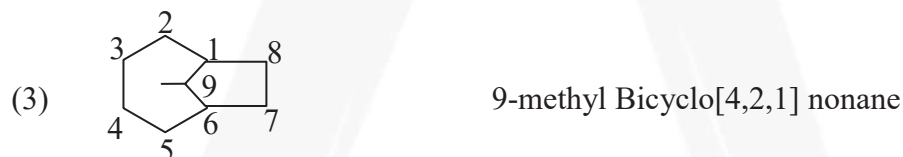
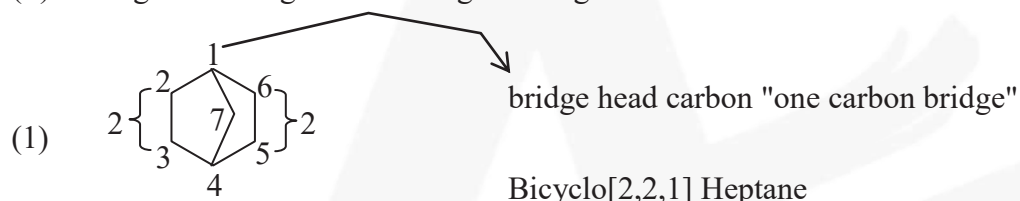
cyclohexa - 1,3-diene

(Organic Chemistry) Classification and Nomenclature**NAMING OF BICYCLO COMPOUND**

If two rings are fused at two common carbon atoms then compound are known as Bicyclic Compound.'

(i) Numbering always start with bridge head centre.

(ii) During numbering move on largest \rightarrow larger \rightarrow smaller



(Organic Chemistry) Classification and Nomenclature

NAMING OF SPIRO COMPOUND

Spiro Compound:- only one carbon common in two ring called spiro compound

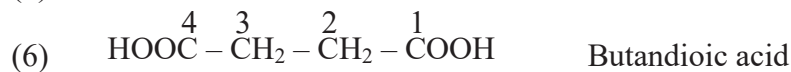
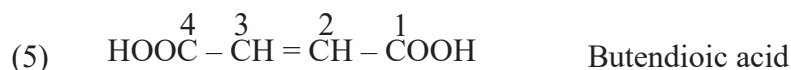
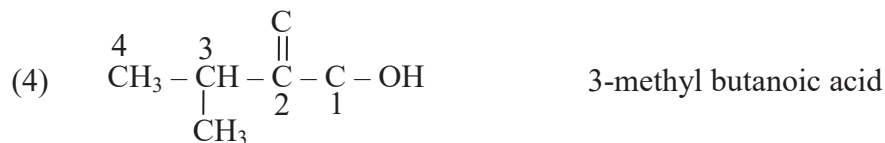
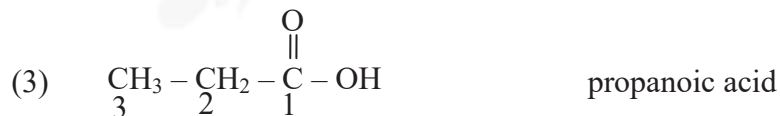
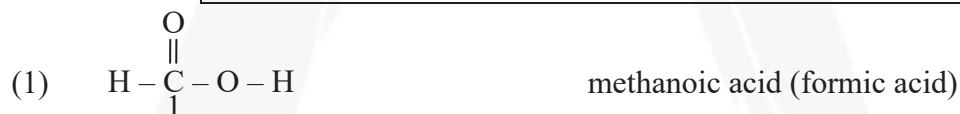
Rule :-

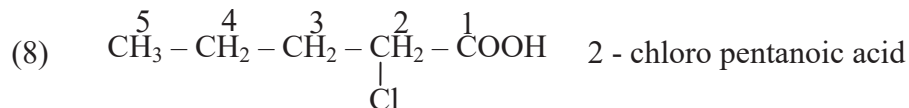
(i) Numbering start with smaller ring which is directly attached to spiro carbon and move toward larger ring.



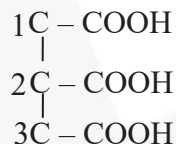
NAMING OF CARBOXYLIC ACID

F.G -COOH	Suffix oic acid	Prefix carboxy	Special suffix carboxylic acid
--------------	--------------------	-------------------	-----------------------------------



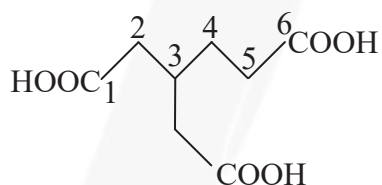
(Organic Chemistry) Classification and Nomenclature**SPECIAL NAME**

- (i) If there are more than 2 same functional group are present as senior functional group then select a chain in which all the senior functional group are directly connected and use their special suffix name

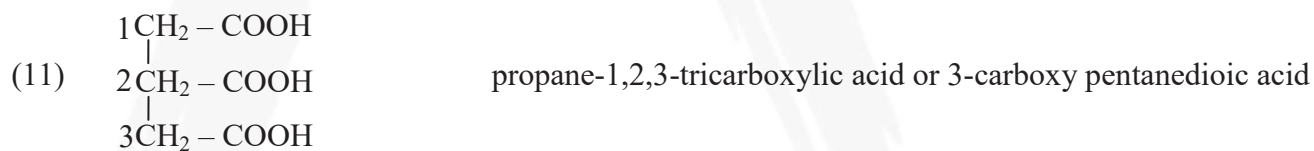


Propane-1,2,3-tricarboxylic acid

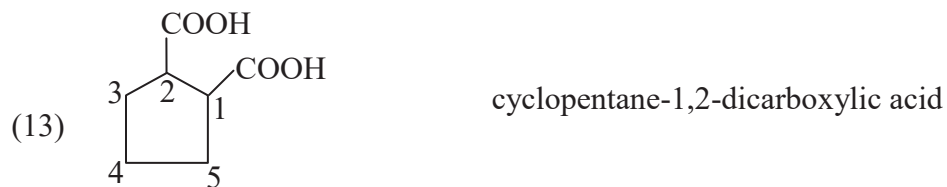
- (ii) If senior functional group are not directly connected to principal chain then select the chain having maximum number of senior functional group & skip any senior functional group.
- (iii) For skipped senior functional group use prefix and for selected senior functional group use suffix



3-(1-methylcarboxy)hex-1,6-dioic acid



cyclohexane carboxylic acid



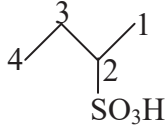
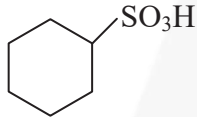
cyclopentane-1,2-dicarboxylic acid

(Organic Chemistry) Classification and Nomenclature

NAMING OF SULPHONIC ACID

F.G -SO ₃ H	Suffix -Sulphonic acid	prefix -sulpho
---------------------------	---------------------------	-------------------

Rule:- Alkane + Sulphonic acid → alkanesulphonic acid

- (1) $\text{CH}_3 - \text{SO}_3\text{H}$ methane sulphonic acid
- (2) $\text{CH}_3 - \text{CH}_2 - \text{SO}_3\text{H}$ Ethane sulphonic acid
- (3)  Butane-2-sulphonic acid
- (4)  Cyclohexane sulphonic acid

DICARBOXYLIC ACID

G.F $\text{HOOC} - (\text{CH}_2)_n - \text{COOH}$

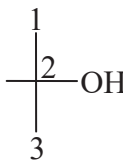
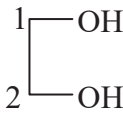
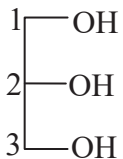
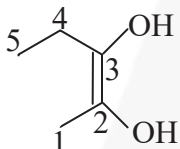
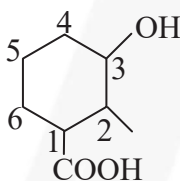
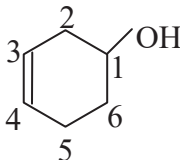
n =	0	1	2	3	4	5	6
	O	M	S	G	A	P	S
	↓	↓	↓	↓	↓	↓	↓
	Oxalic acid	Malonic acid	Succinic acid	Glutaric acid	Adipic acid	Pinelic acid	Suberic acid

Exam. When n = 0	$\text{HOOC} - \text{COOH}$	Oxalic Acid
When n = 1	$\text{HOOC} - \text{CH}_2 - \text{COOH}$	Malonic acid+
When n = 6	$\text{HOOC} - (\text{CH}_2)_6 - \text{COOH}$	Suberic acid

NAMING OF ALCOHOL

F.G	Suffix	Prefix
-OH	-ol	-Hydroxy

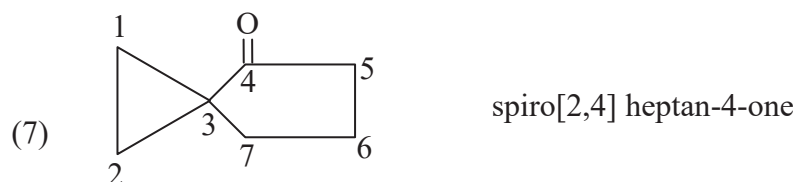
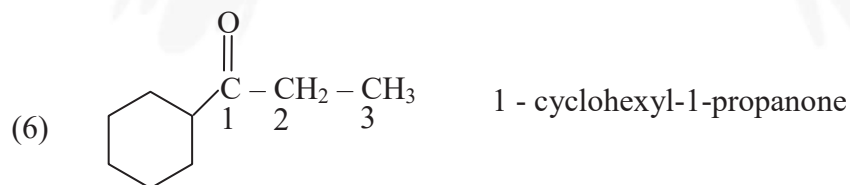
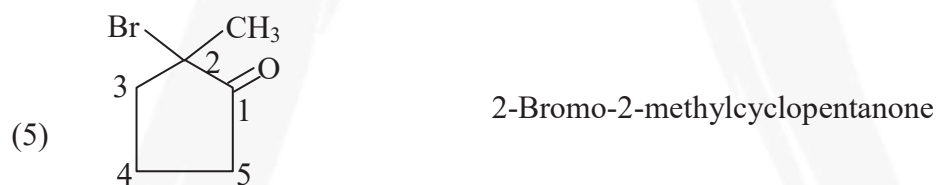
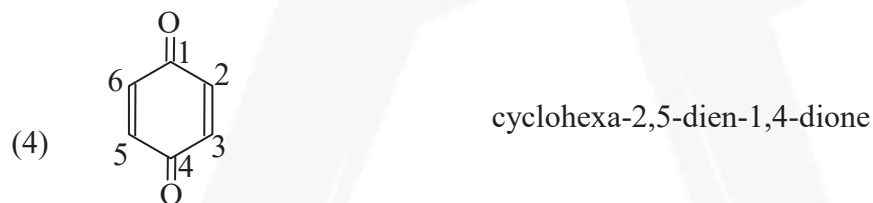
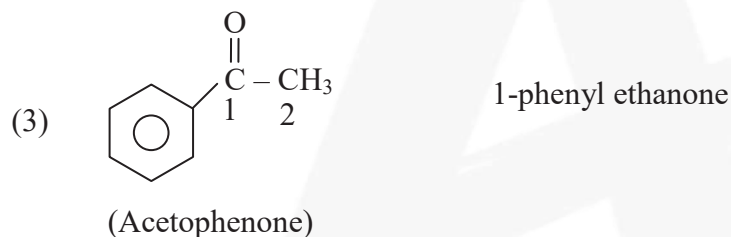
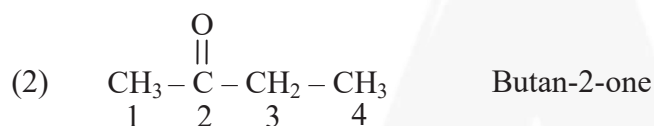
Rule: Alkane + ol → Alkanol

- (1) CH_3OH Methanol Methylalcohol
- (2) $\text{CH}_3\text{--CH}_2\text{--OH}$ Ethanol Ethylalcohol
- (3) $\text{CH}_3\text{--CH}_2\text{--CH}_2\text{--OH}$ Propanol
- (4)  2-methyl prop-2-ol Tertiary butyl alcohol
- (5)  Ethan-1,2-diol Ethylene glycol
- (6)  propan-1,2,3-triol glycerol
- (7)  Pent-2-en-2,3-diol
- (8)  3-hydroxy cyclohexane-1-carboxylic acid
- (9) $\text{HO--CH}_2\text{--}\underset{\text{CH}_2\text{--OH}}{\text{CH}}\text{--CH}_2\text{--OH}$ 2-hydroxymethyl propan-1,3-diol
- (10)  cyclohex-3-en-1-ol

(Organic Chemistry) **Classification and Nomenclature**
NAMING OF KETONE

F.G.	Suffix	Prefix
$\text{R}-\underset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{R}'$	-one	Keto or oxo

Rule:- Alkane + one → Alkanone Common Name

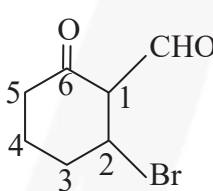
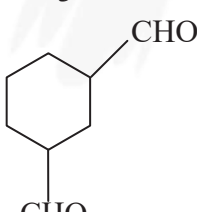
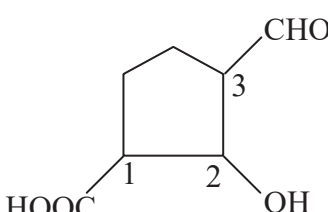


(Organic Chemistry) Classification and Nomenclature

NAMING OF ALDEHYDE

F.G	Suffix	Prefix	Spec.suffix
$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{H} \end{array}$	-al	formyl or oxo	carbaldehyde

Rule:- Alkane + al \rightarrow alkanal

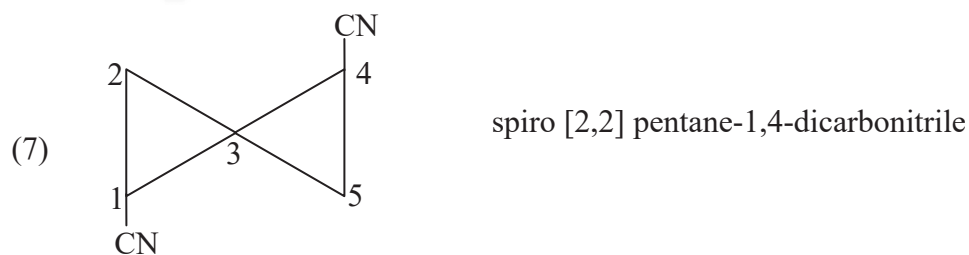
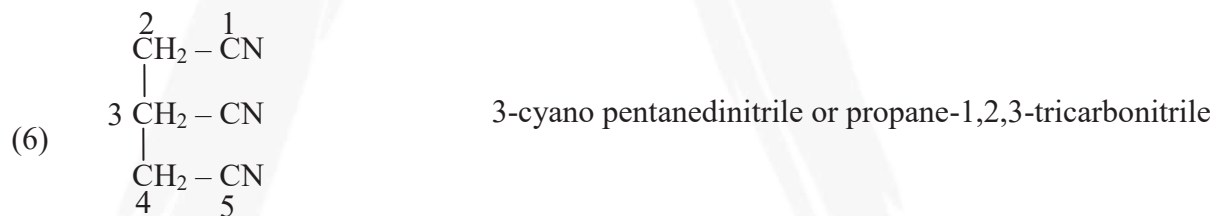
- (1) $\begin{array}{c} \text{O} \\ || \\ \text{H}-\text{C}-\text{H} \end{array}$ Methanal (formaldehyde)
- (2) $\begin{array}{c} \text{O} \\ || \\ \text{CH}_3-\text{C}-\text{H} \end{array}$ Ethanal (Acetaldehyde)
- (3) $\begin{array}{ccccccc} & & 2 & 3 & 4 & & \\ & & \text{CH} & -\text{CH}_2 & -\text{CH}_3 & & \\ & & | & & & & \\ & & 1\text{CHO} & & & & \end{array}$ 2-Ethylbutanal
- (4) $\begin{array}{c} \text{CHO} \\ | \\ \text{CHO} \end{array}$ Ethandial (glyoxal)
- (5) $\begin{array}{c} 1\text{CHO} \\ | \\ 2\text{CH}-\text{CHO} \\ | \\ 3\text{CHO} \end{array}$ 3 - formyl propan - 1, 3 - dial
- (6) $\begin{array}{ccccccc} & & \text{O} & & \text{CH}_3 & & \\ & & || & & | & & \\ \text{CH}_3 & - & \text{C} & - & \text{CH} & - & \text{CH} & - & \text{CH} & - & \text{CH}_3 \\ 5 & & 4 & & 3 & & 2 & & 1 & & \\ & & & & | & & | & & & & \\ & & & & \text{CH}_3 & & 1\text{CHO} & & & & \end{array}$ 2 - Isopropyl - 3 - methyl - 4- oxo pentanal
- (7)  2- Bromo - 6 - oxo cyclohexane carbaldehyde
- (8)  cyclohexan - 1, 3 - dicarbaldehyde
- (10)  3- formyl - 2 - hydroxy cyclopentane-1- carboxylic acid

(Organic Chemistry) Classification and Nomenclature

NAMING OF CYANIDE

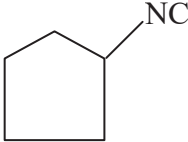
F.G -C \equiv N	Suffix Nitrile	Prefix -cyano	Special suffix Carbonitrile
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Rule : Alkane + Nitrile \rightarrow Alkane nitrile



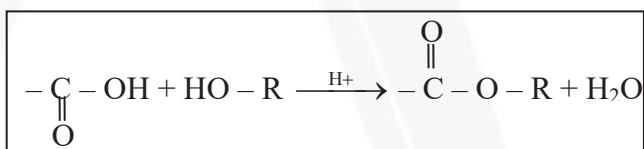
(Organic Chemistry) Classification and Nomenclature

NAMING OF ISOCYANIDE

	F.G -NC	Suffix Isocyanide	Prefix Isocyano
1.	R - NC	Alkyl Isocyanide	
2.	CH ₃ - NC	Methyl Isocyanide	
3.		Cyclopentyl Isocyanide	
4.	$\text{NC} - \overset{1}{\text{C}} - \overset{2}{\text{C}} - \overset{3}{\text{C}} - \overset{4}{\text{C}} - \text{NC}$	4 - Isocyano butanenitrile	

NAMING OF ESTER

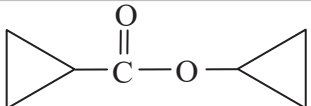
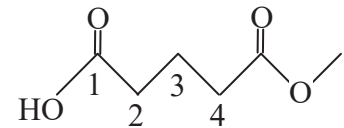
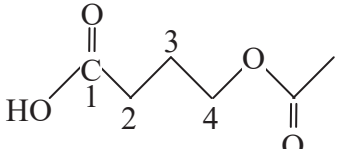
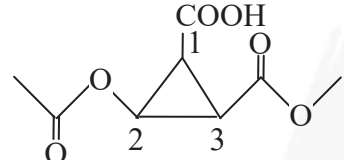
F.g $\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{O}-\text{R}' \end{array}$	Suffix -oate	Prefix $\begin{array}{c} \text{O} \\ \\ \text{Parent chain} - \text{C}-\text{O}-\text{R}' \\ \text{Alkoxy cabonyl} \end{array}$	Special suffix Carboxylate
		$\begin{array}{c} \text{O} \\ \\ \text{R}-\text{C}-\text{O}-\text{Parent Chain} \\ \text{Alkonoyloxy} \end{array}$	



Rule :- Alkylalkane + oate → Alkyl alkanoate

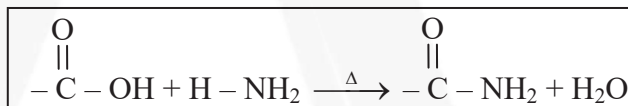
- (1) $\begin{array}{c} \text{O} \\ || \\ \text{H}-\underset{1}{\text{C}}-\text{O}-\text{CH}_3 \end{array}$ Methyl Methanoate
- (2) $\begin{array}{c} \text{O} \\ || \\ \text{H}-\text{C}-\text{O}-\text{CH}_2-\text{CH}_3 \end{array}$ Ethyl methanoate
- (3) $\begin{array}{c} \text{O} \\ || \\ \text{CH}_3-\underset{1}{\text{C}}-\text{O}-\text{CH}_3 \\ 2 \end{array}$ Methyl ethanoate
- (4) $\begin{array}{c} \text{O} \quad \text{O} \\ || \quad || \\ \text{CH}_3-\underset{2}{\text{C}}-\underset{1}{\text{C}}-\text{O}-\text{CH}_2-\text{CH}_3 \\ 3 \end{array}$ Ethyl 2 - oxo propanoate

(Organic Chemistry) Classification and Nomenclature

- (5)  cyclobutyl cyclopropane carboxylate
- (6)  4-Methoxycarbonyl Butanoic acid
- (7)  4 - ethanoyloxy Butanoic acid
- (8)  2 - ethanoyloxy -3- methoxycarbonyl cyclopropanoic acid

NAMING OF AMIDE

F.G $\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{NH}_2 \end{array}$	Suffix -Amide	Prefex Carbamoyl	Special suffix Carboxamide
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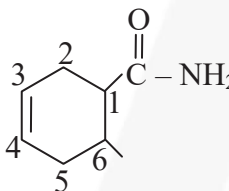
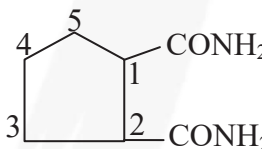
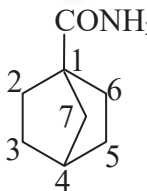


Rule :- Alkane + Amide \rightarrow Alkanamide

- (i) $\begin{array}{c} \text{O} \\ || \\ -\text{C}-\text{NH}_2 \end{array}$ Primary acid amide
- (ii) $\begin{array}{c} \text{O} \\ || \\ -\text{C}-\text{NH}-\text{R} \end{array}$ Secondary acid amide
- (iii) $\begin{array}{c} \text{O} \\ || \\ -\text{C}-\text{N} \begin{array}{l} \nearrow \text{R} \\ \searrow \text{R} \end{array} \end{array}$ Tertiary acid amide
- (1) $\begin{array}{c} \text{O} \\ || \\ \text{CH}_3-\text{C}-\text{NH}_2 \\ 2 \quad 1 \end{array}$ Ethnamide (Acetamide)
- (2) $\begin{array}{c} \text{O} \\ || \\ \text{H}-\text{C}-\text{NH}_2 \end{array}$ Methanamide (Formamide)

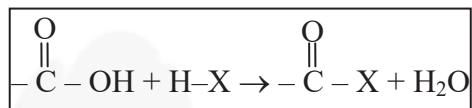
(Organic Chemistry)

Classification and Nomenclature

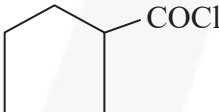
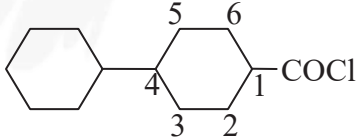
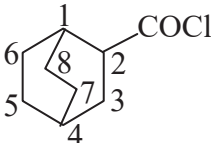
- (3) $\text{H}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}-\begin{matrix} \text{CH}_3 \\ \text{CH}_3 \end{matrix}$ N, N - Dimethyl methanamide (Dimethyl formamide) (DMF)
- (4) $\text{CH}_3-\overset{\text{O}}{\parallel}{\underset{1}{\text{C}}}-\text{N}-\begin{matrix} \text{CH}_3 \\ \text{CH}_3 \end{matrix}$ N, N - Dimethyl ethanamide (Dimethyl acetamide) (DMA)
- (6) $\text{CH}_3-\text{CH}_3-\text{N}-\overset{\text{O}}{\parallel}{\underset{1}{\text{C}}}-\underset{2}{\text{CH}}-\underset{3}{\overset{\text{CH}_3}{\text{CH}}}-\underset{4}{\text{CH}_3}$ N, N - Diethyl - 2, 3 - dimethyl Butanamide
- (7) $\text{H}_2\text{N}-\overset{1}{\underset{\parallel}{\text{C}}}-\overset{2}{\text{C}}-\overset{3}{\text{C}}-\overset{4}{\underset{\parallel}{\text{C}}}-\text{NH}_2$ Butandiamide
- (8) $\text{H}_2\text{N}-\overset{1}{\underset{\parallel}{\text{C}}}-\overset{2}{\text{CH}}-\overset{3}{\underset{\parallel}{\text{C}}}-\text{NH}_2$ 2 - Amino propandiamide
- (9)  6 - Methyl cyclohex-3-ene-carboxamide
- (10)  Cyclopentane -1, 2 - dicarboxamide
- (11)  Bicyclo [2, 2, 1] heptanecarboxamide
- (12) $\text{NH}_2-\overset{6}{\text{CH}_2}-\overset{5}{\overset{\text{O}}{\parallel}{\text{C}}}-\underset{4}{\text{CH}_2}-\underset{3}{\text{CH}_2}-\underset{2}{\text{CH}_2}-\overset{1}{\overset{\text{O}}{\parallel}{\text{C}}}-\text{NH}_2$ 6 - Amino-5-oxo hexanamide

NAMING OF ACID HALIDE

F.G	Suffix	Prifex	Special suffix
$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{X} \end{array}$	-oyl halide	Halo Carbonyl	Carbonylhalide
X = F, Cl, Br, I			



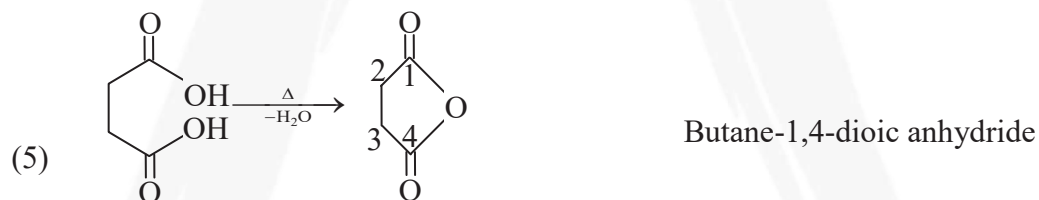
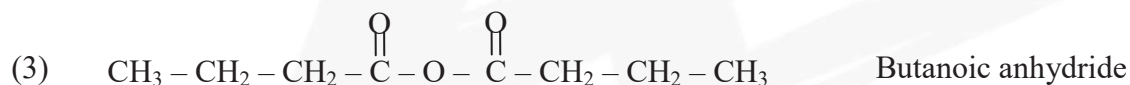
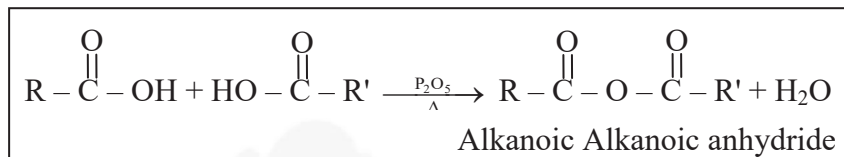
Rule: Alkane + oylhalide \rightarrow Alkanoyl halide

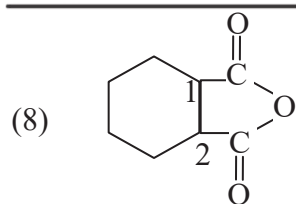
- (1) $\text{H}-\overset{\text{O}}{\parallel}{\text{C}}-\text{Cl}$ Methanoyl chloride (Formyl chloride)
- (2) $\text{CH}_3-\overset{\text{O}}{\parallel}{\underset{\text{1}}{\text{C}}}-\text{Br}$ Ethanoyl Bromide
- (3) $\text{Cl}-\overset{\text{O}}{\parallel}{\text{C}}-\overset{\text{O}}{\parallel}{\text{C}}-\text{Cl}$ ethane dioylchloride
- (4) $\text{Cl}-\overset{\text{O}}{\parallel}{\text{C}}-\underset{\text{3}}{\text{CH}_2}-\underset{\text{2}}{\text{CH}_2}-\underset{\text{1}}{\text{COOH}}$ 3-chloro carbonyl propanoic acid
- (5)  Cyclopentane carbonylchloride
- (6)  4 - Cyclohexyl cyclohexane-1-carbonyl chloride
- (7)  Bicyclo [2,2,2] octane -2- carbonyl chloride

(Organic Chemistry) Classification and Nomenclature

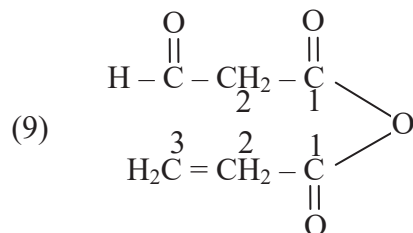
NAMING OF ACID ANHYDRIDE

F.G	Suffix	Special suffix
$\begin{array}{c} \text{O} \quad \text{O} \\ \parallel \quad \parallel \\ -\text{C}-\text{O}-\text{C}- \\ \parallel \quad \parallel \\ \text{O} \quad \text{O} \end{array}$	-oic anhydride	Carboxylic anhydride





Cyclohexane - 1, 2 - dicarboxylic anhydride



2- Formyl ethanoic prop-2-enoic anhydride

NAMING OF AMINES

F.G. -NH ₂	Suffix -amine	Prefix -amino
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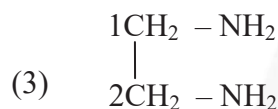
Rule:- Alkane + Amine → Alkanamine



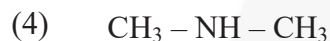
Methanamine (Methyl amine)



Prop -2- enamine



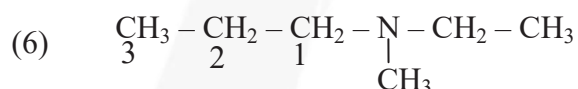
Ethane - 1,2 - diamine



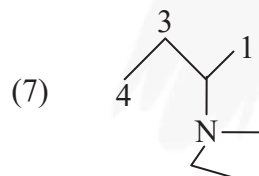
N - Methyl methanamine (Dimethyl Amine)



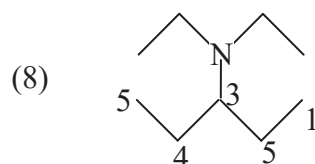
N-Methyl ethanamine



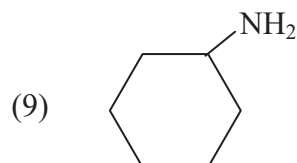
N-Ethyl-N-methyl propan -1- amine



N-Ethyl-N-methyl Butan -2- amine



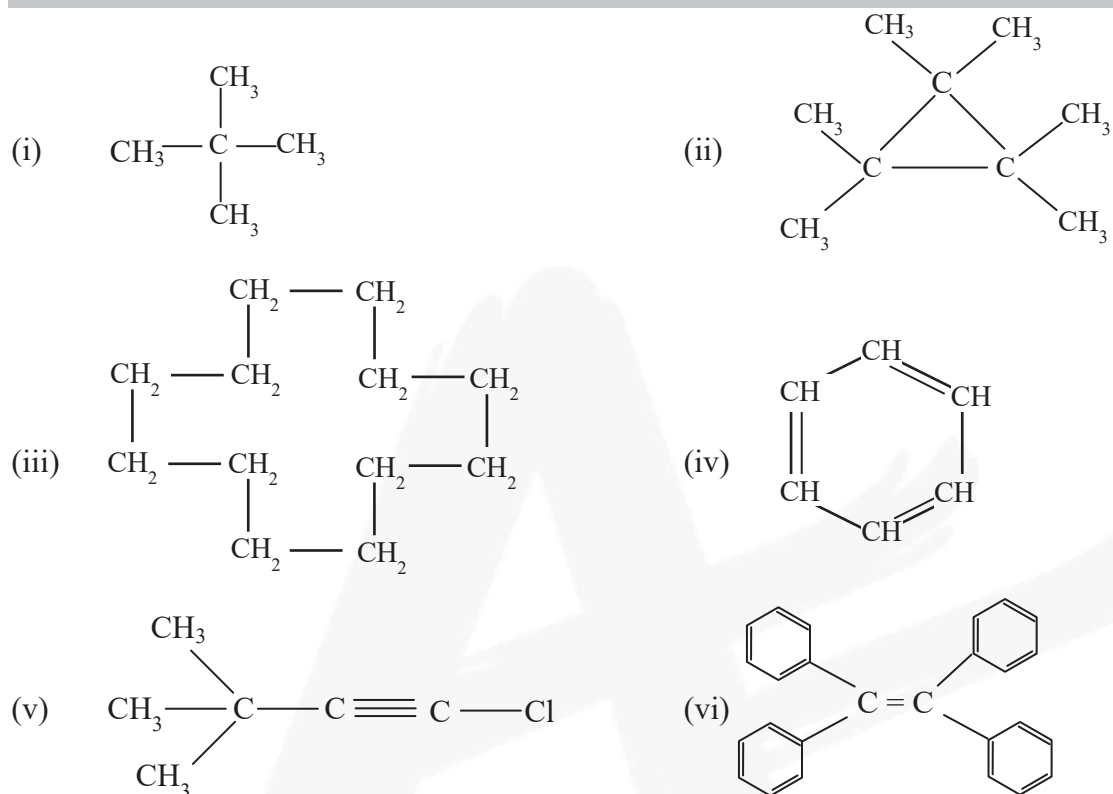
N,N-Diethyl pentan-3-amine



Cyclohexanamine

(Organic Chemistry) **Classification and Nomenclature**
ANSWER KEY

DO YOURSELF – 1



DO YOURSELF – 2

- (i) $1^\circ \rightarrow 5, 2^\circ \rightarrow 3, 3^\circ \rightarrow 1, 4^\circ \rightarrow 4$ (ii) $1^\circ \rightarrow 2, 2^\circ \rightarrow 8, 3^\circ \rightarrow 4, 4^\circ \rightarrow 0$
 (iii) $1^\circ \rightarrow 6, 2^\circ \rightarrow 3, 3^\circ \rightarrow 6, 4^\circ \rightarrow 0$

DO YOURSELF – 3

- (i) 1° alkyl halide (ii) 2° alkyl halide
 (iii) 3° alkyl halide (iv) 1° alkyl halide
 (v) 2° alkyl halide

DO YOURSELF – 4

- (i) 1° alcohol (Primary alcohol) (ii) 2° alcohol (Secondary alcohol)
 (iii) 3° alcohol (Tertiary alcohol) (iv) 1° alcohol

(Organic Chemistry) Classification and Nomenclature**DO YOURSELF – 5**

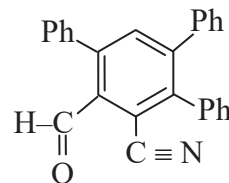
(i) 2

(ii) 6

(iii) 7 ; **Hint:** 

(iv) 8

(v) 5

(vi) 19 ; **Hint :****DO YOURSELF – 6**

(i) 6

(ii) 3

(iii) 5

(iv) 3

(v) 4

DO YOURSELF – 7

(i) Methyl Cyclopropane

(ii) 1, 2 - Dimethyl cyclohexene

(iii) propyl cyclopropane

(iv) 1 - cyclohexyl - 3 - methyl pent - 1 - ene

(v) 1 - bromo-4-chloro cyclohexane

(vi) 1,3,5 - Tricyclopropyl cyclohexane