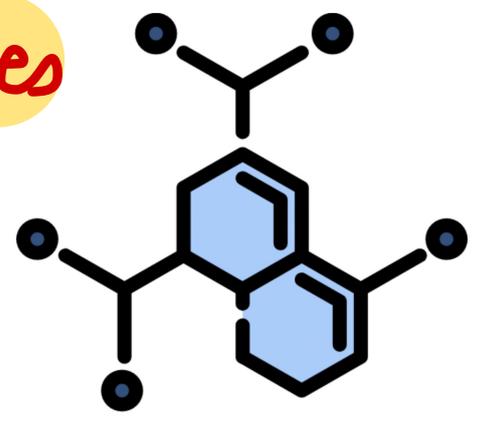


CLASS-11<sup>TH</sup>

chapter - 12

Best Handwritten Notes

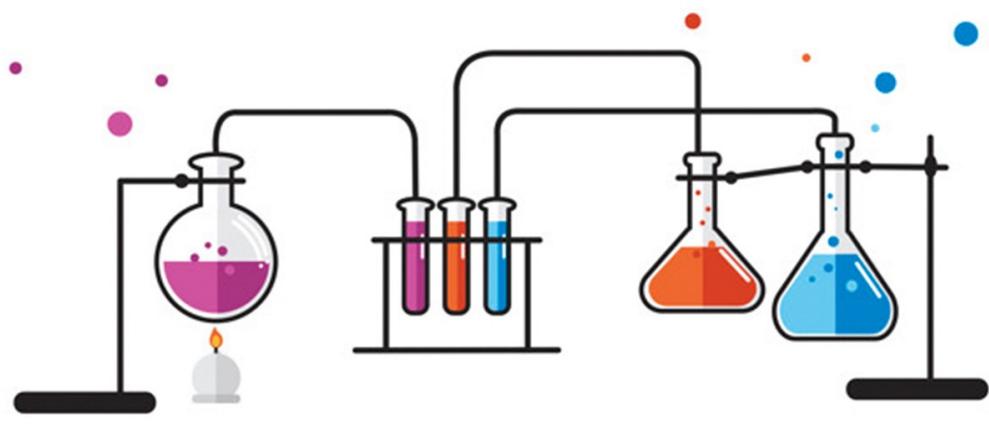
Organic



Chemistry

ATDB.uno

- SOME BASIC PRINCIPLES & TECH.



With ❤️  
By Bharat Panchal Sir



Bharat Panchal Sir



bharatpanchal92



**NOTE**

number of organic compounds is very large. The reason for large no. of Organic compounds is **catenation**

Q what is catenation?

Ans. It is the tendency of an element to form chains of identical atoms. It is maximum in carbon. Catenation depends upon bond enthalpy, which is maximum in carbon

Order of catenation



**HYBRIDIZATION OF CARBON:**

| Type   | % S-character | Geometry        | Bond Angle       | Example                  |
|--------|---------------|-----------------|------------------|--------------------------|
| $sp^3$ | 25%           | Tetrahedral     | $109^{\circ}28'$ | Alkane - 4 $\sigma$ bond |
| $sp^2$ | 33.3 %        | Trigonal planar | $120^{\circ}$    | Alkene - 3 $\sigma$ bond |
| $sp$   | 50%           | Linear          | $180^{\circ}$    | Alkyne - 2 $\sigma$ bond |

**NUMBER OF  $\sigma$  and  $\pi$  BONDS:**

| Type of Bond | No. of $\sigma$ Bond | No. of $\pi$ Bond |
|--------------|----------------------|-------------------|
| $C-C$        | 1                    | 0                 |
| $C=C$        | 1                    | 1                 |
| $C \equiv C$ | 1                    | 2                 |

**APPLICATION OF HYBRIDISATION:**

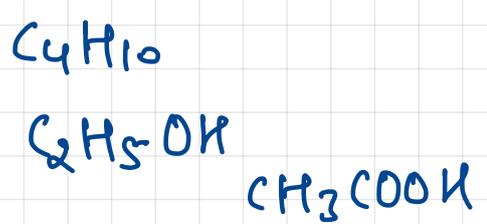
Size -  $sp^3 > sp^2 > sp$       Bond length -  $C \equiv C < C = C < C-C$

Bond enthalpy -  $C \equiv > C = > C-C$

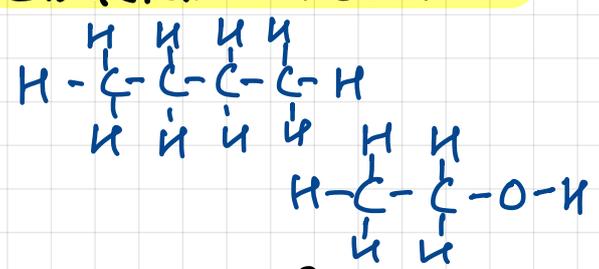
Electronegativity -  $sp > sp^2 > sp^3$

# REPRESENTATION OF ORGANIC COMPOUNDS:

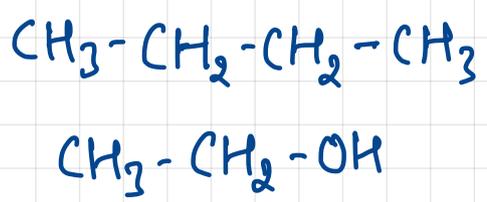
## Molecular formula



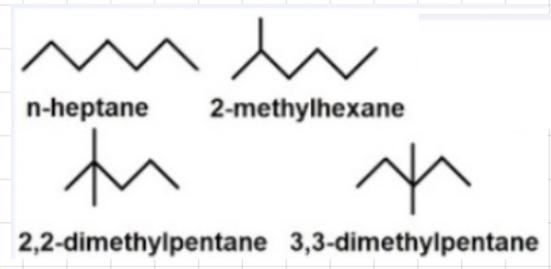
## Structural formula



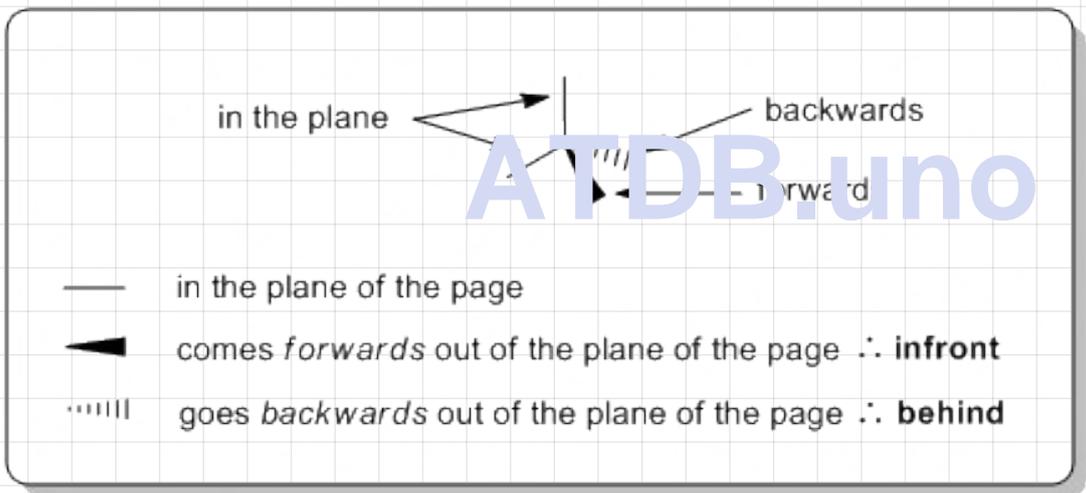
## Condensed formula



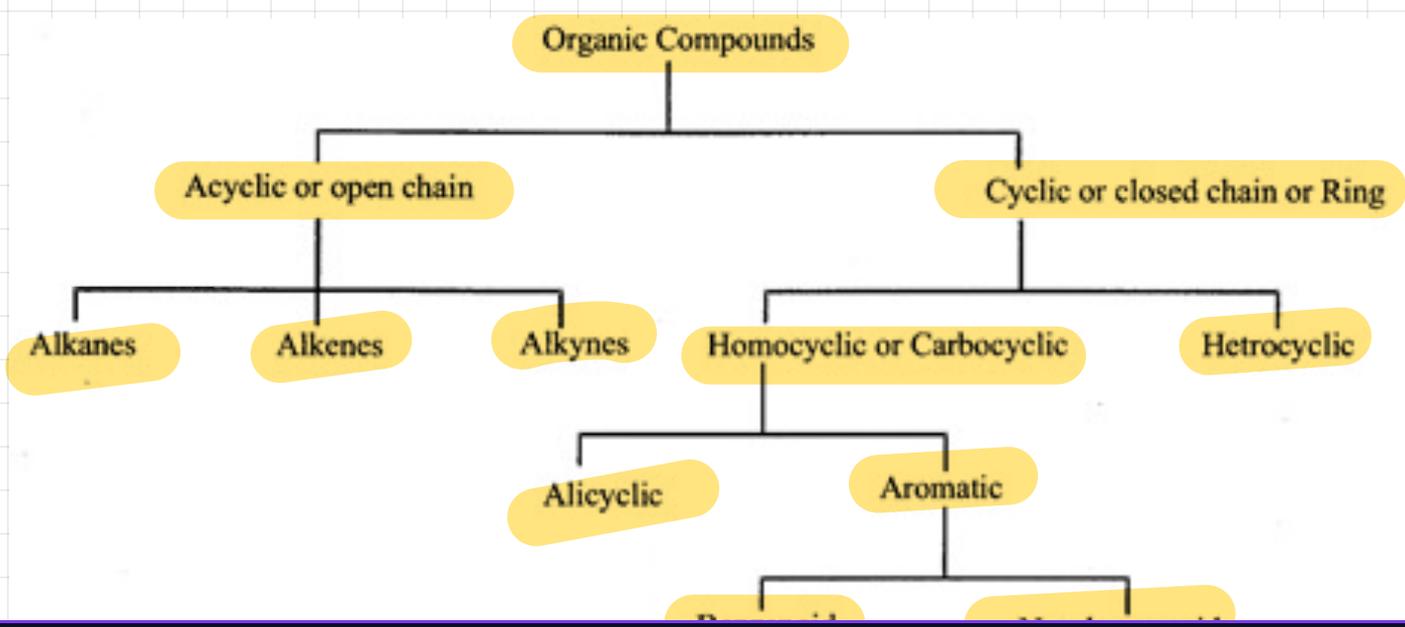
## Bond line formula



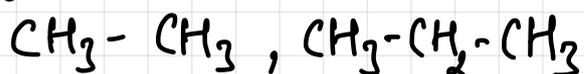
## 3-D Str. of organic compounds.



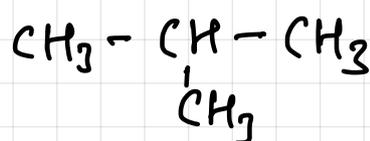
## CLASSIFICATION OF ORGANIC COMPOUNDS:



straight Chain

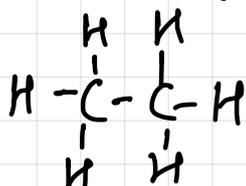


Branched Chain



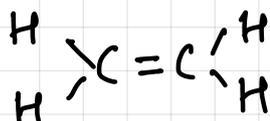
> Saturated or Unsaturated

ethane (Saturated)

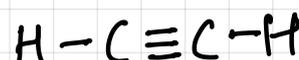


Unsaturated

Ethene



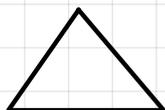
Ethyne



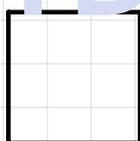
> Cyclic Compounds:

These compounds contain at least one closed chain of atoms.

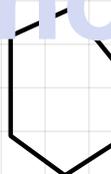
Alicyclic Compounds



Cyclopropane



Cyclobutane



Cyclohexane

Aromatic Compound:

which follows Huckel Rule

- Cyclic Str.
- $sp^2$  hybridisation
- Trigonal planar geometry
- $(4n + 2) \pi e^-$
- i.e 2, 6, 10, 14, 18 ...

Benzoid



Benzene



Toluene

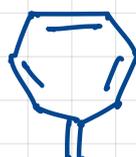


Napthalene

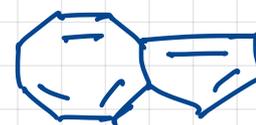


Anthracene

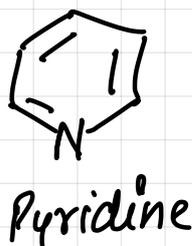
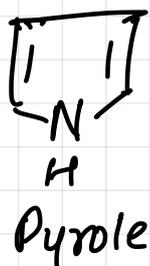
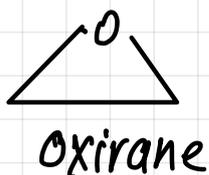
Non-Benzoid



Trocholone



Azulene

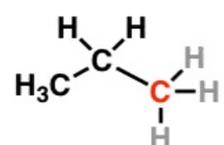
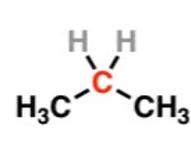
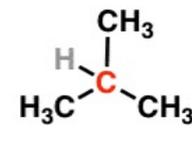
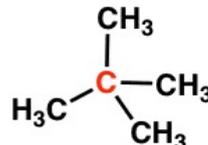


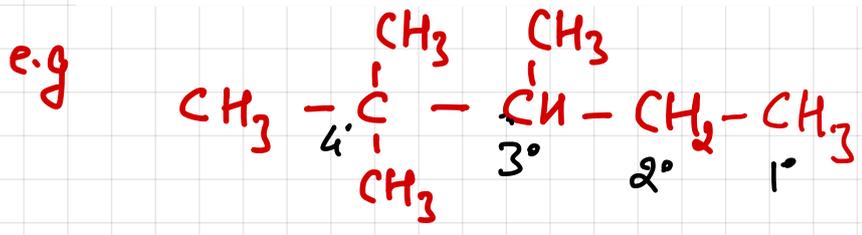
Q what is a functional group?

Ans: an atom or group of atom in a molecule which is responsible for the characteristic chemical properties of organic compound.

| Class of compounds | Functional group structure                            | IUPAC group prefix | IUPAC group suffix | Example   |
|--------------------|---|--------------------|--------------------|---|
| Halides            | -X<br>(X=F, Cl, Br, I)                                | halo-              | -                  | 1-Bromobutane,<br>CH <sub>3</sub> (CH <sub>2</sub> ) <sub>2</sub> CH <sub>2</sub> Br                              |
| Alcohols           | -OH   | hydroxy-           | -ol                | Butan-2-ol,<br>CH <sub>3</sub> CH <sub>2</sub> CHOHCH <sub>3</sub>  |
| Aldehydes          | -CHO  | formyl,<br>oxo     | -al                | Butanal,<br>CH <sub>3</sub> (CH <sub>2</sub> ) <sub>2</sub> CHO   |
| Ketones            | >C=O  | oxo-               | -one               | Butan-2-one,<br>CH <sub>3</sub> CH <sub>2</sub> COCH <sub>3</sub>   |
| Nitriles           | -C≡N  | cyano              | nitrile            | Pentanenitrile,<br>CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CN                             |
| Ethers             | -R-O-R-   | alkoxy-            | -                  | Ethoxyethane,<br>CH <sub>3</sub> CH <sub>2</sub> OCH <sub>2</sub> CH <sub>3</sub>                                 |
| Carboxylic acids   | -COOH   | carboxy            | -oic acid          | Butanoic acid,<br>CH <sub>3</sub> (CH <sub>2</sub> ) <sub>2</sub> CO <sub>2</sub> H                               |
| Carboxylate ions   | -COO <sup>-</sup>                                     | -                  | -oate              | Sodium butanoate,<br>CH <sub>3</sub> (CH <sub>2</sub> ) <sub>2</sub> CO <sub>2</sub> <sup>-</sup> Na <sup>+</sup> |
| Esters             | -COOR   | alkoxycarbonyl     | -oate              | Methyl propanoate,<br>CH <sub>3</sub> CH <sub>2</sub> COOCH <sub>3</sub>  |
| Acyl halides       | -COX<br>(X=F, Cl, Br, I)                              | halocarbonyl       | -oyl halide        | Butanoyl chloride,<br>CH <sub>3</sub> (CH <sub>2</sub> ) <sub>2</sub> COCl  |
| Amines             | -NH <sub>2</sub> ,<br>>NH, >N-                        | amino-             | -amine             | Butan-2-amine,<br>CH <sub>3</sub> CHNH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>                               |
| Amides             | -CONH <sub>2</sub> ,<br>-CONHR,<br>-CONR <sub>2</sub> | -carbamoyl         | -amide             | Butanamide,<br>CH <sub>3</sub> (CH <sub>2</sub> ) <sub>2</sub> CONH <sub>2</sub>                                  |
| Nitro compounds    | -NO <sub>2</sub>                                      | nitro              | -                  | 1-Nitrobutane,<br>CH <sub>3</sub> (CH <sub>2</sub> ) <sub>3</sub> NO <sub>2</sub>                                 |
| Sulphonic acids    | -SO <sub>3</sub> H                                    | sulpho             | sulphonic acid     | Methylsulphonic acid<br>CH <sub>3</sub> SO <sub>3</sub> H   |

## Types of Carbon Atoms

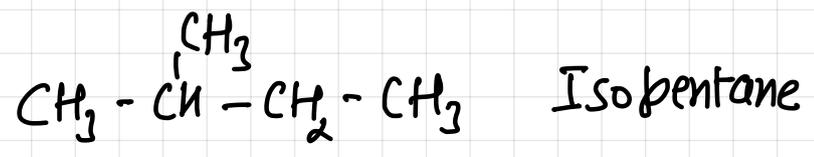
|                            |   |   |  |   |
|----------------------------|---|---|--|---|
| $\text{CH}_4$              |  |  |  |  |
| 0 carbons attached         | 1 carbon directly attached  | 2 carbons attached  | 3 carbons attached   | 4 carbons attached  |
| <b>Methane</b><br>(unique) | <b>Primary (1°) carbon</b><br>("methyl")  | <b>Secondary (2°) carbon</b><br>("methylene")                                     | <b>Tertiary (3°) carbon</b><br>("methine")   | <b>Quaternary (4°) carbon</b><br>("quaternary")                                     |



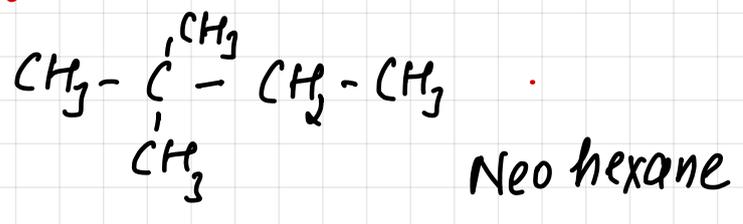
## Some Common Prefixes

n- (normal) - It is used for straight chain hydrocarbon

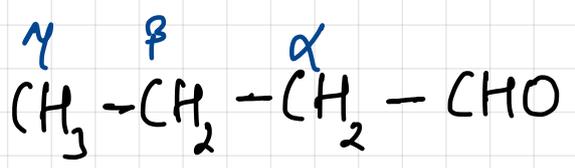
Iso-  $\text{C}-\text{C}-\text{C}-\text{C}-\text{C}$   
 $\text{CH}_3$  group is attached to 2nd last carbon



Neo- two  $\text{CH}_3$  groups are attached to 2nd last carbon



## α- and β - Carbon Atoms



**2° Prefix + 1° Prefix + Word Root + 1° Suffix + 2° Suffix**

|                         |                   |                        |                  |                         |
|-------------------------|-------------------|------------------------|------------------|-------------------------|
| ↓                       | ↓                 | ↓                      | ↓                | ↓                       |
| <b>Substituent</b>      | <b>Chain Type</b> | <b>Principal chain</b> | <b>Bond Type</b> | <b>Functional group</b> |
| Fluoro - F              | open - x          | C <sub>1</sub> - meth  | - ane            |                         |
| Chloro - Cl             | close - Cyclo     | C <sub>2</sub> - eth   | = ene            |                         |
| Bromo - Br              |                   | C <sub>3</sub> - prop  | ≡ yne            |                         |
| Iodo - I                |                   | C <sub>4</sub> - but   |                  |                         |
| Nitro - NO <sub>2</sub> |                   | C <sub>5</sub> - pent  | 2(=) diene       |                         |
| Nitroso - NO            |                   | C <sub>6</sub> - hex   | 3(=) triene      |                         |
| Diazo - N <sub>2</sub>  |                   | C <sub>7</sub> - hept  | 2(≡) triyne      |                         |
| Alkoxy - OR             |                   | C <sub>8</sub> - oct   |                  |                         |
| Alkyl - R               |                   | C <sub>9</sub> - non   |                  |                         |
| Pheny                   |                   | C <sub>10</sub> - dec  |                  |                         |

**2° Suffix tells us about functional group**

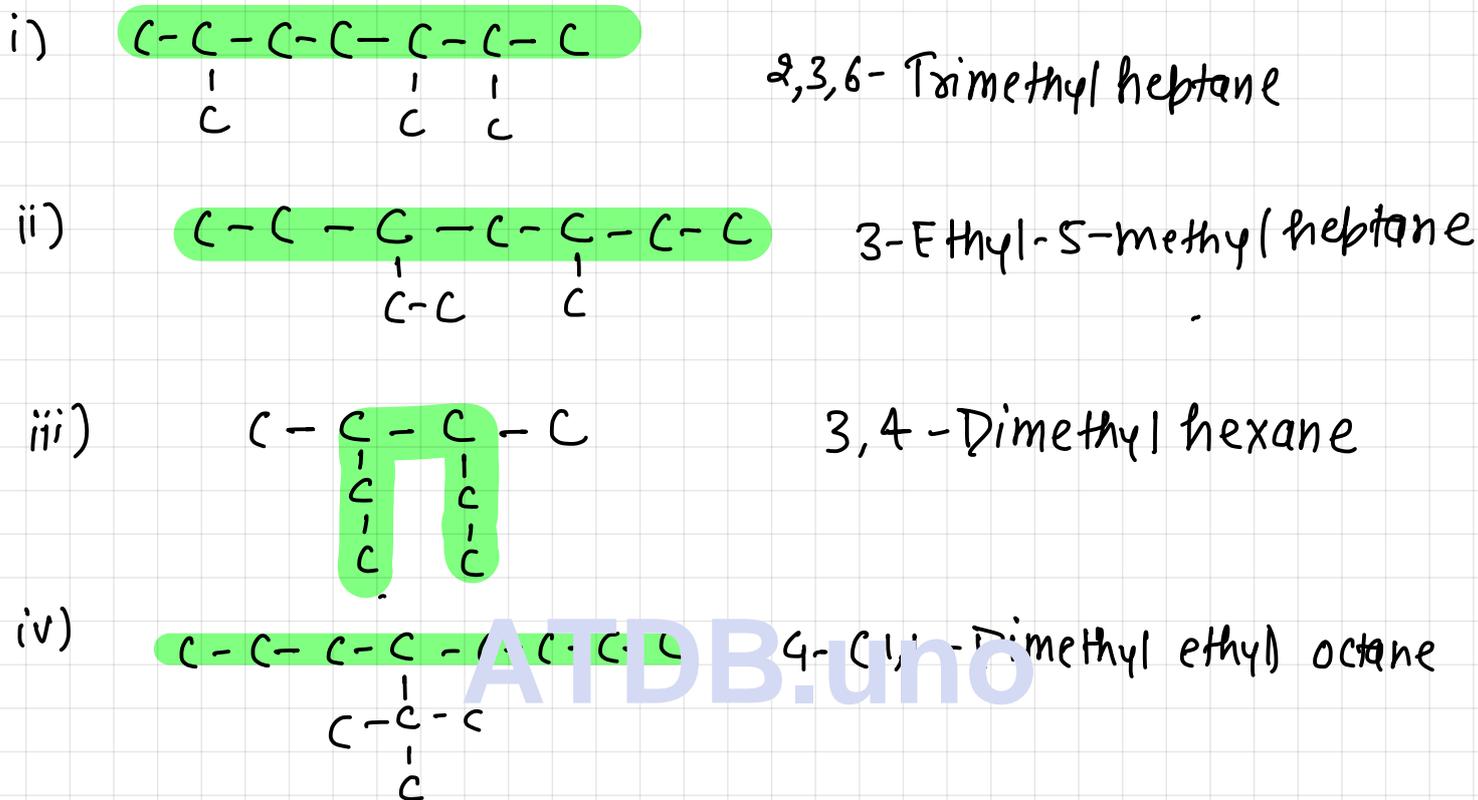
| Name                    | Functional Group  | IUPAC Ending |
|-------------------------|---|--------------|
| <b>Alcohols</b>         | R-OH  | -ol          |
| <b>Ethers</b>           | R-O-R'  | ether        |
| <b>Aldehydes</b>        | $\text{R}-\overset{\text{O}}{\parallel}-\text{H}$           | -al          |
| <b>Ketones</b>          | $\text{R}-\overset{\text{O}}{\parallel}-\text{R}'$          | -one         |
| <b>Carboxylic Acids</b> | $\text{R}-\overset{\text{O}}{\parallel}-\text{OH}$          | -oic acid    |
| <b>Esters</b>           | $\text{R}-\overset{\text{O}}{\parallel}-\text{O}-\text{R}'$ | -ate         |

**Note** extra 'a' is added to word root if 1° suffix begins with a consonant

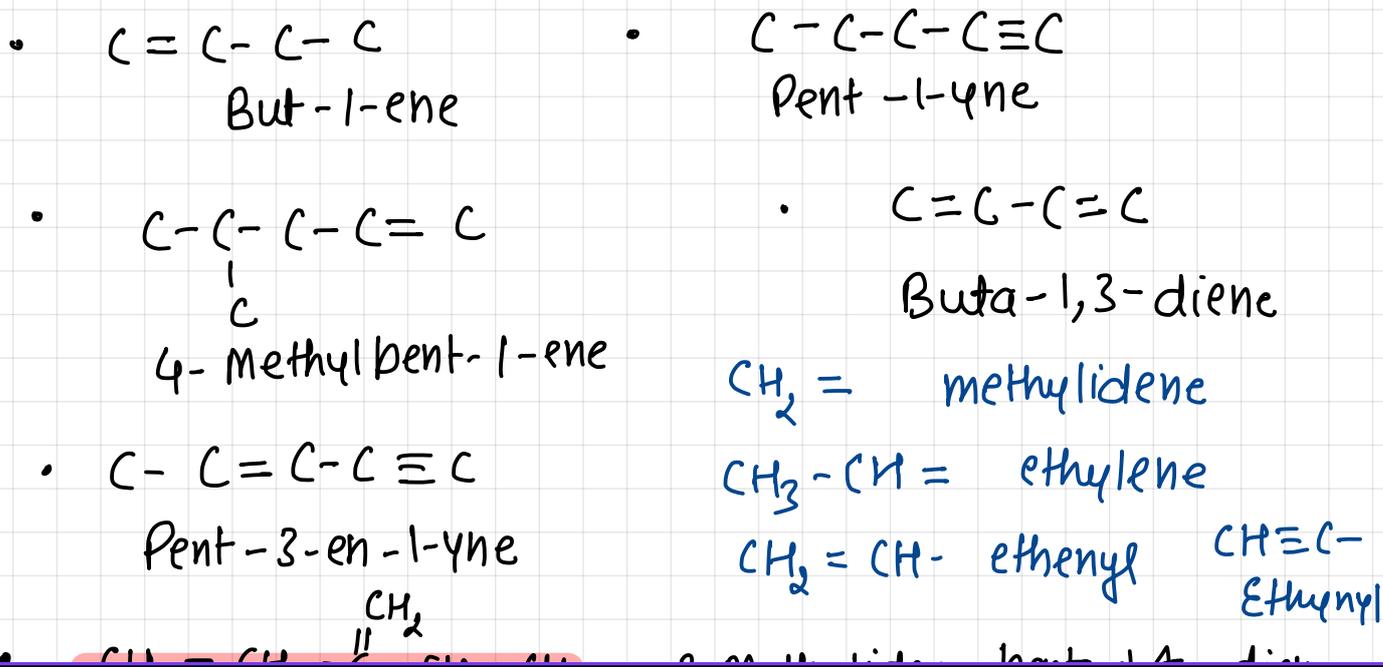
**Note** If 2° suffix begins with a vowel the terminal 'e' is dropped.

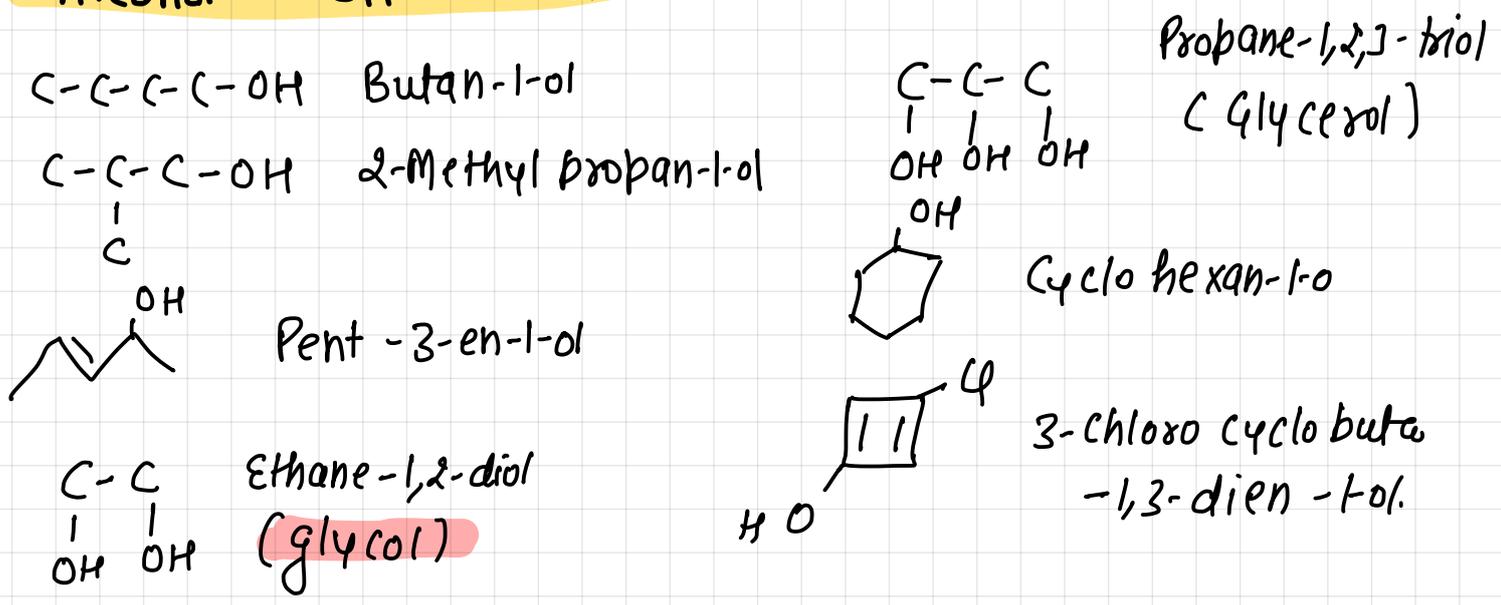
# RULES FOR IUPAC NOMENCLATURE

- Selection of longest chain
- Numbering of selected chain
- Arrangement of Prefixes (Alphabetical order)

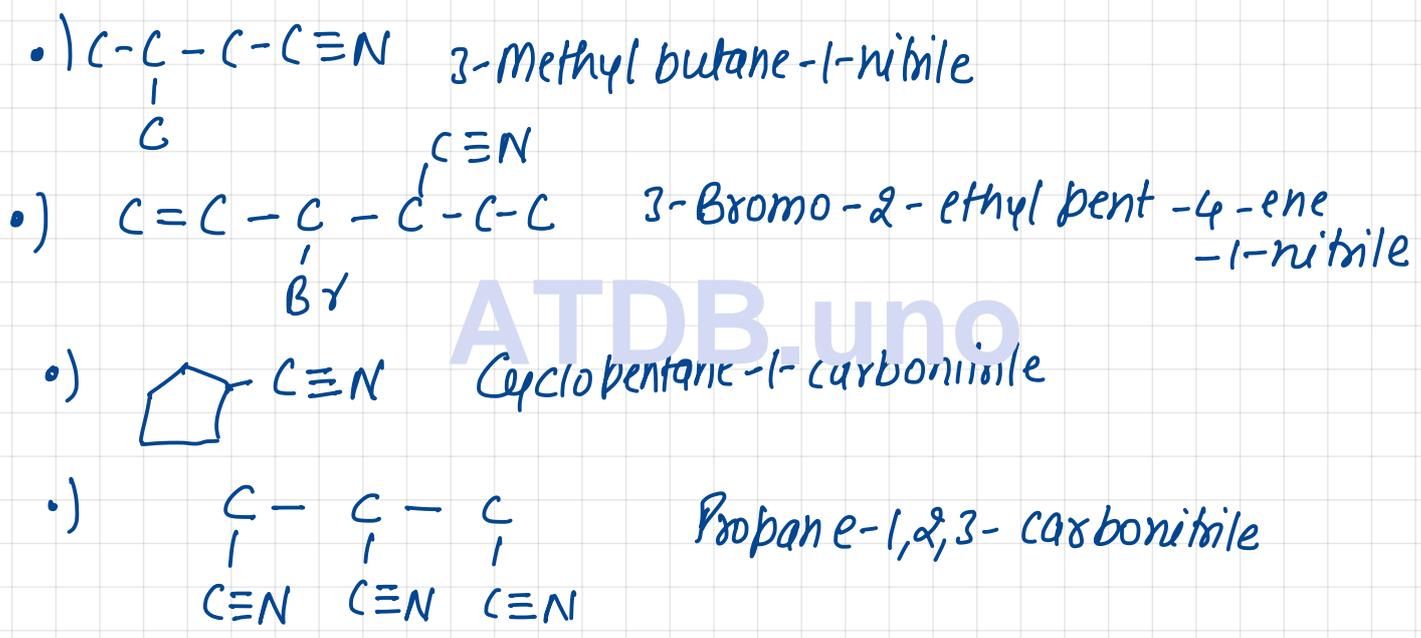


## Nomenclature of Unsaturated Hydrocabons -

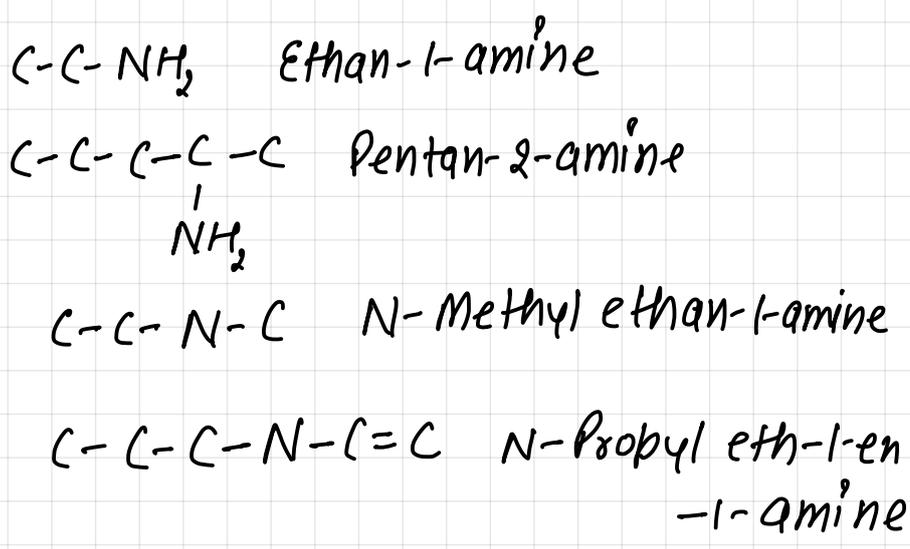




### # Cyanide ( $C \equiv N$ ) - Nitrile



### # Amine $-NH_2$ - amine



**ETHERS**      **R-O-R**      **alkoxy alkane**

- $C-O-C$  Methoxymethane
- $C-C-O-C$  Methoxy ethane
- $C-C-C-O-C=C$  Propoxy ethene

- $C-C-O-C-C$  Ethoxy ethane
- $C=C-O-C\equiv C$  Ethynoxy ethene

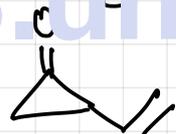
**# Aldehyde**       $-C(=O)-H$       **-al**

- $C-CHO$  Ethan-1-al
- $C-C(CHO)$  2-Methylpropan-1-al
- $C-C=C-C-CHO$  3-Cyclopropyl pent-3-en-1-al

-  Cyclopentane-1-carbaldehyde
- $C-C-C-CHO$  4-Cyclopropyl butan-1-al

**# Ketones**       $-C(=O)-$       **-one**

- $C-C(=O)-C$  Propan-2-one
- $C-C-C(=O)-C$  Butan-2-one
-  Cyclohexan-1-one

- $C-C-C-C(=O)-C-C$  4-Methyl hexan-3-one
-  2-Ethenyl cyclopropanone

**# Carboxylic Acid**       $-COOH$       **-oic acid**

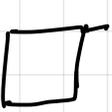
- $C-C-COOH$  Propan-1-oic acid
- $C=C-COOH$  Prop-2-en-1-oic acid
- $C-C-COOH$  3-Cyclopropyl propan-1-oic acid

-  But-2-ene-1-carboxylic acid
- $C\equiv C-C=C-COOH$  Pent-2-en-4-yn-1-oic acid

**# Acid Amide**       $-CONH_2$       **-amide**

$C-CONH_2$  Ethan-1-amide

$C-C(Ph)-CONH_2$  2-Phenyl propan-1-amide

 Cyclobutane-1-carboxamide

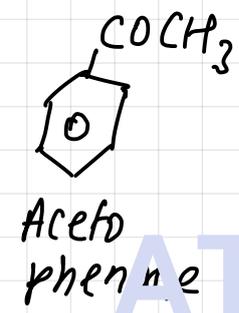
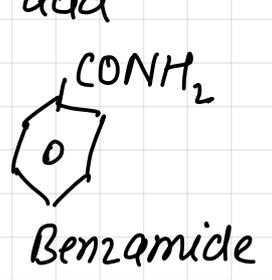
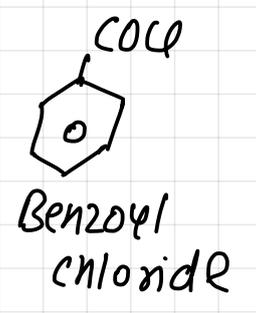
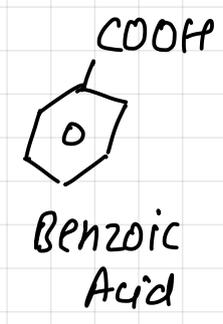
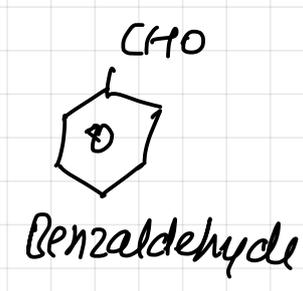
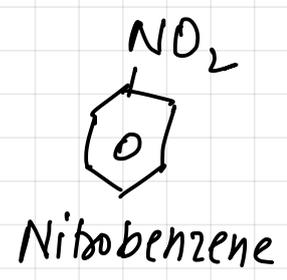
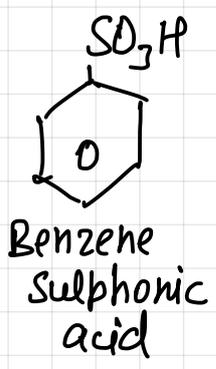
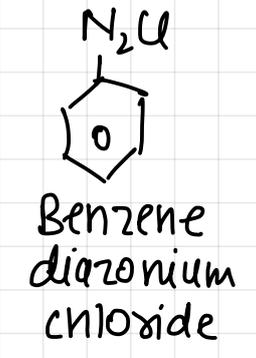
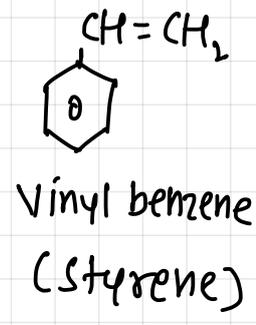
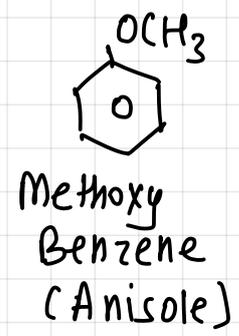
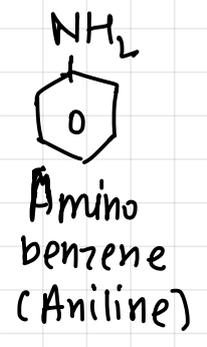
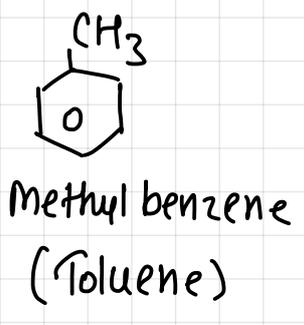
Precedence order of functional group

|                 |                    |                 |                 |
|-----------------|--------------------|-----------------|-----------------|
| Carboxylic Acid | -COOH              | Carboxy         | oic acid        |
| Sulphonic Acid  | -SO <sub>3</sub> H | Sulpho          | sulphonic acid  |
| Ester           | -COO-              | Alkoxy Carbonyl | alkyl alkanoate |
| Acid Chloride   | -COCl              | Chloroformyl    | oyl chloride    |
| Amide           | -CONH <sub>2</sub> | carbamoyl       | amide           |
| Cyano           | -C≡N               | Cyano           | nitrile         |
| Isoocyano       | -N≡C               | Isoocyano       | isonitrile      |
| Aldehyde        | -CHO               | Oxo / formyl    | al              |
| Ketone          | -CO-               | Oxo / keto      | one             |
| Alcohol         | -OH                | hydroxyl        | -ol             |
| Amine           | -NH <sub>2</sub>   | amino           | amine           |

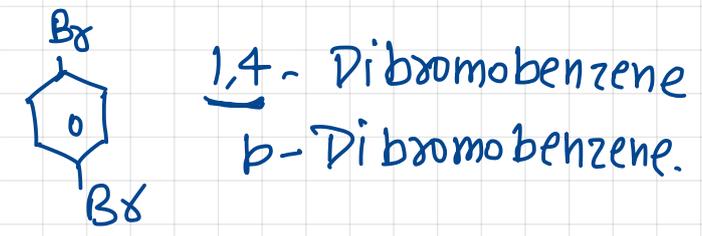
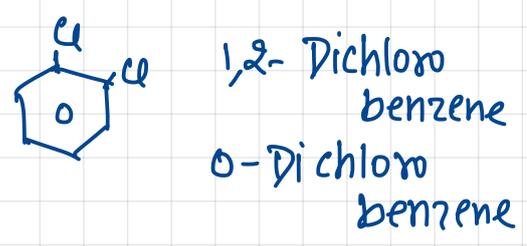
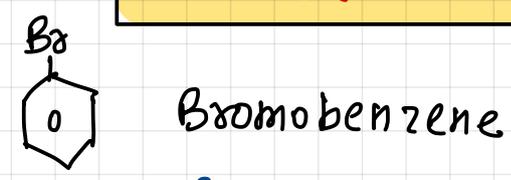
# Polyfunctional groups

- 1)  $\begin{array}{c} \text{C} - \text{C} - \text{COOH} \\ | \\ \text{OH} \end{array}$       2-Hydroxy propanoic acid
- 2)  $\begin{array}{c} \text{NH}_2 \\ | \\ \text{C} - \text{C} - \text{C} - \text{C} - \text{C} \\ | \quad | \\ \text{O} \quad \text{OH} \end{array}$       3-Amino pentan-2-ol
- 3)  $\begin{array}{c} \text{O} \\ || \\ \text{C} - \text{C} - \text{C} - \text{C} - \text{C} \\ | \quad | \\ \text{NH}_2 \quad \text{OH} \end{array}$       2-Amino -4-hydroxy pentan-3-one
- 4)  $\text{C} - \overset{\text{O}}{\parallel}{\text{C}} - \text{C} - \text{COOH}$       3-Oxobutan-1-oic acid
- 5)  $\begin{array}{c} \text{O} - \text{C} \\ | \\ \text{C} - \text{C} - \text{CHO} \end{array}$       2-Methoxy propanal

# Nomenclature of Benzene and its derivatives.

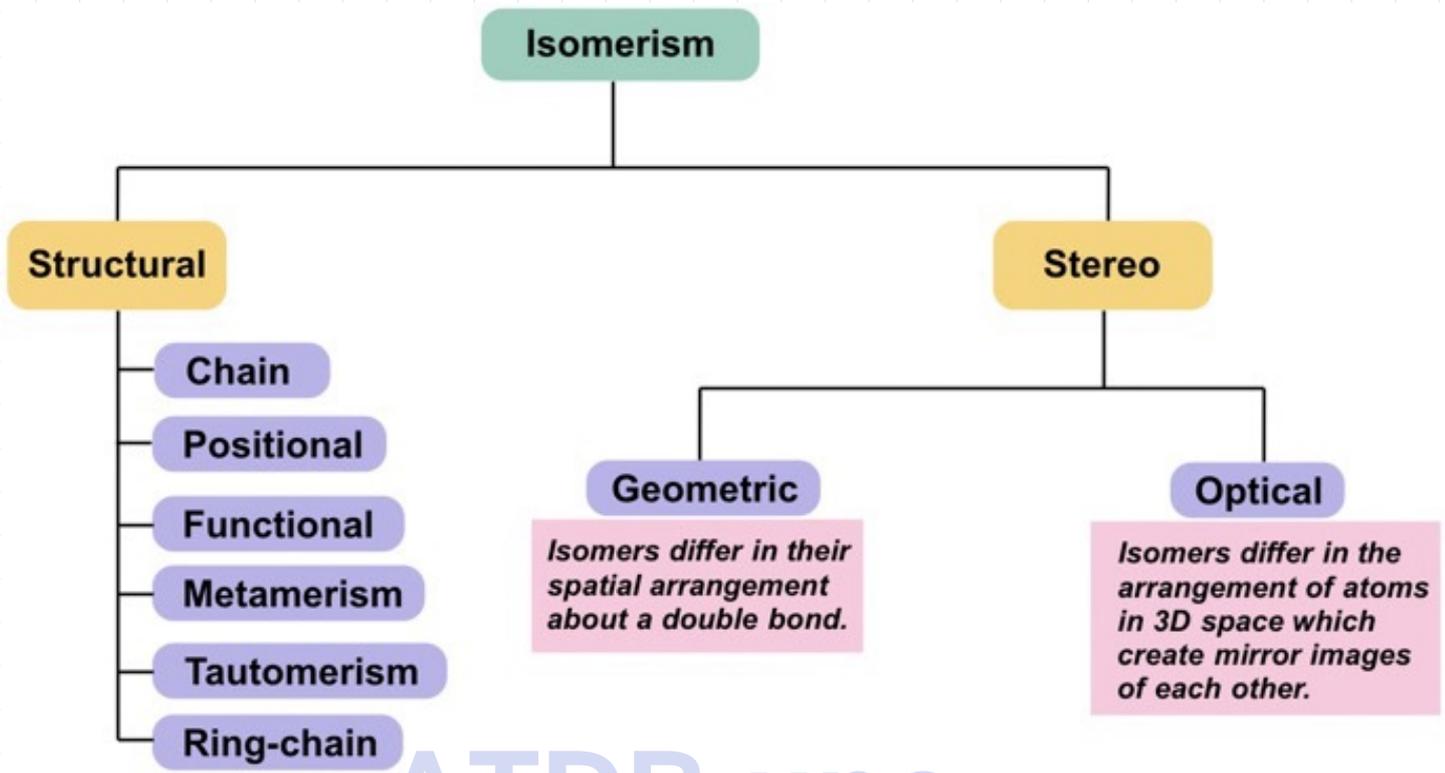


1,2 or 1,6 - ortho  
 1,3 or 1,5 - meta  
 1,4 - para



# ISOMERISM:

Those compounds which have same molecular formula but differ from each other in their properties and this phenomenon is called isomerism

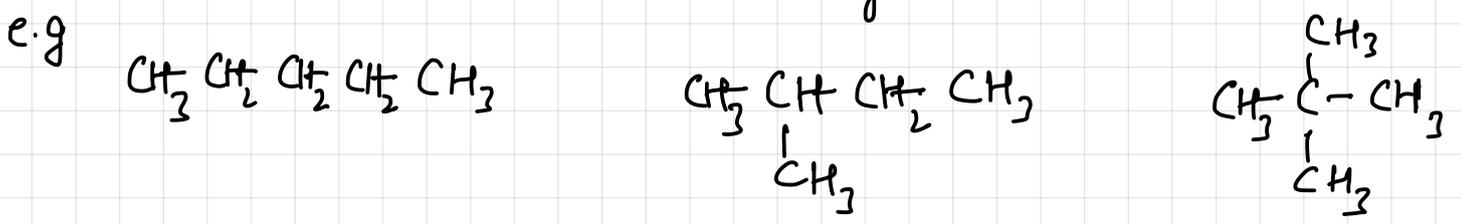


ATDB.uno

**Structural Isomers** have same molecular formula but different str. are called structural isomers.

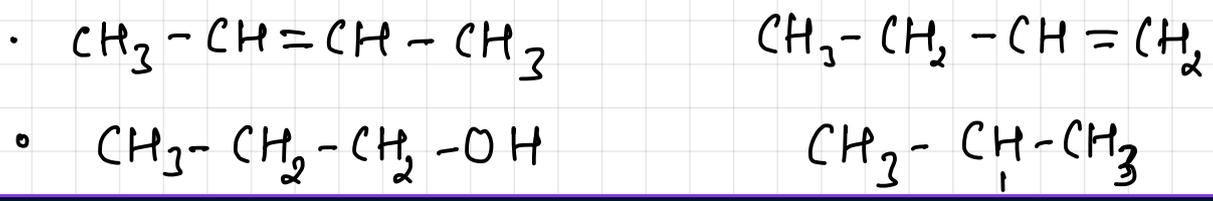
## Chain Isomerism

chain isomers have difference in chain (straight or branched)



## Position Isomerism:

Position isomers differ in the position of multiple bond or substituent or functional group in the same carbon chain.



## # FUNCTIONAL ISOMERISM :

Functional isomers have same molecular formula but different functional group. Thus, they have different physical and chemical properties.

### Alcohol $\leftrightarrow$ Ether



### Aldehyde $\leftrightarrow$ Ketone



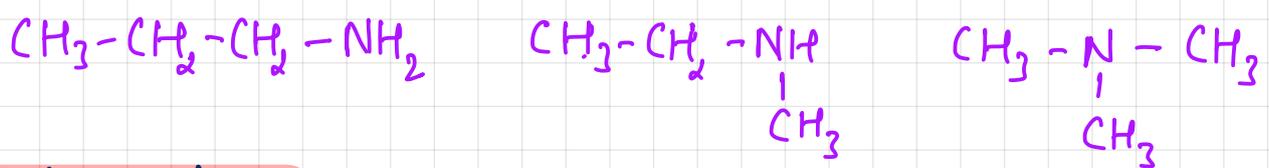
### Carboxylic Acid $\leftrightarrow$ Ester



### Cyanide $\leftrightarrow$ Isocyanide

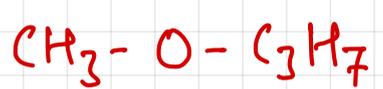
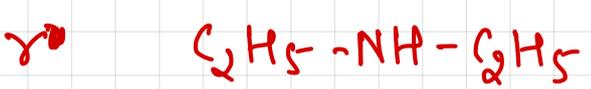
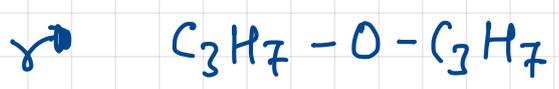
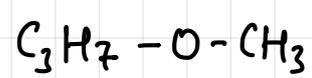
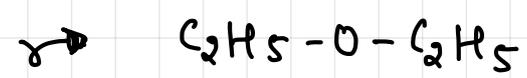
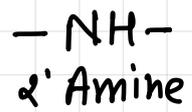


### 1° Amine $\leftrightarrow$ 2° Amine $\leftrightarrow$ 3° Amine



## # Metamerism :

It occurs due to presence of different alkyl groups attached to same divalent functional group or atom i.e



It is due to the migration of H-atom (mobile H-atom) between carbon and polyvalent atom of functional group within same molecule



**Stereoisomerism:**

The compounds having same molecular formula but different arrangement of atoms or groups in space.

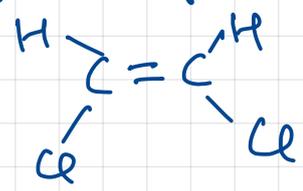
**i) Geometrical Isomerism:**

This type of isomerism arises due to the restricted rotation around C=C multiple bonds.

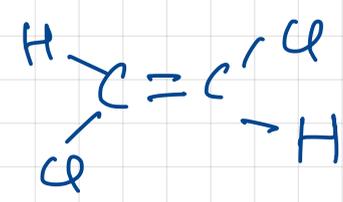
**(a) Cis-Trans Isomerism**

If similar groups are adjacent to each other the isomers are called cis while if similar groups are opposite to each other the isomers are called cis-trans isomer

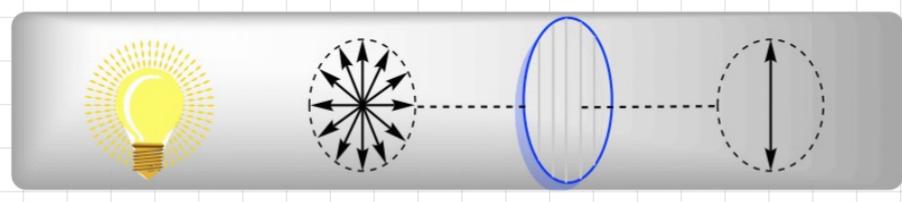
**Cis** same group at adjacent position



**Trans** same group at opposite position

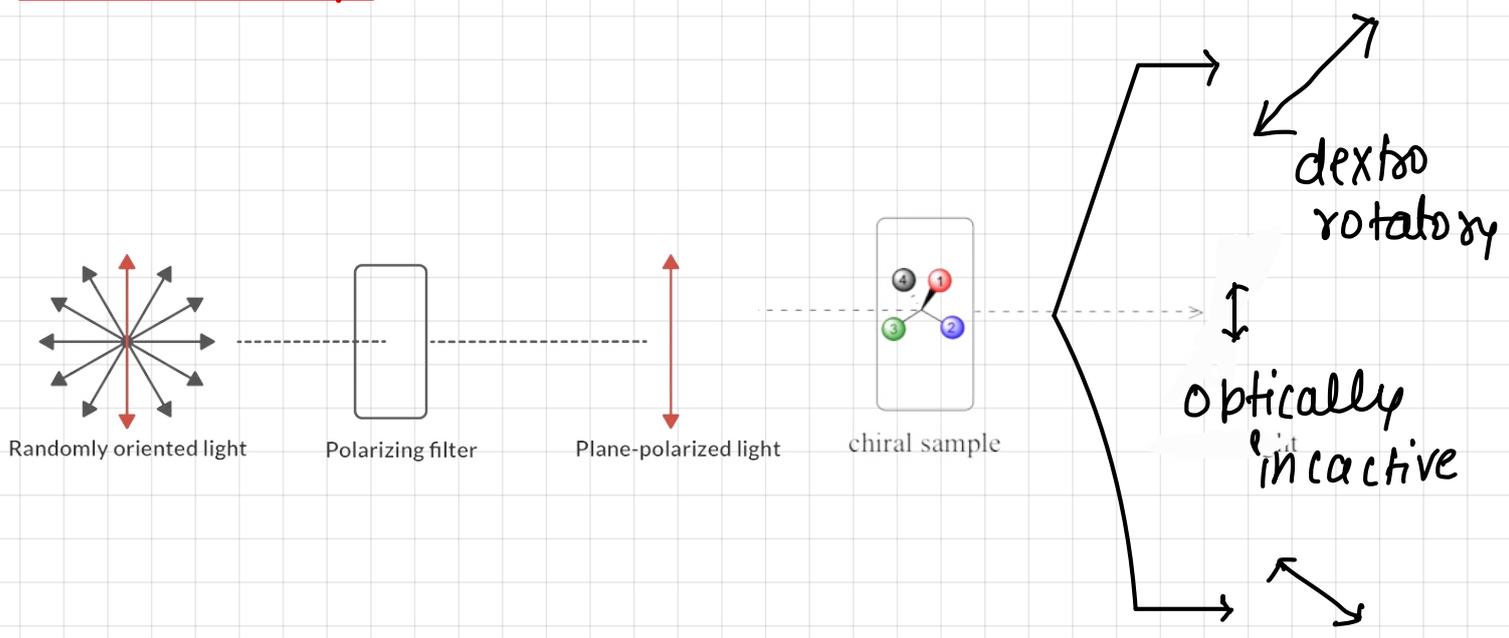


**OPTICAL ISOMERS:**



A beam of ordinary light consist of electromag-netic waves vibrating in all planes when pass through Nicol prism vibrates in one plane

Levo-Rotatory - which rotate PPL towards left.

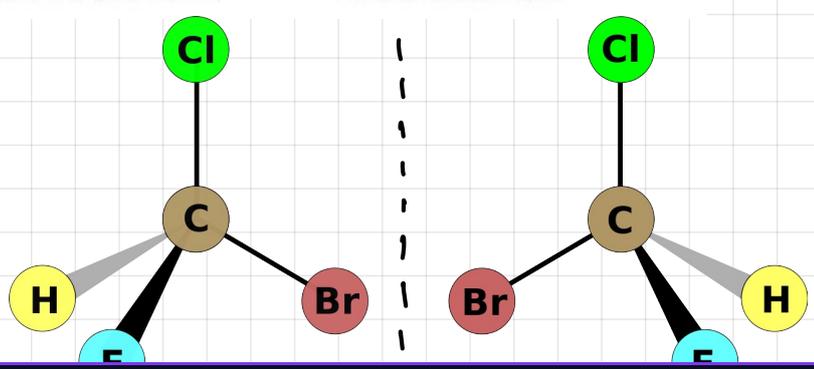


Racemic Mixture equimolar mixture of d and l, so that net rotation of PPL is zero.

**Enantiomers**

*blu rat Rancheal*

- The optical isomers are called **enantiomers**.
- These are distinguished by +/-, D/L or more correctly R/S.
- A 50/50 mixture of the two enantiomers is called a **racemic mixture** or a **racemate**.



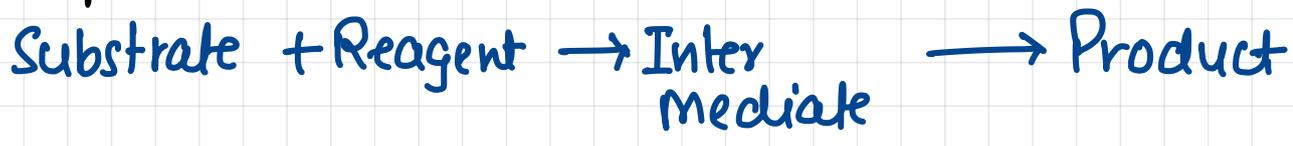
## Tautomerism

It is due to the migration of H-atom (mobile H-atom) between carbon and polyvalent atom of functional group within same molecule



## Mechanism of Organic Reaction

In an organic reaction, reactants consist of substrate and reagent. The substrate is attacked by the reagent leading to the formation of intermediate and finally the product.



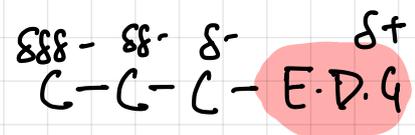
## Inductive Effect

The permanent displacement of electron pairs along the saturated chain of C-atom when either electronegative atom or electropositive atom is attached with one end of carbon chain

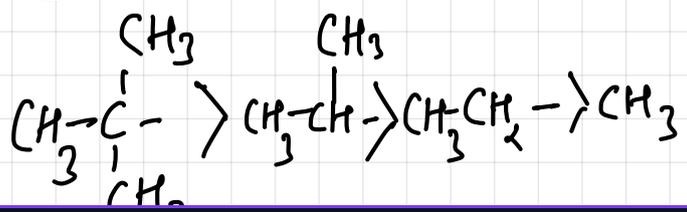
### Type

### +I effect

when electron donating group is attached with the chain of C-atom

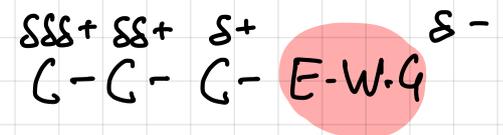


e.g

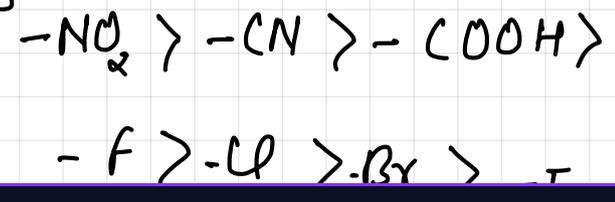


### -I effect

when electron withdrawing group is attached with C-atom.



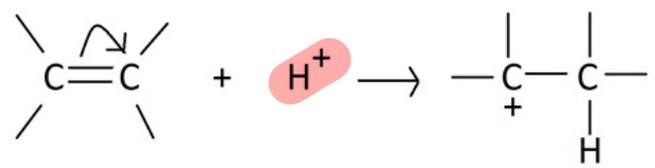
e.g



## Electromeric effect

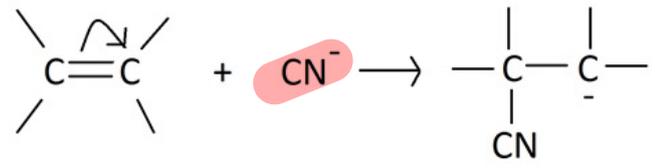
The process of complete transference of electron pair of  $\pi$  bond to one of the atom which is usually more electronegative in the presence of attacking reagent is called as electromeric effect. It is temporary effect. It occurs in the presence of attacking reagent.

### Positive electromeric effect



If attacking reagent attaches to that atom which withdraw the pair of electron

### Negative electromeric effect



If attacking reagent attaches to that atom whose electron pair withdraw.

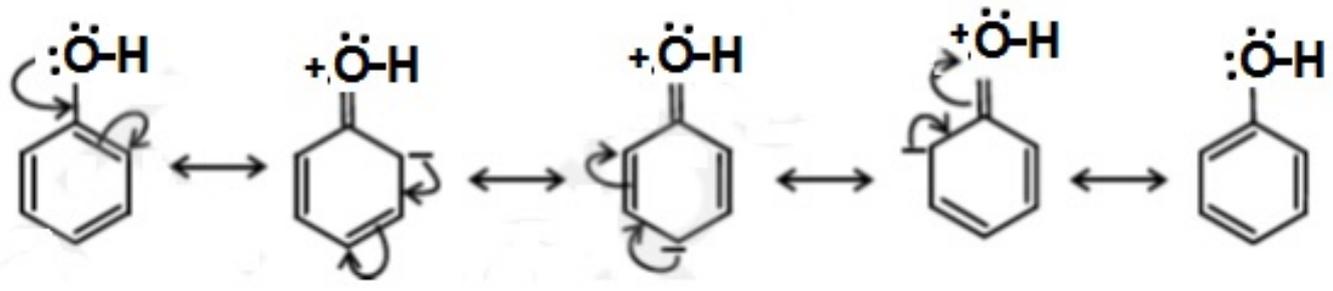
## Resonance or Mesomeric effect

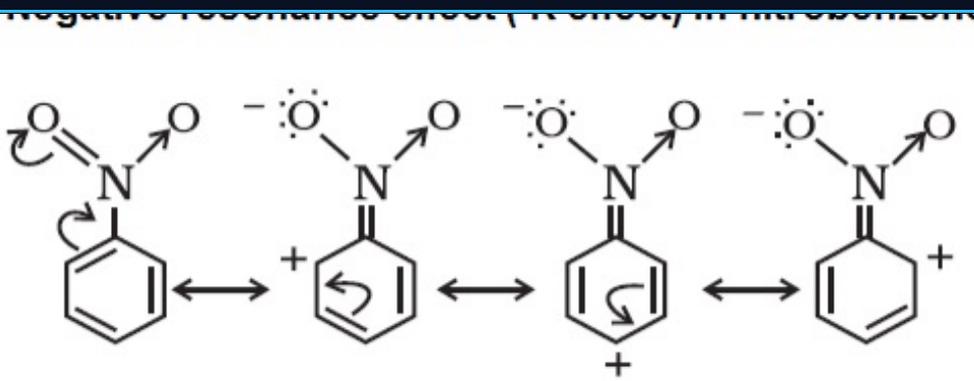
The process of transfers of electron from one part of conjugated system to the other part of conjugated system due to phenomenon of resonance is called Resonance effect.

If group donates electrons to the conjugated system

### Positive resonance effect (+R effect)

#### Phenol



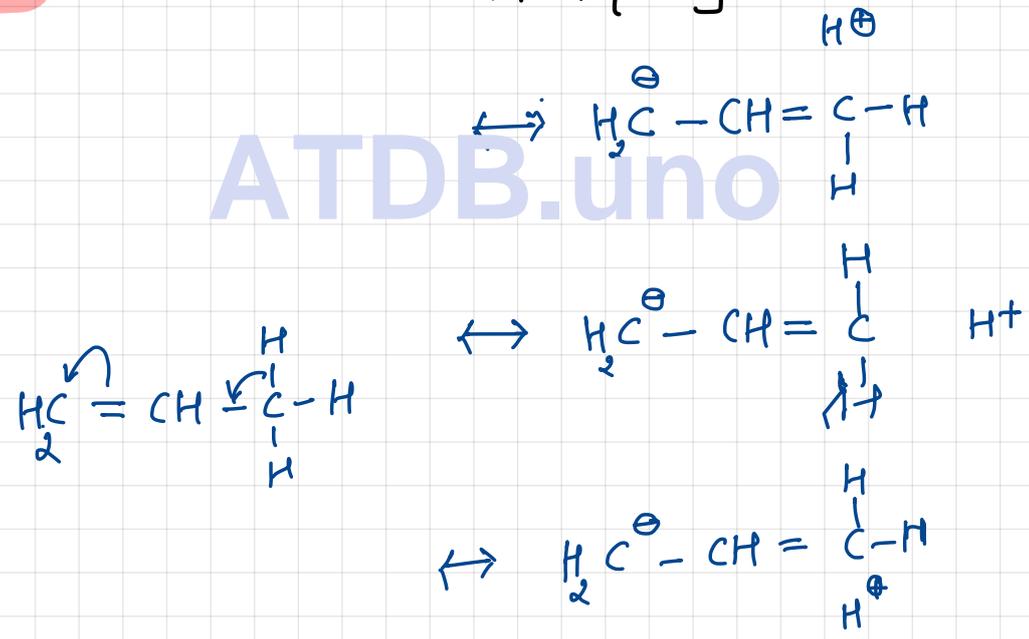


If group withdraws  $e^-$  from the conjugated system

**Hyperconjugation effect:**

It is a type of interaction between  $\pi$ -electrons and  $\sigma$  electrons of near by C-H bond. This effect is achieved when conjugative system is attached with alkyl group.

**CONDITION:**  $\alpha$ -carbon with hydrogen.

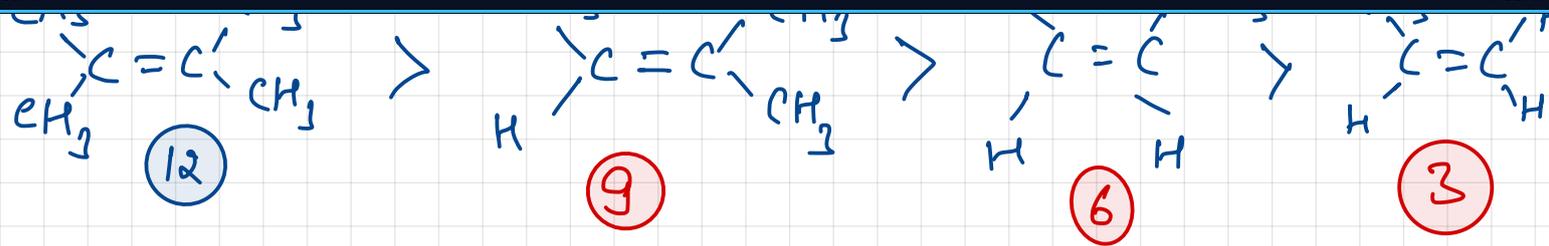


Also called **no bond resonance** or **Anchimeric assistance** or **Baker Nathen effect**

**Note** Greater the no. of hyperconjugative str. are formed more will be its stability.

**Condition for hyperconjugation effect**

Molecules that shows hyperconjugative effect must have  $\alpha$ -C atom with hydrogen. The no. of hyperconjugative str. formed directly related with no. of  $\alpha$ -H-atoms.

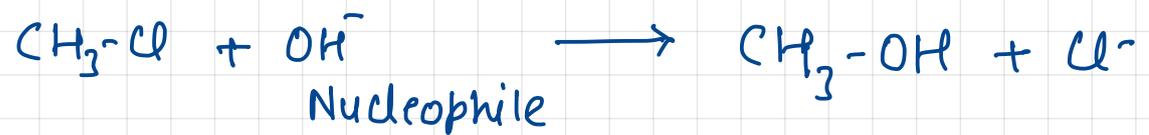


## Substitution Reaction

The types of organic reactions in which one group or atom is displaced by other atoms. These reactions are of three types.

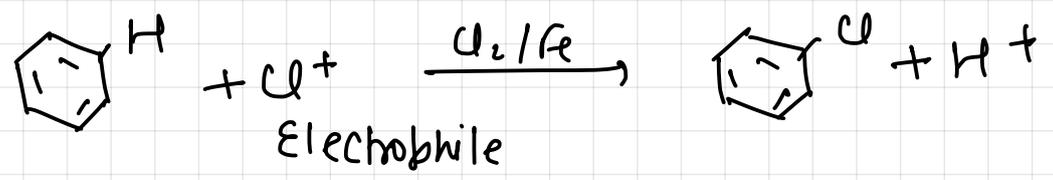
### Nucleophilic Substitution Rxn

Substitution reaction carried by the nucleophile.



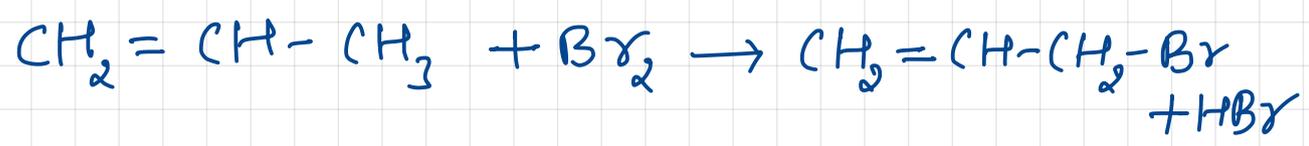
### Electrophilic Substitution Rxn

The substitution reaction is carried out by the electrophile.



### Free Radical Substitution Rxn

Substitution Rxn is carried out by free radical.



## Addition Reaction

The types of reactions in which two atoms or groups react with each other to form a single molecule of the product.

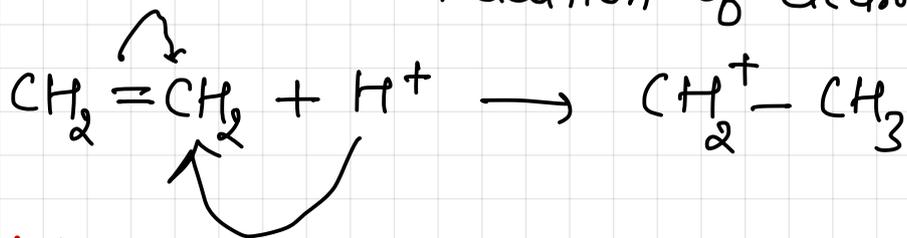
### Nucleophilic Addition Rxn

Addition of nucleophile to carbonyl group



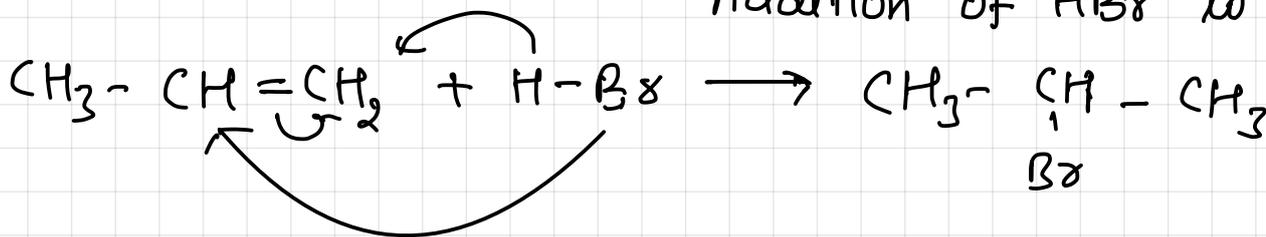
to alkene

Addition of electrophile



**Free Radical Addition Rxn**

Addition of HBr to Alkene



**Elimination Reaction**

The type of organic reactions in which two atoms or groups are eliminated to form alkene or cycloalkane or carbon etc.

**Types**

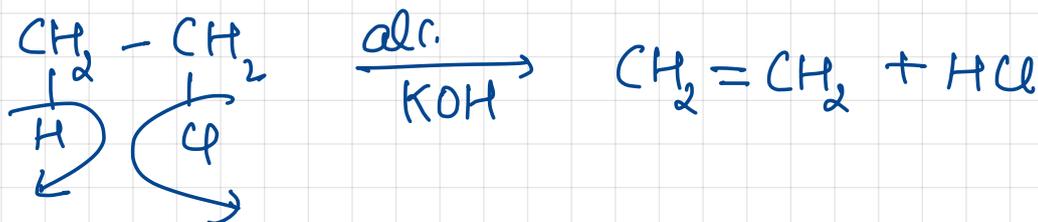
**$\alpha, \alpha$ -Elimination**

Elimination of two atoms from same C-atom e.g. Rxn of  $\text{CHCl}_3$  with alkali



**$\alpha, \beta$ -Elimination**

Elimination of two atoms or groups from adjacent atoms e.g. Dehydrohalogenation Rxn



**$\alpha, \gamma$ -elimination:**

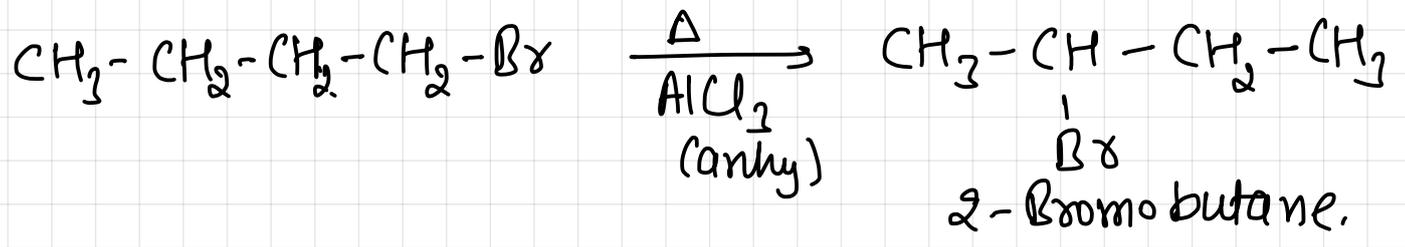
Elimination of two atoms or groups from one position to another position within same molecule

e.g. Rxn of 1,3-dibromo propane with Zn dust

## REARRANGEMENT OR ISOMERISATION RXN

The types of organic reactions in which one group migrate from one position to another position within same molecule.

e.g 1-Bromobutane (Isomerisation)

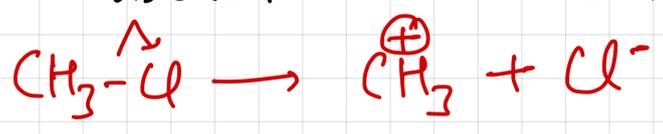


**Bond Fission:** Breaking of a covalent bond is called bond fission or bond cleavage

**Homolytic Fission**  
If a covalent bond breaks in such a way that each atom acquires one e<sup>o</sup> from bond. The species thus formed is called **free radicals**



**Heterolytic Fission**  
If a covalent bond breaks in such a way that both the e<sup>o</sup> of a bond pair acquire by one atom. The species thus formed are carbocation or carboanion.



**Electrophile** These are e<sup>o</sup> loving species. They are e<sup>o</sup> deficient species. They acts as Lewis Acids.

- e.g  $\text{Cl}^+$ ,  $\text{Zn}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{NH}_4^+$  ion  
 $\text{BF}_3$ ,  $\text{BCl}_2$ ,  $\text{BBr}_3$ ,  $\text{AlF}_3$

