13. ORGANIC CHEMISTRY

BULLET MASTER'S
CHEM BEATS!

IPE VIEW:
1 VSAQ (OR) 1 SAQ (OR) 1LAQ

GRAND WELCOME to the **'live World'** of **ORGANIC CHEMISTRY!**

ORGANIC means LIFE (జీవం)

Organic Chemistry deals with 'organic compounds' related to 'living organisms'.
Each and every 'Organ of our body' grows and lives due to Organic compounds (Biomolecules).
Organic compounds just decide Shape, Size, Mood and even life span of Human beings !

Organic compounds consists of

1) Natural Compounds produced from Plants, Animals like Proteins, Carbohydrates, Lipids, Vitamins, Enzymes, Minerals, Hormones, Nucleic acids(DNA), Sugars, Alkanoids....
2) Synthetic Compounds made artificially like Polymers, Plastics, Rubbers, Insulin, Ethanol, Medical drugs, Dyes....

These organic compounds are being used in a variety number of ways in our daily life, such as, Medicines,Fuel,Plastics,Clothes, Food preservatives, Soaps & Detergents, Rubbers....

Organic King element **C;** Organic Queen Element **H**
Organic Princess Element **O;** Organic Prince Element **N**

Four Core Organic Molecules: C, H, O, N + S,P

These 4 Organic molecules carry 96% mass of body of Human beings.

How much big is Organic Chemistry ?

ఈ ప్రపంచంలో సుమారు 100 మూలకాల యొక్క different Permutations & Combinationsలతో ఏర్పడిన All Chemical Compounds సంఖ్య సుమారు 100 లక్షల వరకు ఉంటే.....
వాటిలో కేవలం C, H, O, N....లతో ఏర్పడిన Organic Compounds సంఖ్యే 90 లక్షలు!

So, you just imagine how big is Organic Chemistry !!

Such gigantic and enormous expansion of organic compounds is occurred due to unique 'Catenation property' of King Carbon.

What do we study in Organic Chemistry?

We study the Nomenclature, Structure, Composition, Preparations & Properties of Organic compounds.

IPE Point of view:

(i)) IUPAC Nomenclature of Organic compounds
(ii) Preparation and Properties of Ethane, Ethelyne, Acetylene, Benzene

TIPS to master ORGANIC CHEMISTRY:

i) Read & Review the basics regularly before and after your chemistry class.
ii) Give first priority to study Organic chemistry at home.
iii) Stick some 'Organic Formulae - diagram sheets' on the walls of your study room.
iv) Do daily discussions with your classmates and study groups.
v) Don't simply memorize but try to understand the concept
vi) Ask lot of questions how, why, how to remember yourself....
vii) Learn from mistakes

Make learning of **O.C** as a **'challenging task'!**

Eventually Organic Chemistry **enhances 'memory power'** of students.

Learning 'Organic Chemistry' is just like learning the 'Chess game'.

If you learn the basic steps properly 'you rock the game'**!**

STUDY NOTES

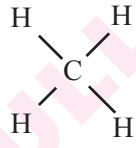
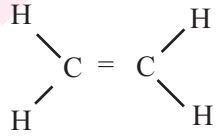
1.0 The compounds of carbon and hydrogen are known as **Hydrocarbons**.

Organic chemistry mainly deals with the study of Carbon compounds containing Hydrocarbons & their derivatives.

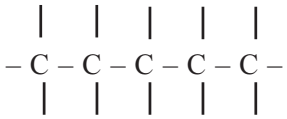
There are three major reasons for the existence of millions of carbon compounds.

They are (i) Tetravalency (ii)Catenation (iii) Isomerism of carbon.

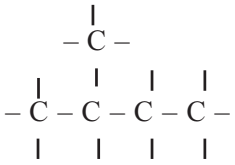
1.1 Tetravalency: The valency of carbon is 4 . Hence , every carbon atom always tends to form 4 bonds with other atoms. Also, between any two carbon atoms 3 types of bonds are possible.

S.No.	Name Type	Examples	Structure Hybridisation	Bond angle bond length	Remarks
1)	Single bond C – C 1 σ bond	Methane CH_4 Ethane C_2H_6	 SP^3 – Tetrahedral	$109^0 28^1$ 1.54 A^0	Saturated compound and Stable
2)	Double bond C = C 1 σ &1π bond	Ethene C_2H_4 Propene C_3H_6	 SP^2 – Trigonal planar	120^0 1.34A^0	Unsaturated compound and Active
3)	Triple bond C ≡ C 1 σ &2πbonds	Ethyne C_2H_2	H – C ≡ C – H SP – Linear	180^0 1.20 A^0	Unsaturated compound and Active

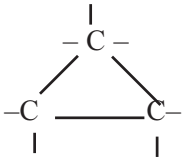
1.2 Catenation: Formation of long chains or rings by the linking of similar atoms is called Catenation Carbon atom has very high catenation power, due to its high C–C bond dissociation energy. Carbons form 3 types of chains.They are (i) Straight chains (ii) Branched chains (iii) Ring structures



Straight Chain



Branched Chain

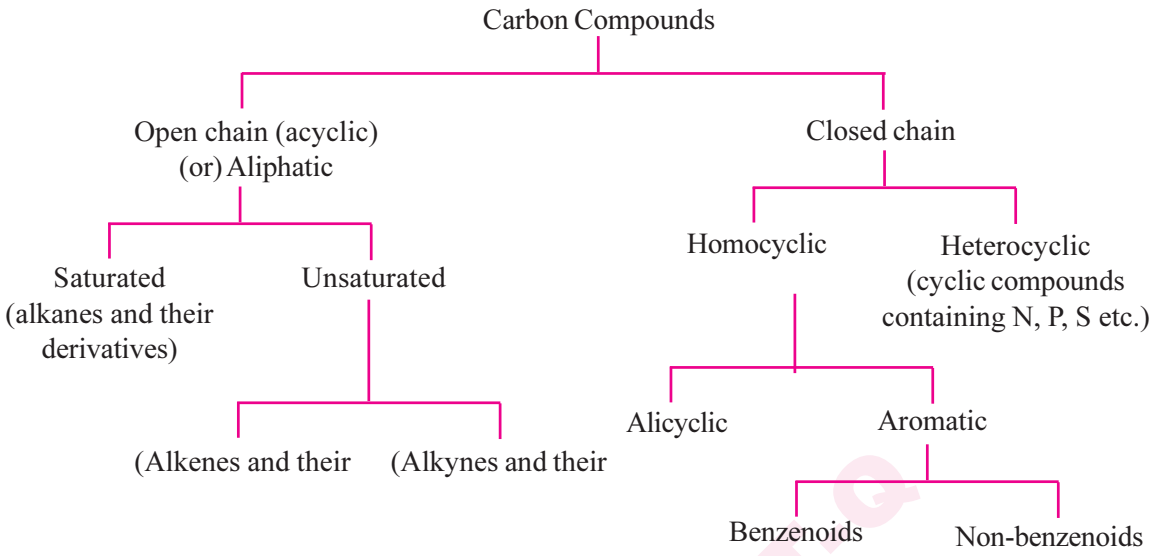


Ring Structure

1.3 Isomerism : Compounds having same molecular formula, but different structures are called isomers and the phenomenon is called isomerism.

In this chapter, we mainly study (i) Classification of Hydrocarbons (ii) Nomenclature of Organic compounds (iii) Isomerism (iv)Types of Organic reactions (v) Alkanes, Alkenes, Alkynes and Benzene-Preparation and Properties (vi) Some other concepts.

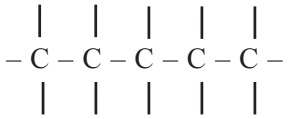
2. CLASSIFICATION OF CARBON COMPOUNDS- ON THE BASIS OF 'CARBON CHAIN STRUCTURES'



I. Open chain compounds

These have straight or branched chains

Ex :



1.1 Saturated compounds :

These compounds contain single bonds.

These are very saturated and stable.

Ex : Methane, Ethane

1.2 Unsaturated compounds:

These compounds contain double or triple bonds.These are unsaturated and hence very active.

Ex : Ethene, Ethyne

1.3 Alkenes:

These compounds contain double bonds.

Ex : Ethene, Propene

1.4 Alkynes :

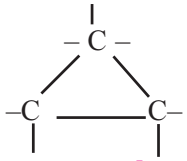
These compounds contain triple bonds.

Ex : Ethyne , Butyne

II. Closed chain compounds

These compounds have ring structures.

Ex :



2.1 Homocyclic compounds:

Only carbon atoms are present in the rings.

2.2 Heterocyclic compounds:

Other than carbon atoms are also present in rings.

2.3 Alicyclic compounds :

Cycloalkanes,Cycloalkenes, Cycloalkynes

2.4 Aromatic compounds :

'Aroma' means 'pleasant odour'. Accoding to Huckel's rule planar ring structures with $(4n+2)\ \pi$ electrons are called aromatic compounds.

Majority of these compounds contain benzene rings.

2.5 Benzenoids:

These compounds contain benzene rings, which are very unstable.

2.6 Non-Benzenoids:

These aromatic compounds donot contain benzene rings.

3.0 Important concepts

3.1 Homologous series: A series of compounds having similar chemical properties, with successive compounds differing by a '– CH_2' group, is called a homologous series.

A particular group of a homologous series is called **homologue**. **Ex:** Alkanes, Alkenes, Alkynes

Characteristics of homologous series :

1) All the homologues of a given series can be represented by a general formula.
2) The chemical properties of homologues are almost similar.
3) Homologues show a regular gradation in their physical properties.
4) Homologues have same general methods of preparation.

3.2 Alkanes, Alkenes, Alkynes:

Alkanes : Alkanes are saturated hydrocarbons with general formula C_nH_{2n+2}.
Ex: : Methane CH_4, Ethane C_2H_6.

Alkenes : Alkenes are unsaturated hydrocarbons having general formula C_nH_{2n}.
Ex : Ethene C_2H_4 , Propene C_3H_6.
Alkenes mainly participate in addition reactions.

Alkynes: Alkynes are unsaturated hydrocarbons having general formula C_nH_{2n-2}.
Ex : Ethyne (or) acetylene C_2H_2, Propyne C_3H_4 .

Note: **Cycloalkanes:** Cyclo alkanes are cyclic hydrocarbons having general formula C_nH_{2n}.

3.3 Functional group: An 'atom' or a'group of atoms', which is responsible for the **characteristic** properties of an organic compound, is called functional group.

Functional groups play 'more reactive part' in chemical properties of organic compounds.

Organic compounds (different) with **same functional group** exhibit **similar properties.**

The Functional group **–OH** is called **Hydroxyl group (**or) **Alcoholic group**.

The Functional group **–CHO** is called **Aldehyde group**.

The Functional group **–CO** is called **Ketone group**.

The Functional group **$–NO_2$** is called **Nitro group**.

The Functional group **$–NH_2$** is called **Amino group**.

The Functional group **–Cl** , **–Br** etc is called **Halogen group**.

The Functional groups are classified into 2 types.

i) **Principal functional groups :** Esters, Carboxylic acids, Aldehydes, Ketones, Alcohols ..
Note: The functional groups are given 'a priority order' for Nomenclature, in case of compounds containing poly functional groups

ii) **Secondary functional groups :** Amines, Halides, Cyanides ,Nitro compounds etc.,
Note: These are to follow the **alphabetical** order , for Nomenclature.

3.4 Alkyl group : The group which is formed by removing one H atom from an **Alkane** molecule is called **Alkyl group.** Its general formula is C_nH_{2n+1}. Alkyl group is generally denoted by **–R**

Note : Alkane – H = Alkyl

Ex1: $CH_4 - H = -CH_3$
Methane Methyl

Ex2: $C_2H_6 - H = -C_2H_5$
Ethane Ethyl.

3.5 Substituent : An atom or group used to replace another atom or group in organic compounds is called a substituent.

4. Classification of organic compounds based on functional groups

Class	Functional group	General formula	Example	Common name	IUPAC name
Alkanes	C – C	C_nH_{2n+2}	CH_4 C_2H_6	Methane Ethane	Methane Ethane
Alkenes	C=C	C_nH_{2n}	$CH_2 = CH_2$	Ethylene	Ethene
Alkynes	C≡C	C_nH_{2n-2}	H–C≡C–H	Acetylene	Ethyne
Alkyl halides	–X	R–X	C_2H_5Cl	Ethyl chloride	Chloroethane
Alcohols (or) Alkanols	–OH	R–OH	CH_3OH CH_3CH_2OH $CH_3CH_2CH_2OH$ C_4H_9OH	Methyl alcohol Ethyl alcohol Propyl alcohol Butyl alcohol	Methanol Ethanol Propanol Butanol
Ethers (or) Alkoxyalkanes	–O–	R–O–R	$CH_3–O–CH_3$ $C_2H_5–O–C_2H_5$	Dimethyl ether Di ethyl ether	Methoxy methane Ethoxyethane
Aldehydes (or) Alkanals	–CHO	R–CHO	HCHO CH_3CHO	Formaldehyde Acetaldehyde	Methanal Ethanal
Ketones (or) Alkanones	$-\overset{\overset{O}{\|}}{C}-$	$R-\overset{\overset{O}{\|}}{C}-R$	$CH_3–CO–CH_3$ $CH_3–CO–C_2H_5$	Acetone Ethyl methyl ketone	Propanone Butanone
Acids (or) Alkanoic acids	–COOH	R–COOH	HCOOH CH_3COOH C_2H_5COOH C_3H_7COOH	Formic acid Acetic acid Propionic acid Butyric acid	Methanoic acid Ethanoic acid Propanoic acid Butanoic acid
Esters (or) Alkyl alkanoates	–COO–	R–COO–R	$HCOOCH_3$ CH_3COOCH_3 $C_2H_5COOC_2H_5$	Methyl formate Methyl acetate Ethyl acetate	Methyl methanoate Methyl ethanoate Ethyl propanoate
Amines (or) Amino alkanes	$–NH_2$	$R–NH_2$	$CH_3–NH_2$	Methyl amine	Amino methane
Cyanides	–CN	R–CN	CH_3CN	Methyl cyanide	Ethane nitrile
Isocyanides	–N=C	R–N=C	CH_3NC	Methyl iso cyanide	Methyl carbylamine

5.0 IUPAC SYSTEM OF NOMENCLATURE

Naming of organic compounds using certain rules prescribed by IUPAC (International Union of Pure and Applied Chemistry) is called IUPAC system of nomenclature:

5.1 Naming of straight chain hydro carbons .

(i) Root word : This denotes the number of carbon atoms present in the parent carbon chain.

No. of carbons	1	2	3	4	5	6	7	8	9	10
Root word	Meth	Eth	Prop	But	Pent	Hex	Hept	Oct	Non	Dec

(ii) Suffix : A suffix comes after the root word.It denotes the nature of carbon chain or functional group of the compound. Suffix may be i) Primary suffix ii) Secondary suffix

Primary Suffix (P.S) : This denotes whether the compound is saturated (or) unsaturated.

(a) For saturated compounds with C-C bonds the P.S is 'ane'

Ex : $H_3C–CH_3$, (C_2H_6) ; Eth + ane = Ethane.

(b) For unsaturated compounds with C=C bonds, the P.S is 'ene'

Ex : $H_2C=CH_2$, (C_2H_4) ; Eth + ene = Ethene.

(c) For unsaturated compounds with C≡C bonds, the P.S is 'yne'.

Ex : HC≡CH, (C_2H_2) ; Eth + yne = Ethyne.

S.No.	Group	Molecule	Root word	Primary suffix	IUPAC name
1	Alkane	CH_4	Meth -	- ane	Methane
2	Alkane	C_2H_6	Eth -	- ane	Ethane
3	Alkene	C_3H_6	Prop -	- ene	Propene
4	Alkene	C_4H_8	But -	- ene	Butene
5	Alkyne	C_5H_8	Pent -	- yne	Pentyne
6	Alkyne	C_6H_{10}	Hex -	- yne	Hexyne

5.2 Naming of simple compounds containing Functional groups.

Here, we use Secondary Suffix (S.S)

Secondary Suffix (S.S): This denotes the nature of functional group present in the compound. Naming of simple compounds containing 'one functional group' can be derived from the name of an ' Alkane'. Here 'e' in alkane is replaced by appropriate secondary suffix.

Thus, Alkane ⇒ Alkanol; Alkanal; Alkanone; Alkanoic Alkanoate

Ex1: Alkanol / Alcohol (–OH) ⇒ CH_3OH Methanol, C_2H_5OH Ethanol, C_3H_7OH Propanol

Ex2: Alkanoic / Acid(–COOH) ⇒ HCOOH Methanoic acid, CH_3COOH Ethanoic acid, C_2H_5COOH Propanoic acid, C_3H_7COOH Butanoic acid ....

Note: The following 'priority order' has to be followed, for nomenclature, in case of compounds containing poly 'primary functional groups'.

Priority order : Esters, Carboxylic acids, Aldehydes, Ketones, Alcohols ..

In case of **Secondary functional groups,** the **alphabetical** order has to be followed.

Ex : **A**mine (– NH_2), Halo – X [–**Br** bromo, – **Cl** chloro, – F Fluoro etc], **C**yano – CN (Nitrile), **I**socyano – NC (Carbyl amine), **N**itro – NO_2

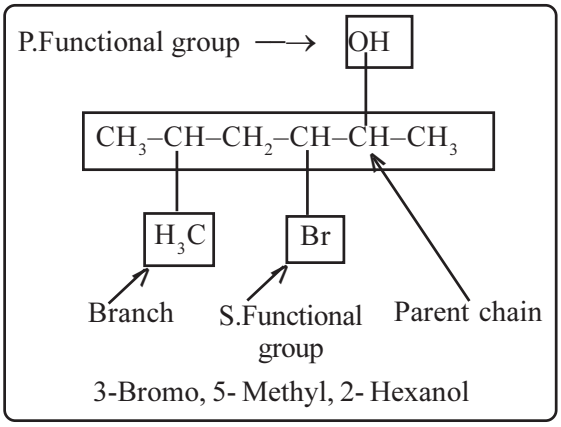
5.3 Nomenclature for Branched chain Hydro carbons – Rules / Steps

i) First of all, longest possible continuous chain of carbon atoms has to be identified. It is called **main chain** (or) **parent chain**.

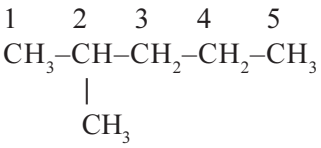
ii) Identify the branches on the main chain, like functional group (or)alkyl substituents.

iii) If more than one **similar** substituents (or) functional groups are present then numerical prefixes like di (for2), tri (for3) etc are to be used.

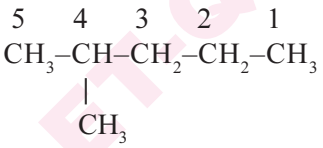
iv) **Numbering to Carbon atoms :** The carbon atoms of main chain are given numbers such that the substituents should get lowest possible number.



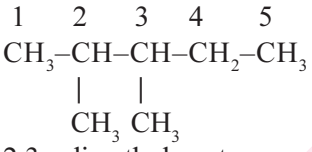
3-Bromo, 5- Methyl, 2- Hexanol



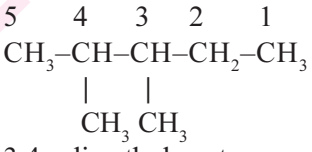
2 – methyl pentane (Right)



4 – methyl pentane (Wrong)

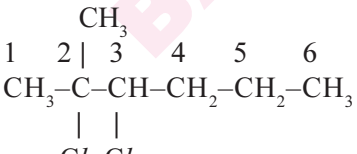


2,3 – dimethyl pentane (Right)

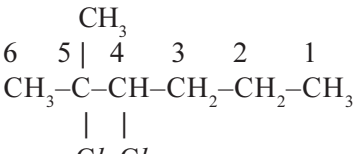


3,4 – dimethyl pentane (Wrong)

v) **Lowest sum rule :** On main chain the numbers are given to carbon atoms (baring substituents) from left to right (or) right to left, such that 'on adding numbers of carbons', it should give the lowest sum possible.



(2+2+3= 7 correct)



(4+5+5 =14 wrong)

vi) **Multiple bonds rule:** If the chain contains multiple bonds then priority should be given to a **double bond** for assigning lowest number.

5.4 Nomenclature of Cyclic compounds or groups with Secondary Functional group.

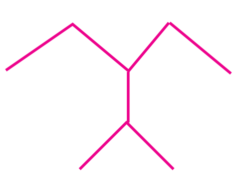
Prefix: A prefix comes before the root word of a cyclic compound or complex compound.

i) A primary prefix is used for cyclic compounds [Begins with *cyclo*]

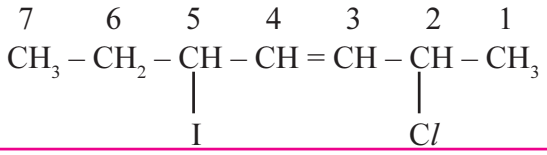
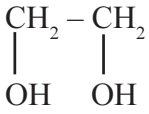
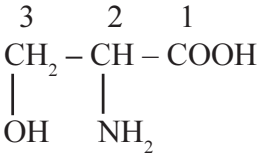
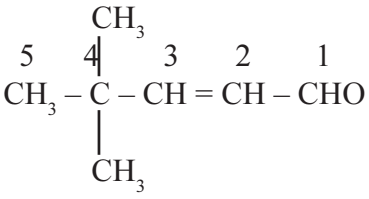
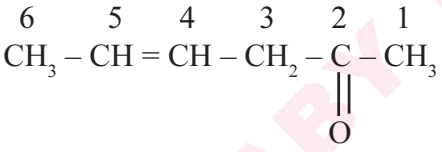
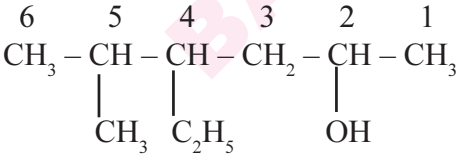
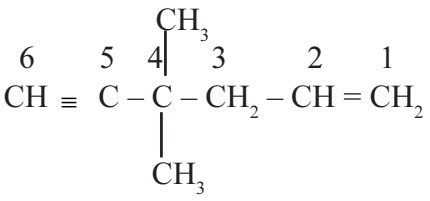
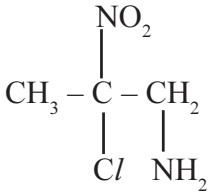
ii) A secondary prefix is used to represent substituent (Secondary functional group in alphabetical order)

The **sequence** of Nomenclature: **Prefix + Rootword + Suffix**

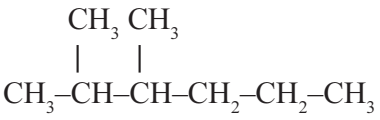
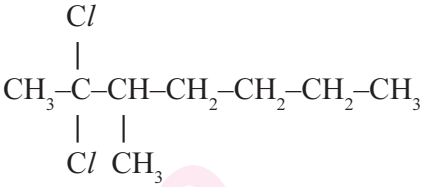
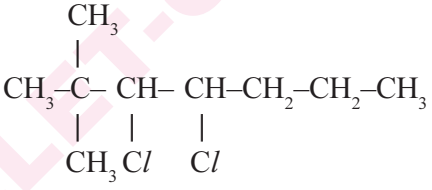
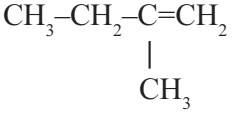
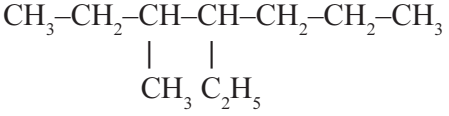
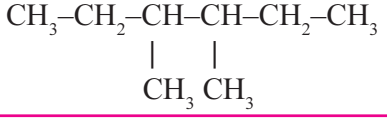
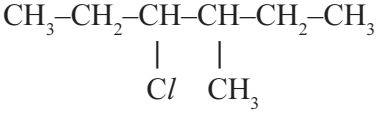
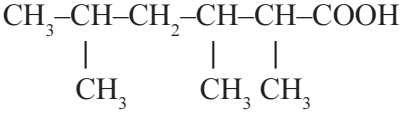
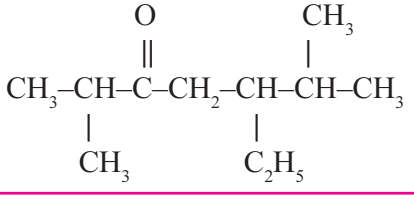
5.5 Few more Common Groups:

	EXAMPLES
Primary, secondary..... 1) A carbon attached to one more carbon is called **primary** carbon (1^0)	$\overset{1^0}{CH_3} - \overset{1^0}{CH_3}$
2) A carbon attached to two more carbons is called **secondary** carbon (2^0)	$\overset{1^0}{CH_3} - \overset{2^0}{CH_2} - \overset{1^0}{CH_3}$
3) A carbon attached to three more carbons is called **tertiarty** carbon (3^0)	$CH_3 - \overset{3^0}{CH}(CH_3) - CH_2 - CH_3$
4)A carbon attached to 4 other carbons is called **quarternary** carbon(4^0).	$CH_3 - CH(CH_3) - \overset{4^0}{C}(CH_3)(CH_3) - CH_3$
5) Isopropyl group $(CH_3)_2CH -$	$(CH_3)_2CH - OH$ Isopropyl alcohol (2 – propanol) $(CH_3)_2CH - CH_3$ Isobutane (2 – methyl propane)
6)Neo pentyl group $CH_3 - C(CH_3)(CH_3) - CH_2 -$	$CH_3 - C(CH_3)(CH_3) - CH_2 - Cl$ Neopentyl chloride (2,2 – dimethyl – 1– chloro propane)
7) SKELTON STRUCTURES 	$CH_3 - CH_2 - CH(CH_3) - CH_2 - CH_3$ 3 – methyl pentane.
	$CH_3 - CH_2 - CH(CH(CH_3)CH_3) - CH_2 - CH_3$ 3 – ethyl –2 – methyl pentane.

5.6 NOMENCLATURE -I: STRUCTURAL Formulae to IUPAC names

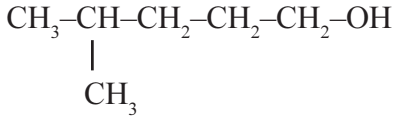
Structural formula	IUPAC name
1) 	2 – chloro – 5 – iodo – hept – 3 – ene.
2) 	Ethane – 1,2 – diol.
3) 	2 – Amino – 3 – hydroxy propanoic acid.
4) 	4,4 – dimethyl penta – 2 – enal.
5) 	2 – Hexanone – 4 – ene. (or) Hex–4–ene–2-one
6) 	4 – ethyl – 5 – methyl – 2 – hexanol.
7) 	4, 4 – dimethyl – hex– 1–ene – 5 – yne.
8) 	2 – chloro – 2 – nitro propanamine.

5.7 NOMENCLATURE -II: IUPAC names to STRUCTURAL formulae

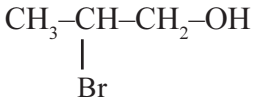
IUPAC name	Structural formula
1) 2,3 - dimethylhexane	
2) 1–propyne	
3) 2,2 –dichloro –3–methylheptane	
4) 3,4 – dichloro - 2,2 dimethyl heptane	
5) 2–methyl–1–butene	
6) 4-ethyl–3–methylheptane	
7) 3,4 –dimethylhexane	
8) 3–chloro – 4 – methylhexane	
9) 2,3,5 – trimethylhexanoicacid	
10) 5–ethyl–2,6–dimethyl–3–heptanone	

5.8 PRACTICE SET of IUPAC names

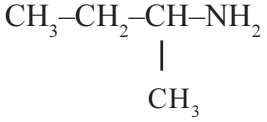
Structural formula

1) 

Name : .....

2) 

Name :.....

3) 

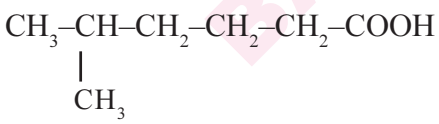
Name :.....

4) $CH_3–CH_2–CH=CH_2$

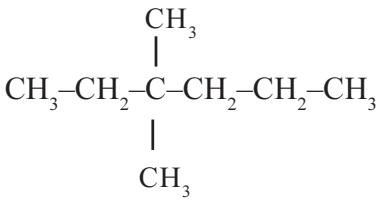
Name :.....

5) $CH_3–CH(CH_3)–CH_2–CH_2–Cl$

Name :.....

6) 

Name :.....

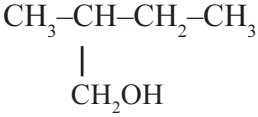
7) 

Name :.....

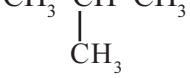
8) CH_3CHO

Name :.....

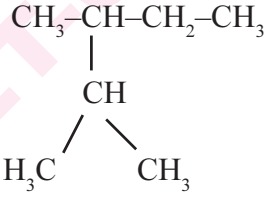
Structural formula

9) 

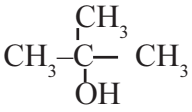
Name : .....

10) 

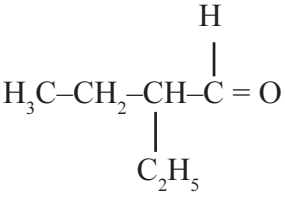
Name :.....

11) 

Name :.....

12) 

Name :.....

13) 

Name :.....

14) $CH_3–CH_2–CH = CH–CH_3$

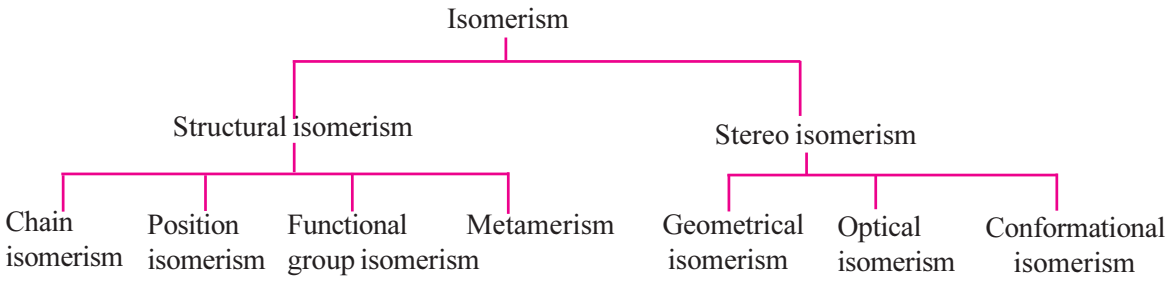
Name :.....

15) $CH_3–CH_2–COOH$

Name :.....

6.0 Isomerism : Compounds having same molecular formula but different structures/properties are called isomers. This phenomenon is called isomerism.

6.1 TYPES OF ISOMERISMS



6.2 ISOMERISMS – DEFINITIONS, PROPERTIES

Structural isomerism	Stereo isomerism
This isomerism arises due to difference in arrangement of atoms (or) groups in a molecule. These isomers differ in physical and chemical properties. Separation of these isomers in a mixture is easy. **1.1 Chain isomerism :** This isomerism arises due to difference in the lengths of carbon chains **1.2 Position isomerism :** This isomerism arises due to difference in the position of functional group/ substituent **1.3 Functional group isomerism :** This isomerism arises due to difference in the nature / type of functional group **1.4 Metamerism :** This isomerism arises due to difference in the nature / type of alkyl groups attached to the same functional group.	This isomerism arises due to difference in **spacial** arrangement of atoms (or) groups around carbons. These isomers differ in physical properties. Most of chemical properties are same. Separation of these isomers in a mixture is difficult. **2.1 Geometrical isomerism :** This isomerism is generally observed in alkens (C=C). This isomerism arises due to difference in **spatial** arrangement of atoms (or) groups around a C=C bond or a ring structure **2.2 Optical isomerism:** This isomerism arises due to the rotation of plane polarised light (light particles vibrate in only one plane). Here, two isomers are mirror images to each other. **2.3 Conformational isomerism :** This isomerism arises due to the rotation of C–C bond in alkanes.

6.3 STRUCTURAL ISOMERISMS – ILLUSTRATIONS

ISOMERISMS	ILLUSTRATIONS
1. Chain isomerism : Compounds having same molecular formula but differ in the length of carbon chain are called chain isomers and the phenomenon is called chain isomerism. ***Note :*** 4 or more carbons are required to form a chain isomerism.	**Ex 1:** $CH_3 - CH_2 - CH_2 - CH_3$ (n – butane) | $CH_3 - CH(CH_3) - CH_3$ (Isobutane) **Ex 2:** $CH_3 - CH_2 - CH_2 - CH_2 - CH_3$ (n – pentane) $CH_3 - CH(CH_3) - CH_2 - CH_3$ (Isopentane) 2-methyl butane $C(CH_3)_4$ (Neopentane) 2,2 - dimethyl propane
2. Position isomerism : Compounds having same molecular formula but differ in the position of functional group / substituent /double / triple bonds are called position isomers and the phenomenon is called position isomerism.	**Ex1:** $CH_2 = CH - CH_2 - CH_3$ (1 – butene) | $CH_3 - CH = CH - CH_3$ (2 – butene) **Ex2:** $CH_3 - CH_2 - CH_2OH$ (n – propyl alcohol) 1 – propanol | $CH_3 - CH(OH) - CH_3$ (Isopropyl alcohol) 2 – propanol
3.Functional group isomerism: Compounds having same molecular formula but differ in nature of functional group are called functions isomers and the phenomenon is called functional isomerism.	**Ex1:** $CH_3 - CH_2 - OH$ (Ethyl alcohol) Ethanol; $CH_3 - O - CH_3$ (Dimethyl ether) Methoxy methane **Ex2:** (i) CH_3CH_2CHO (Acetaldehyde) proponal (ii) CH_3COCH_3 (Acetone) Propanone
4. Metamerism: Compounds having same molecular formula but differ in nature of alkyl groups attached to same functional group are called metamers and the phenomenon is called Metamerism.	**Ex1:** $CH_3–CH_2–O–CH_2–CH_3$ Diethyl ether $CH_3–O–CH_2–CH_2–CH_3$ Methyl-n-propyl ether **Ex2:** $CH_3–CH_2–NH–CH_2–CH_3$ Diethyl amine $CH_3–NH–CH_2–CH_2–CH_3$ Methyl-n-propyl amine

TOP 40 ORGANIC SYNOPSIS POINTS

1. Compounds containing only Carbon &Hydrogen atoms are known as **Hydrocarbons.** Hydrocarbons & their derivatives are called **Organic compounds**

2. **Methods of purification of Organic compounds:**
(i) Crystallisation **(ii)**Sublimation **(iii)** Distilllation(Fractional,Steam,Reduced pressure distillation) **(iv)** Solvent extraction **(v)** Chromatography techniques.

3. **Types of Organic reactions:**
(i) Addition reaction (ii) Substitution reaction (iii) Elimination reaction
(iv) Molecular rearrangements

4. A series of compounds in which two successive compounds differ by a - CH_2 - group is called a **Homologous series.** Ex : Alkanes, Alkenes,Alkynes

5. **Alkanes** are saturated hydro carbons having C-C single bonds.
The general formula is C_nH_{2n+2}. **Ex:** CH_4 Methane, C_2H_6 Ethane
Alkanes are also known as Paraffins (Parafin means lack of ability).
Alkanes are stable and Innert towards many other substances.
Alkanes mainly participate in substitution reactions. **Ex :** Chlorination of ethane

6. **Alkenes** are unsaturated hydrocarbons having C=C double bonds.
The general formula is C_nH_{2n}. **Ex :** C_2H_4Ethyne, C_3H_6Propene
Alkanes are also known as Olefins. Alkenes are unstable and are active.
Alkenes mainly participate in addition reactions.

7. **Alkynes** are also unsaturated hydrocarbons having C ≡ C triple bond
The general formula is C_nH_{2n-2}. **Ex:** C_2H_2 Ethyne , C_3H_4 Propyne
The hydrogens present on triple bonded carbons are acidic in nature.
Alkynes mainly participate in addition reactions.

8. **Cyclo alkanes** are cyclic hydrocarbons having general formula C_nH_{2n}.
Lower cyclo alkanes are unstable due to **Angle strain**.
Hence they participate in addition reactions which is due to cleavage of ring.
Higher cyclo alkanes are stable and participate in substitution reactions.

9. **Benzene** is **aromatic** hydro carbon having formula C_6H_6.
The structure of benzene is a **resonance hybrid** with 6 delocalised pi electrons.
The formula resembles unsaturated hydrocarbon. But unlike unsaturated hydrocarbons it participate in **electrophilic substitution** reactions rather than addition reactions.
This is because, **Benzene is stabilised due to resonance.**
Benzene is mainly extracted from **coal tar.**

10. **Isomerism** is the phenomenon in which compounds having same molecular formula but different properties.

11. Isomerism due to the difference in the nature of carbon chain is called **Chain isomerism**.

12. **Position isomerism** is the difference in the position of a substituent, a functional group or a multiple bond .

13. **Functional group isomerism** arises due to the difference in the nature of functional group.
14. **Metamerism** is due to the difference in the nature of the alkyl groups attached to the same functional group.
15. **Halogenation** is the replacement of H - atoms by halogen atoms.
16. **Nitration** is the replacement of H - atoms by a nitro group .
17. **Sulphonation** is the replacement of H - atoms by a sulphonic acid group.
18. **Alkylation** is the replacement of H - atoms by an alkyl group.
19. **Dehalogenation** is the elimination of halogen molecule.
20. **Dehydrohalogenation** is the elimination of hydrogen and halogen atoms together.
21. **Hydrogenation** is the addition of hydrogen.
22. **Dehydration** is the removal of water molecule .
23. **Grignard reagent** is the Alkyl magnesium halide. **Ex : R Mg X**
24. **Baeyer's reagent** is cold and dilute alkaline $KMnO_4$ solution.
25. **Wurtz reaction:** Alkyl halides on heating with sodium metal in presence of dry ether gives an alkane with twice the number of carbon atoms.
26. **Kolbe's electrolysis:** Electrolysis of a concentrated aqueous solution of sodium or potassium salt of carboxylic acid gives a hydrocarbon at anode.
27. **Huckle's rule** is obeyed by cyclic, planar aromatic compounds.
28. **Soda - lime** is the mixture of sodium hydroxide and calcium oxide.
29. **Chromatography** is a method of separation of components of a mixture between a stationary phase and a mobile phase reagent.
30. **Inductive effect** is the polarization of σ bond caused by the polarization of adjacent σ bond.
31. **Electromeric effect** is the complete transfer of a shared pair of π electrons to one of The atoms joined by a multiple bond on the demand of an attacking group.
32. **Mesomeric effect** of an atom or group is the electron pair displacement caused by an atom or group along a chin by a conjugative mechanism.
33. **Hyperconjugation** is also called **no-bond resonance**.
34. **Elimination reaction** is one, in which two or more atoms or groups of a substrate are removed to form multiple bonds.
35. **Conformational isomers** of an alkane are obtained by rotation about C - C bond.
36. **Markownikoff's rule:** When HX adds to an unsymmetrical alkene,the halide (X) part of HX attaches itself to the double bonded carbon having less number of hydrogens.
37. **Kharsch effect** is the Anti Markownikoff's addition in presence of a peroxide.
38. '**Optically active substance**' is a substance which rotates the plane polarised light.
39. **Chiral** is a organic compound which exhibits optical activity .
40. **Enantiomers** are **non-superimposable** chiral molecule and its mirror image .