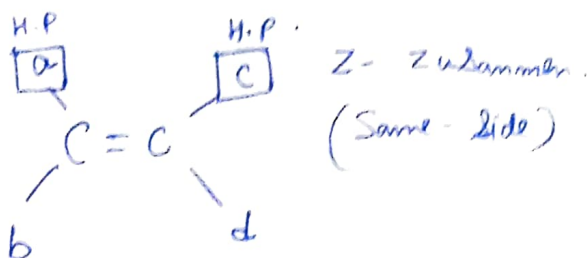
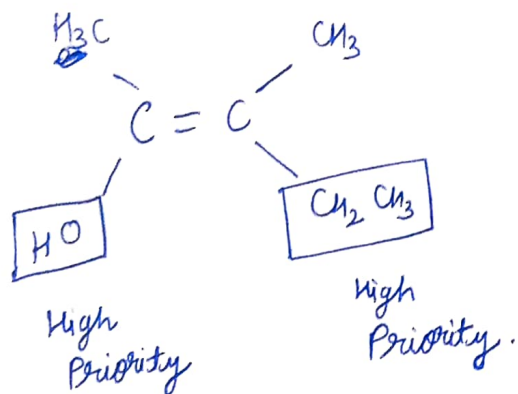


E and Z

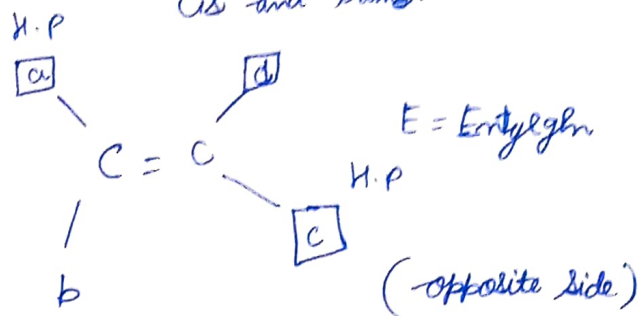
(Cahn Ingold Prelog) Sequence rule,
CIP Rule Priority rule

① The group whose first atom has higher atomic number is senior.

② In case when first atoms are common in both groups, then go for next.



If there are different groups we can't name it as a Cis and trans.



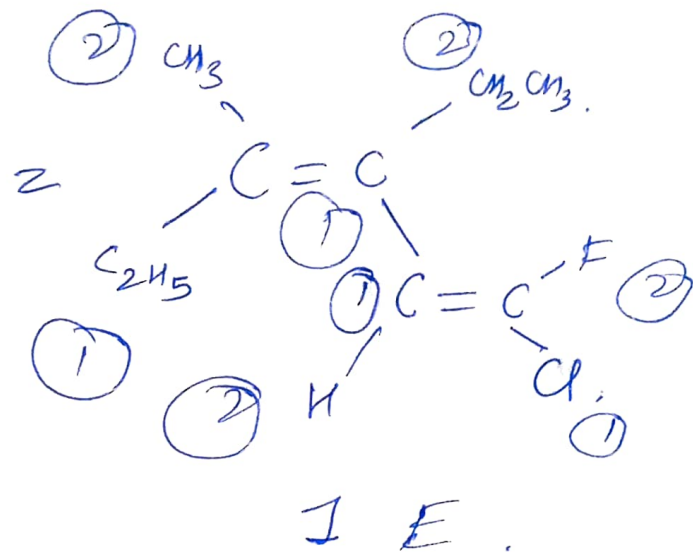
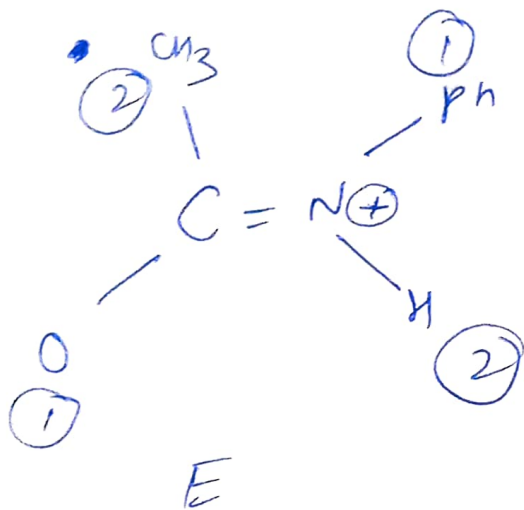
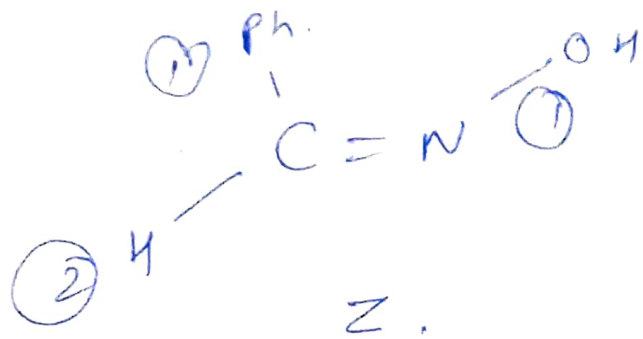
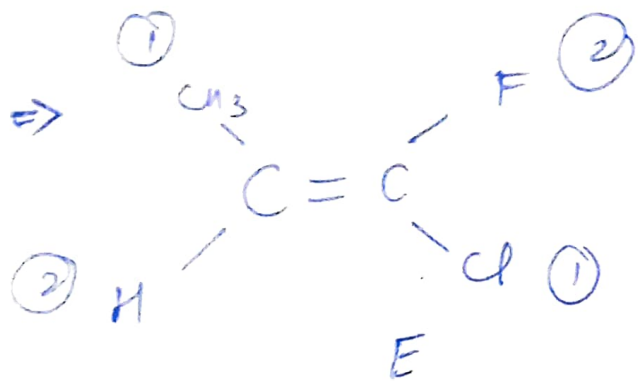
③ In case when first and second atoms of a group are connected through double or triple bond then hypothetically it is considered that they are connected twice (-or) thrice of each other.

④ Heavier isotope is senior $\left[\begin{array}{c} \text{in Hydrogen} \\ \text{T} > \text{D} > \text{H} \end{array} \right]$

⑤ Lone pair is considered to have zero atomic number that's why lone pair is always a junior group.

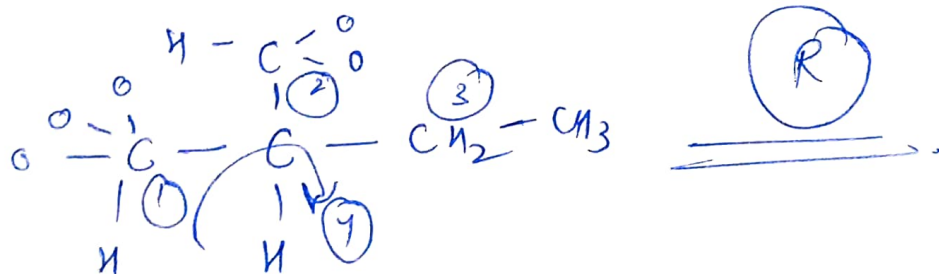
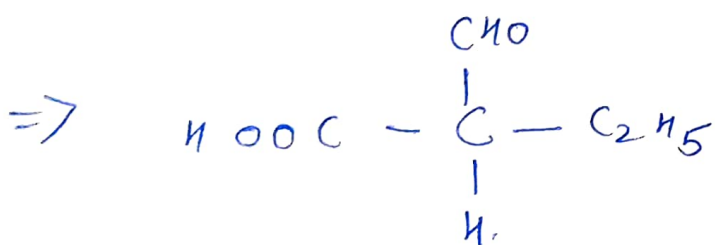
Prep

⇒ Preference = > =



3 Z

$\Rightarrow (1\text{E}), (3\text{Z})$



#

Hyperconjugation :-

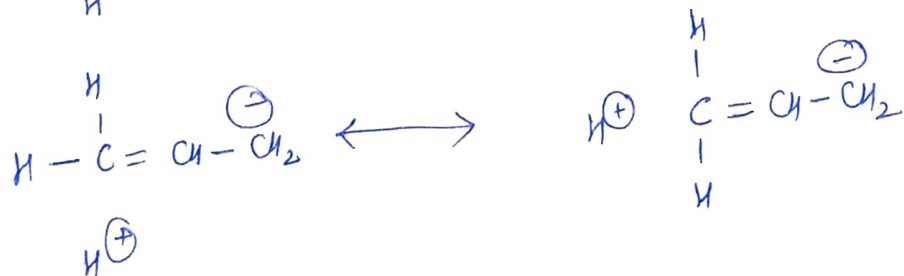
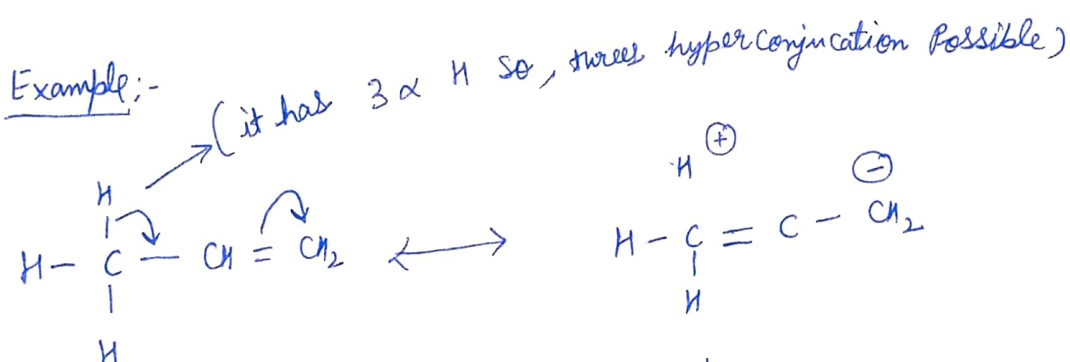
=> Whenever C-H Bond is directly attached to an unsaturated Carbon or benzene ring the Sigma C-H Bond moves into Conjugation with the unsaturated Carbon or benzene ring is called as Hyperconjugation.

=> Structure requirement of hyper Conjugation :-

=> any organic species can show hyper Conjugation phenomena if it fulfilled following condition :-

- 1> Compound should have a sp^2 hybridised Carbon of alkenes, arenes, Carbocation and free radical.
- 2> Alpha Carbon w.r.t sp^2 hybrid Carbon should have at least one hydrogen and hybridisation of alpha Carbon is sp^3 .

Example :-



(3 hyperconjugating structure possible)

Note :-

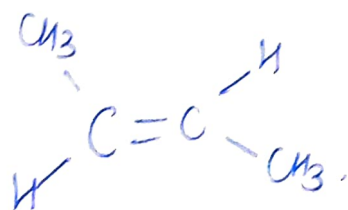
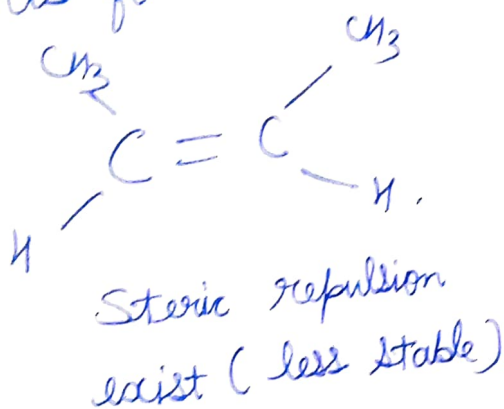
- 1> The no. of hyperconjugated structure is equal to no. of α H present in the compound.
- 2> Greater the no. of ~~top~~ hyperconjugation structure will be stability of the compound.

Steric effect:-

The substituent effect caused by e^- cloud repulsion of bulky group when they are close to each other is called steric effect.

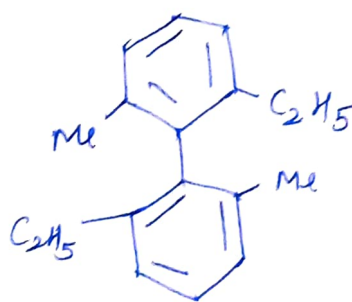
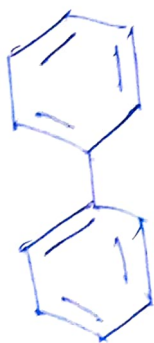
① Stability of cis and trans:-

In general cis structure is less than trans structure. due to more steric repulsion present in cis form.



Not Steric Repulsion
(More stable).

② Plane of Rings changes to minimize steric repulsion:-

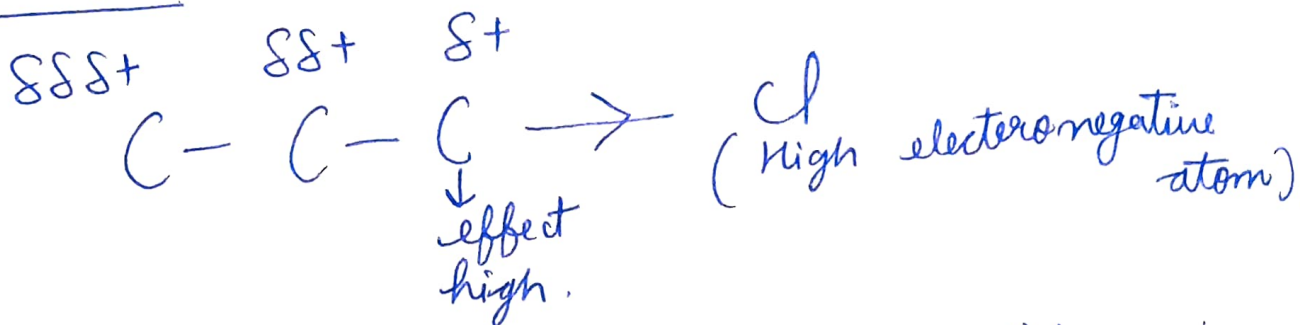


To minimize steric repulsion one ring rotate about other ring and become perpendicular to its.

Inductive effect or I-effect :-

Shifting of electron in covalent bond from low electronegative atom to high electronegative atom.

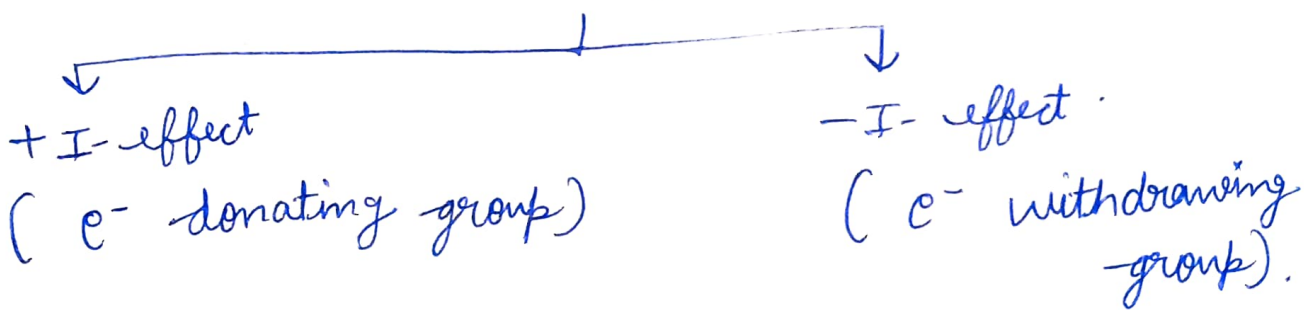
Example :-



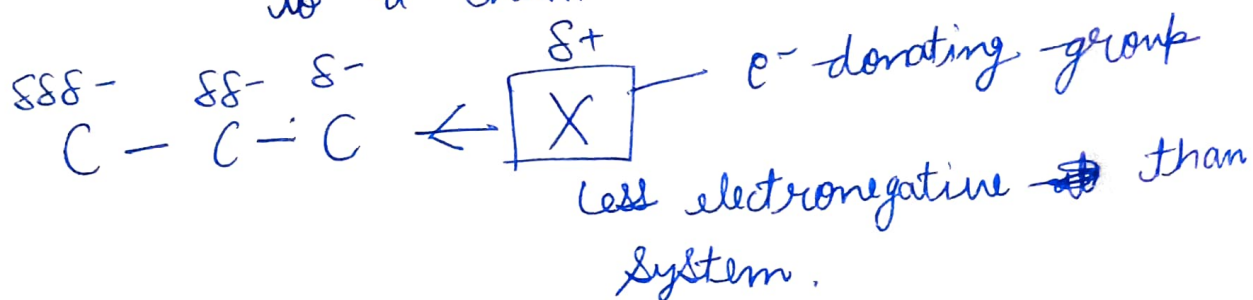
← effect decreases due to the distance increases

Types of Inductive effect :-

Groups.

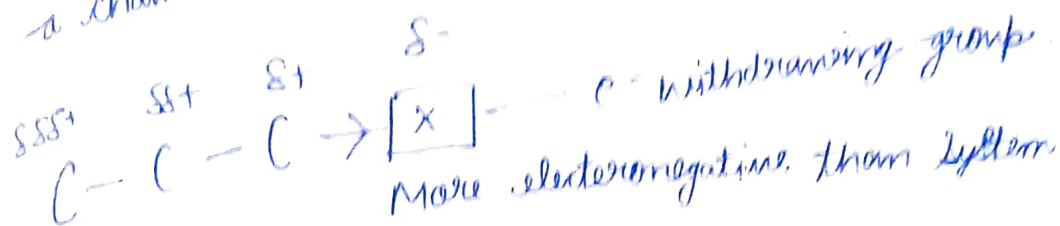


+I effect => The e⁻ donating group attached to a chain.



Example :- -I effect groups = -CHO, -OH, -CO-
All functional groups

-I effect $\Rightarrow$ The e^- withdrawing group attached to a chain



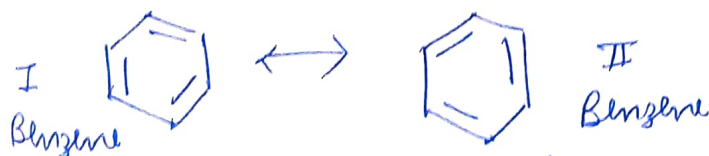
Example:-
 $+I$ effecting group.
 All alkyl groups.
 $-CH_3$, $-CH_2CH_3$ etc.

Application of Inductive effect:-

- (1) Stability of Carbocation.
- (2) " " Carboanion
- (3) " " Free Radical.

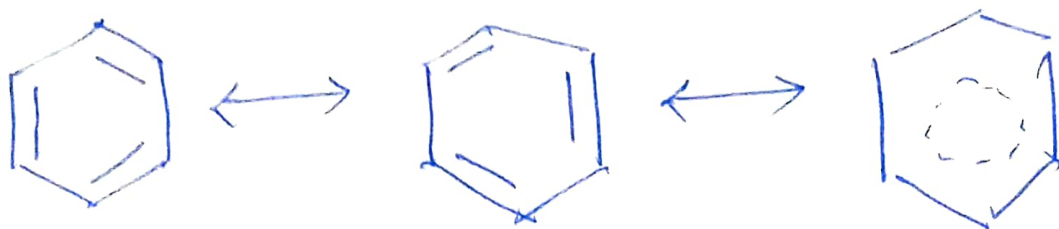
Resonance effect (R-effect).
 or
Mesomeric effect (M-effect)

$\Rightarrow$ Chemical structure can be written in two or more than two different form.



$\Rightarrow$ These different structure are called Resonance structure or Canonical structure.

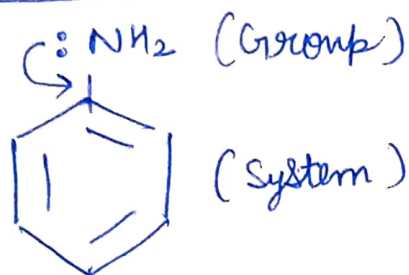
$\Rightarrow$ The Resonance take place due to delocalization of π -electron.



⇒ All Resonance or Canonical Structure can be mixed to form hybrid Structure.

Types of Resonance effect:-

+R effect



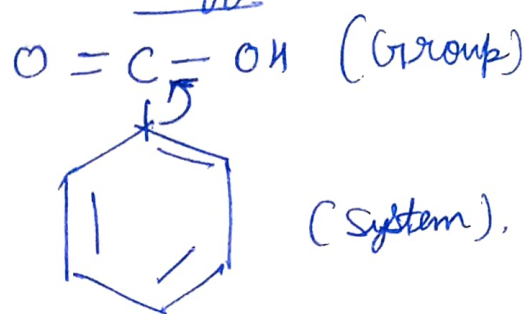
(The electron ~~are~~ move from group to system)

+R (donating groups)

-OH, -NH₂, -OR,

-CH₃ etc.

-R effect



(The electron move from system to group).

-R (withdrawing groups)

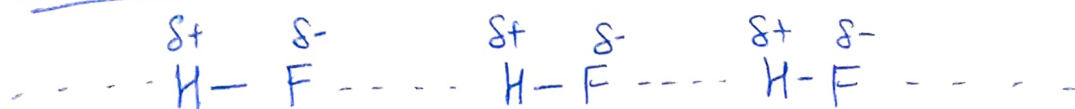
-COOH, -NO₂ ~~etc~~

-CN, -CHO, -CO-
etc.

Hydrogen Bonding :-

⇒ The Bond formation between Hydrogen and high electronegative atoms like F, O, N.

Example :-

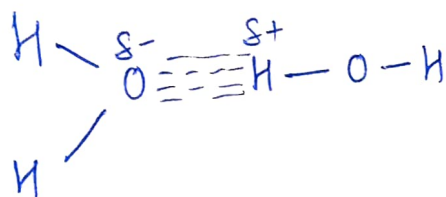


⇒ Type of Hydrogen Bonding :-

① Intermolecular Hydrogen bonding :-

⇒ The hydrogen bond formation take place between two different or same molecule

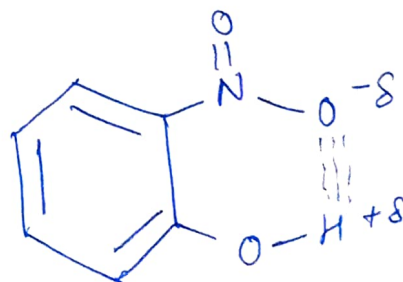
For Example :-



② Intramolecular Hydrogen bonding :-

⇒ The hydrogen bond formation take place within a same molecule.

For Example :-

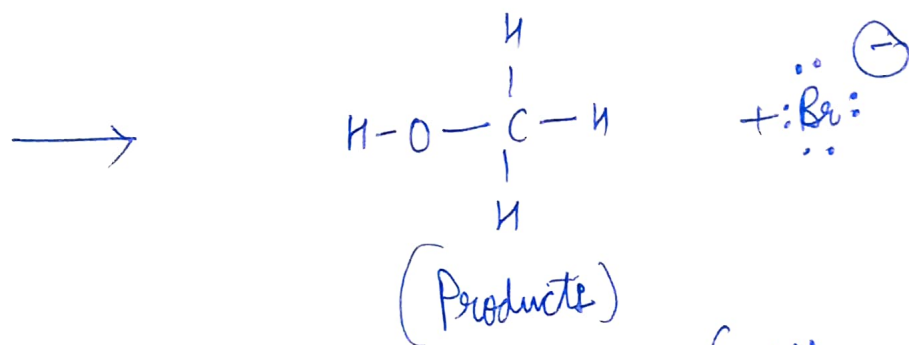
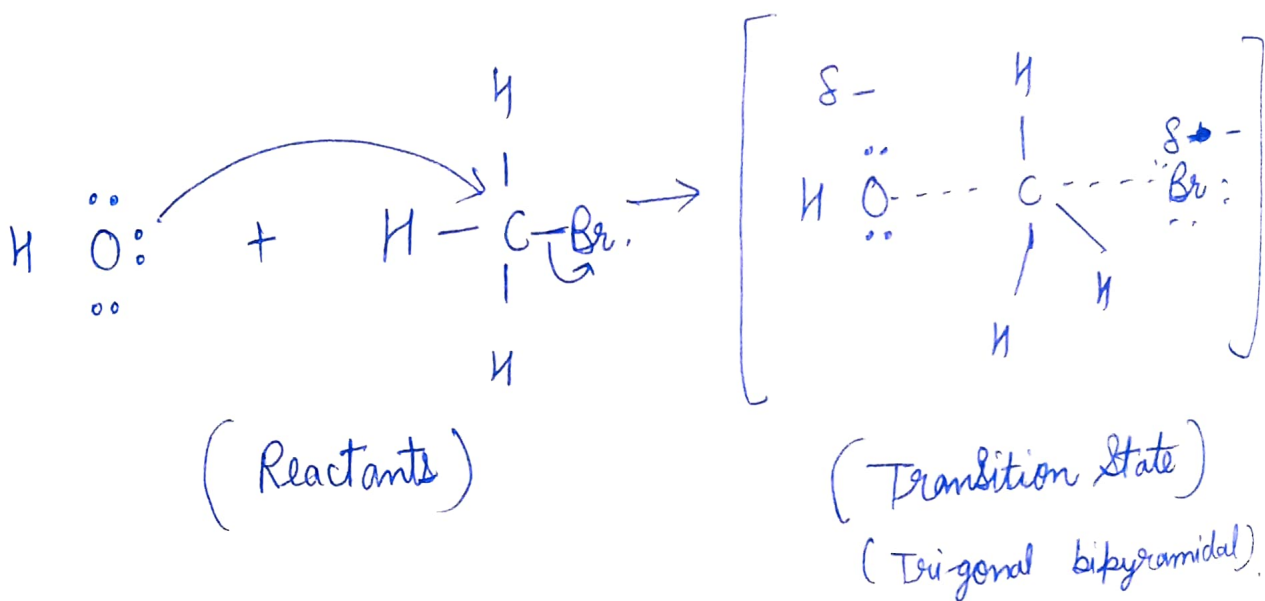


Intermediate and Transition State:-

=> Transition State:-

Transition state is a molecular entity that has a lifetime no longer than a vibration that exhibits some structural characteristics of both the reactants and the products.

Example :-



~~SN² Reaction~~

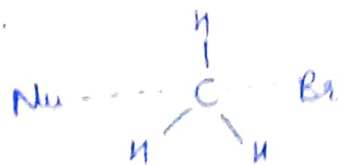
=> SN² Reaction

(All rxn's have transition state in which dissociation or association takes place)

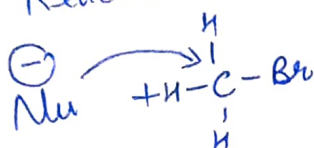
Energy Profile diagram:- (S_N2 Reax.).

↑
energy
|

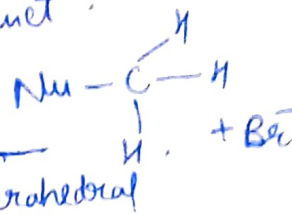
Transition State
(energy max.)



Reactants



Product



Tetrahedral

Reax. Progress.



⇒ Intermediate :-

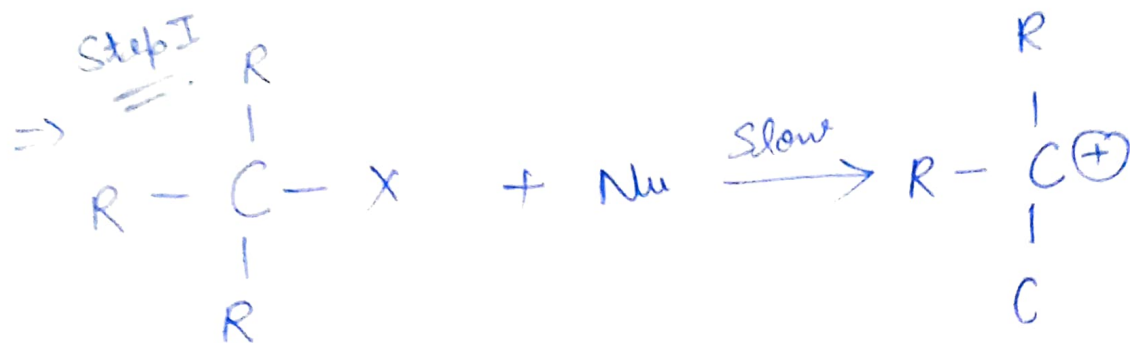
⇒ Intermediate is a ~~compa~~ long lived species than ~~it~~ transition state. and it can be experimentally detect and characterized. this means that an intermediate is an actual molecule or an ion that you can work with, sometimes even isolate.

(It is relatively stable midpoint)

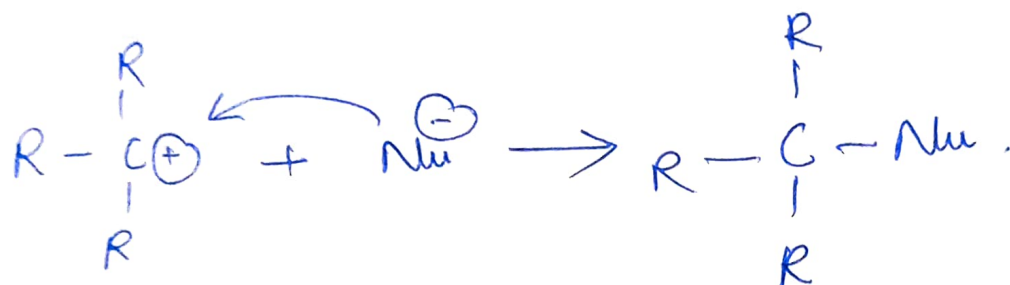
(All Reax's don't have intermediate).

Example

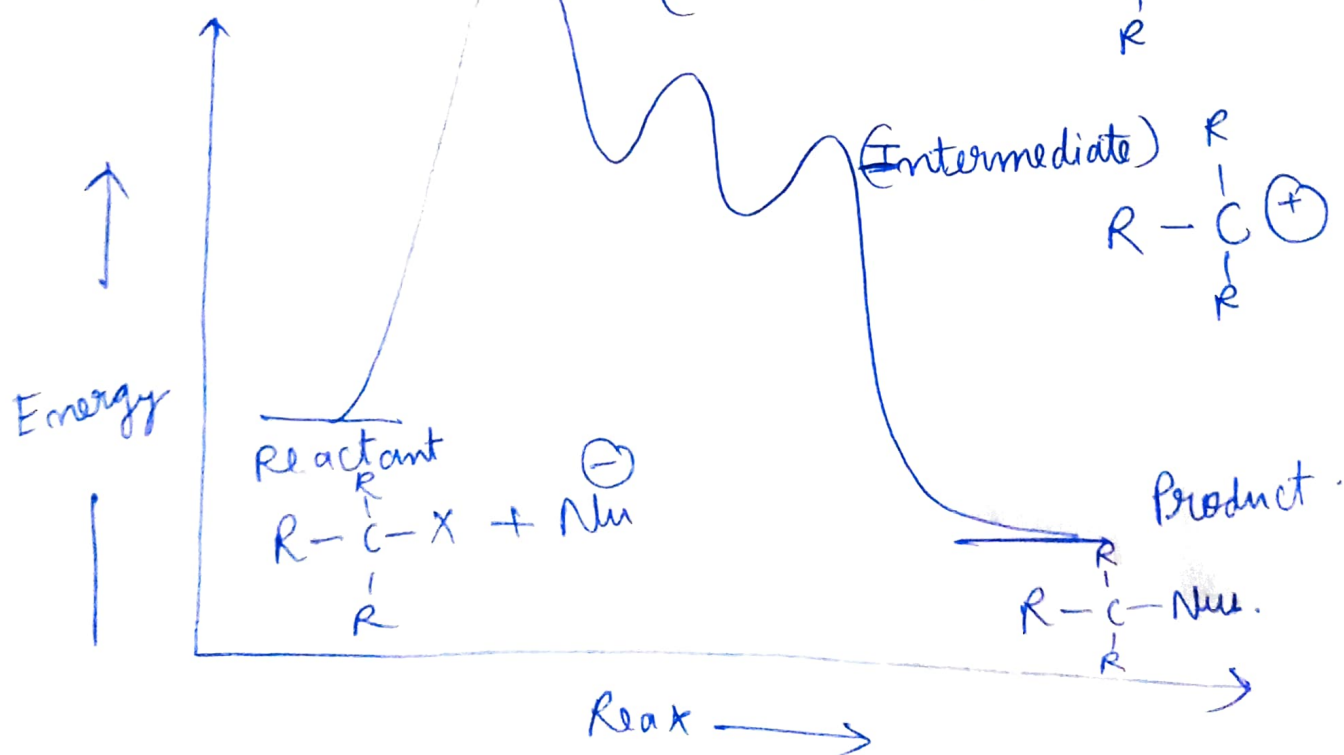
S_N1 Reax.



Step II

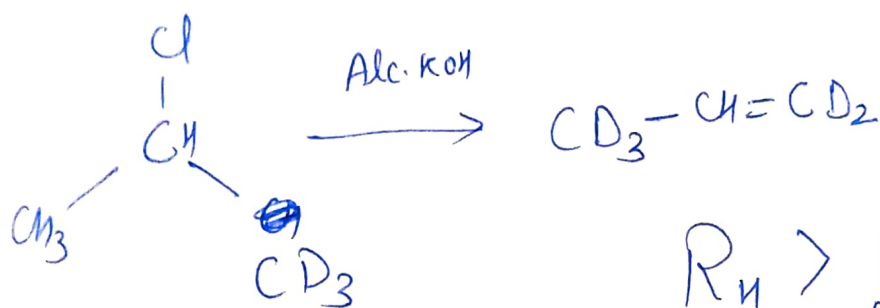
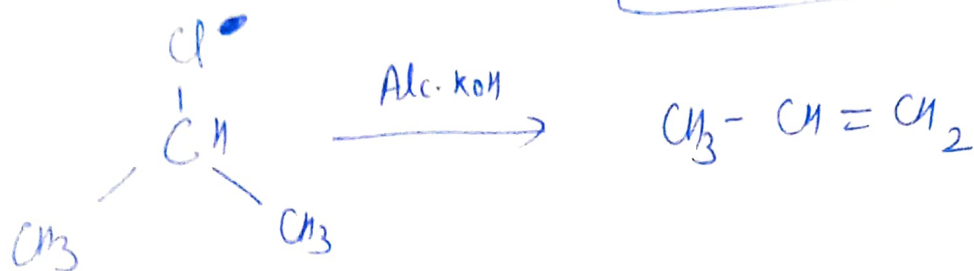


$\Rightarrow$ The energy diagram of the S_N1 nucleophilic Substitution Reax, (Transition State) $\text{R}-\underset{\text{R}}{\overset{\text{R}}{\text{C}}}^{\oplus}-\text{X}^{\ominus}$



Kinetic isotope effect

Elimination Reaction

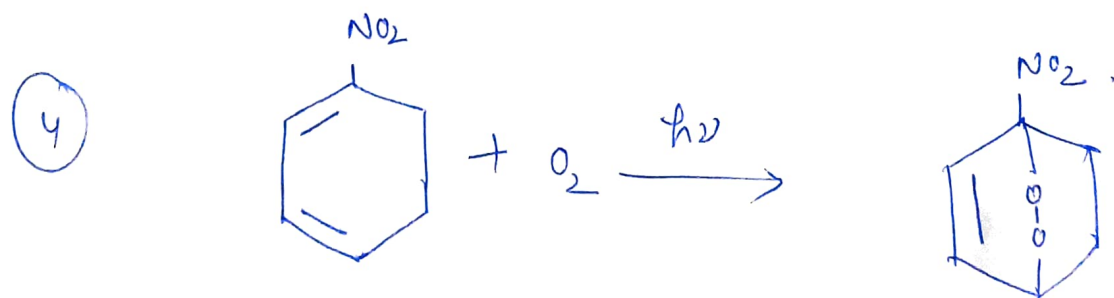
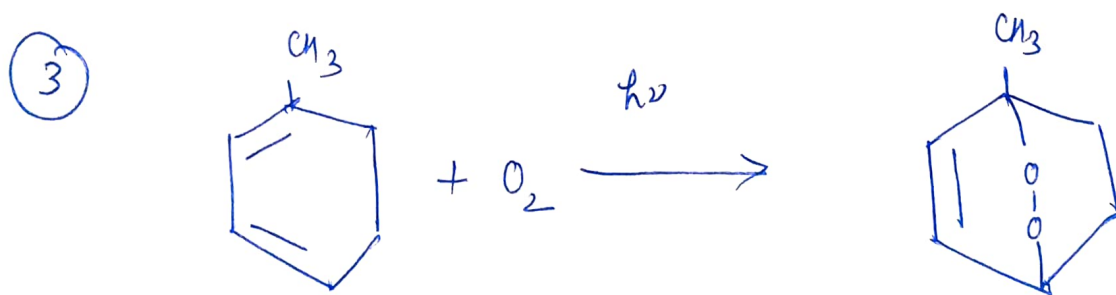
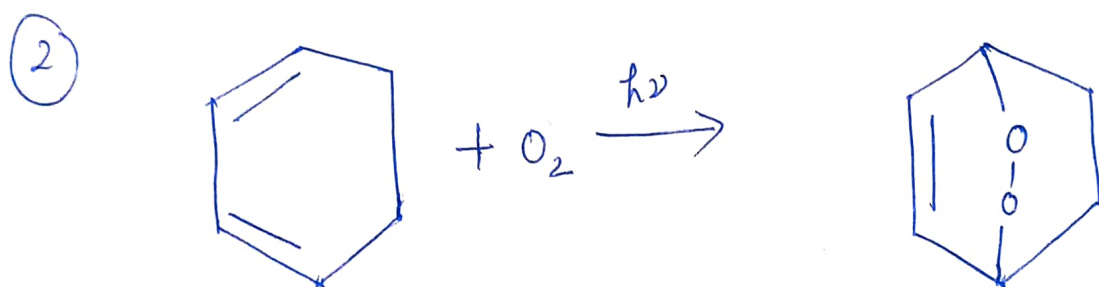
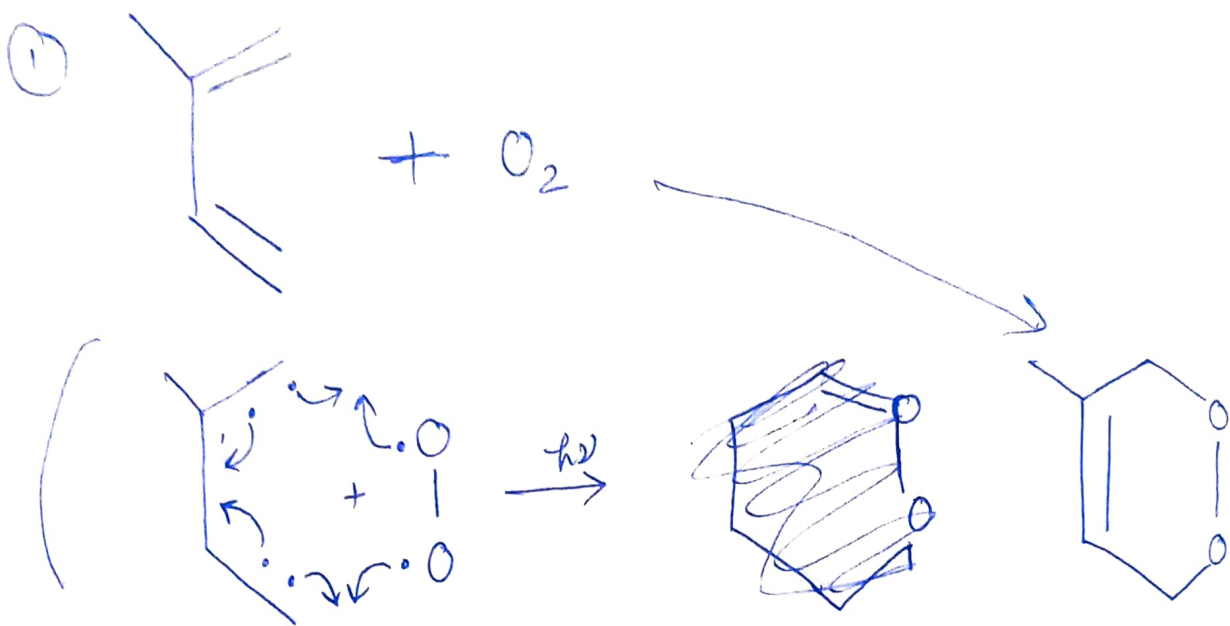


$$R_H > R_D$$

(Rate of H) (Rate of Deuterium)

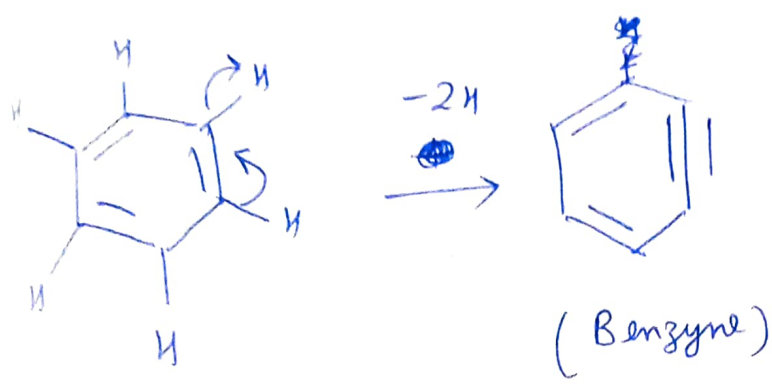
⇒ When H is replaced by another isotope in a reaction, then kinetic rate change. it means kinetic isotope effect take place.

Singlet molecular oxygen Reax:-



Arynes (Benzynes)

=> Aromatic compounds containing Carbon-Carbon triple bond are arynes.

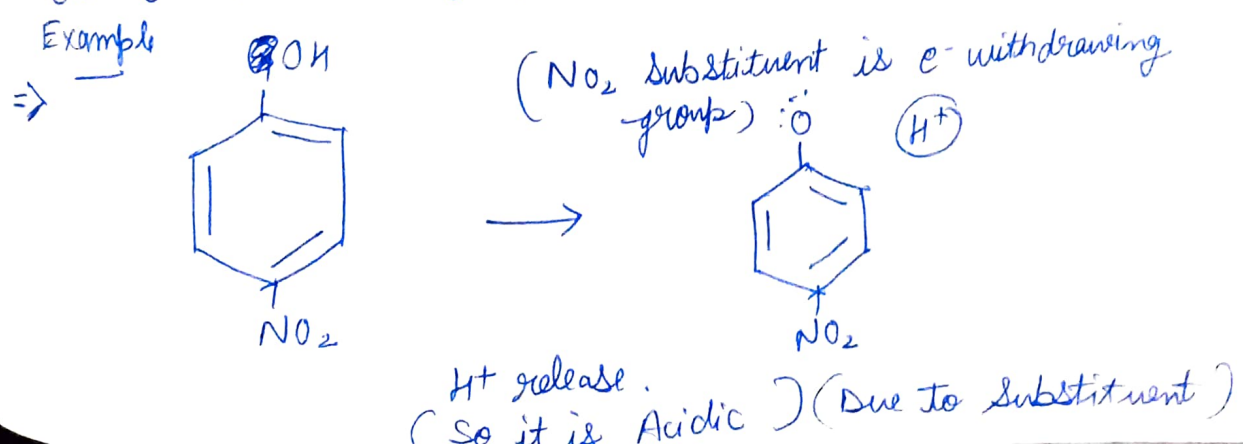


Hammett Equation:-

=> The attached substituent in a reacting molecule changes the rate effect ~~take place due to this~~ ~~attached substituent~~ in a rxn.

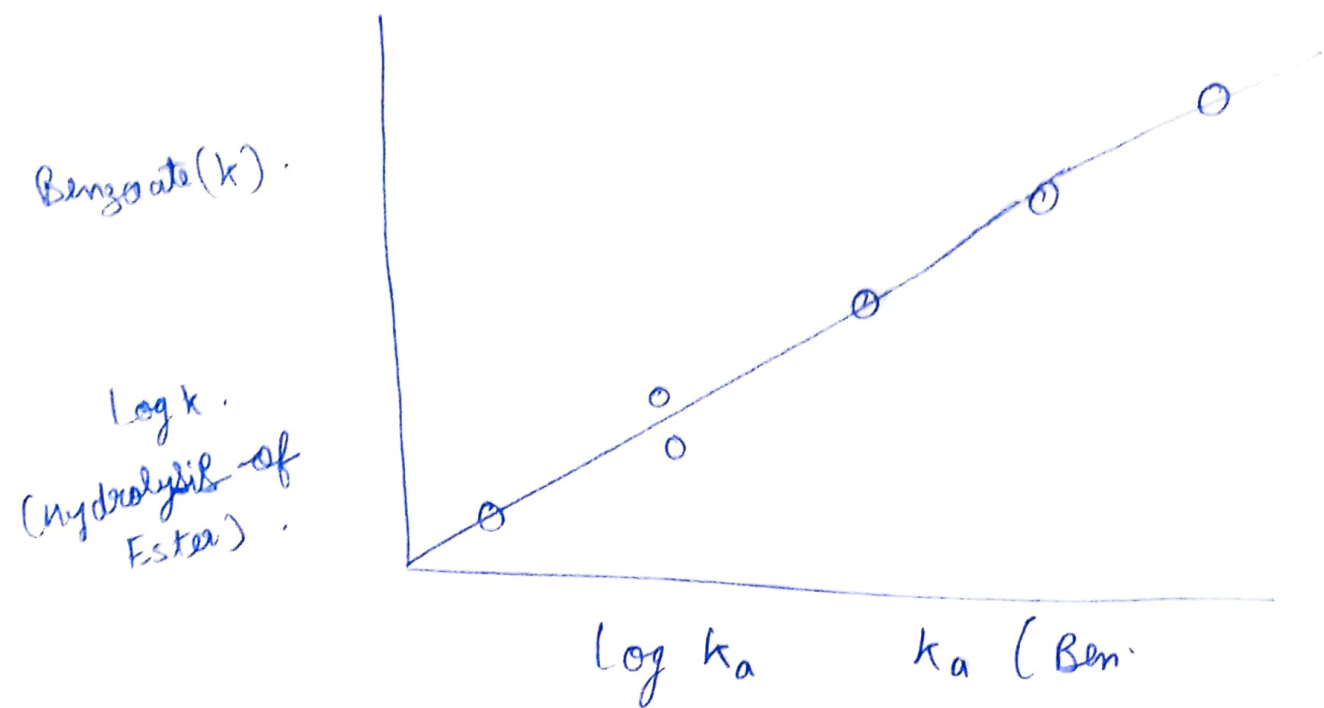
=> Hammett equation gives quantitative relation of substituent effect on which type of reaction.

=> ~~meta~~ ^{ortho} or para substituted in benzene effect the rate (substituted substituent may be e⁻ donor or e⁻ withdrawing group).



Graph

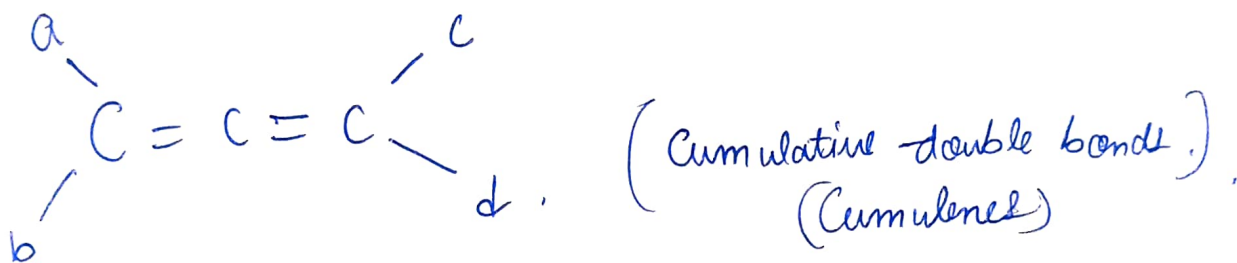
Hammette obtained by plotting the $\log k$ (Para) and (m). Ethyl benzoate against $\log k_a$ Benzoic Acid.



R/S Configuration of Allenes / Biphenyl / Spiranes :-

Allenes, Biphenyl, Spiranes they do not have chiral centres. So they are not optically active and they do not have plane of symmetry, Centre of symmetry and Axis of symmetry.

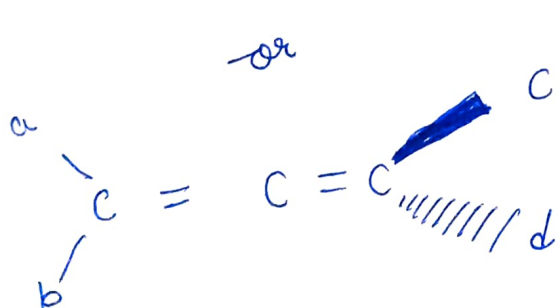
Allene :- Allene have adjacent double bond.



$$a \neq b \quad C \neq d.$$

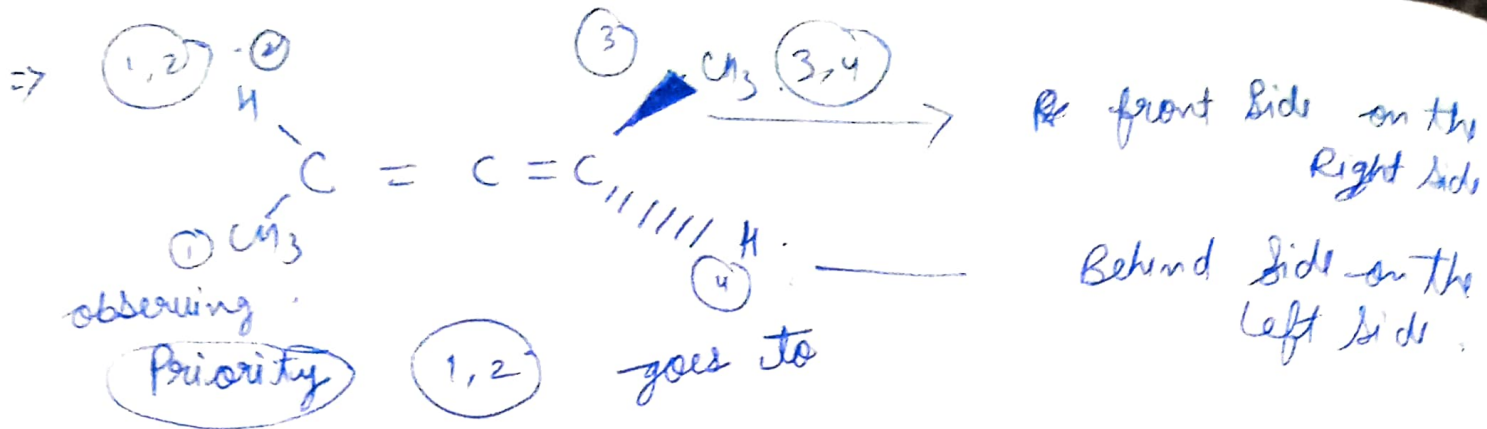
$\Rightarrow$ So they show optical isomer by non-superimposable mirror image.

$\Rightarrow$ enantiomeric form (Non superimposable on its mirror image).



C is towards ~~you~~ the plane.
d is behind the plane.

Note:-
 $\Rightarrow$ Even double bond (it will be chiral)
 $\Rightarrow$ odd double bond (it will be Achiral).



R - Configuration

