

Isomerism

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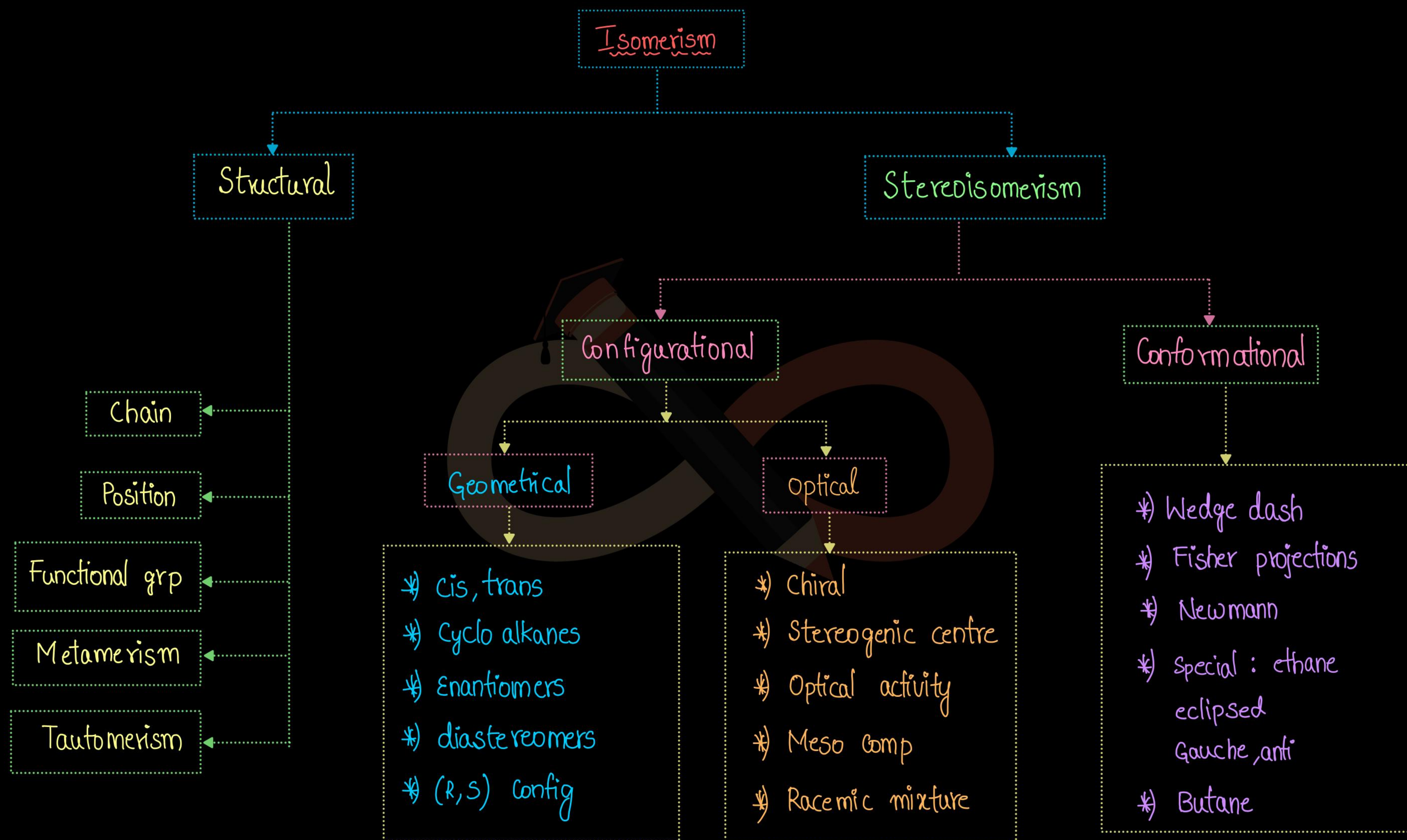
II) Stereoisomerism

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Structural

1) chain: (Parent chain is diff)



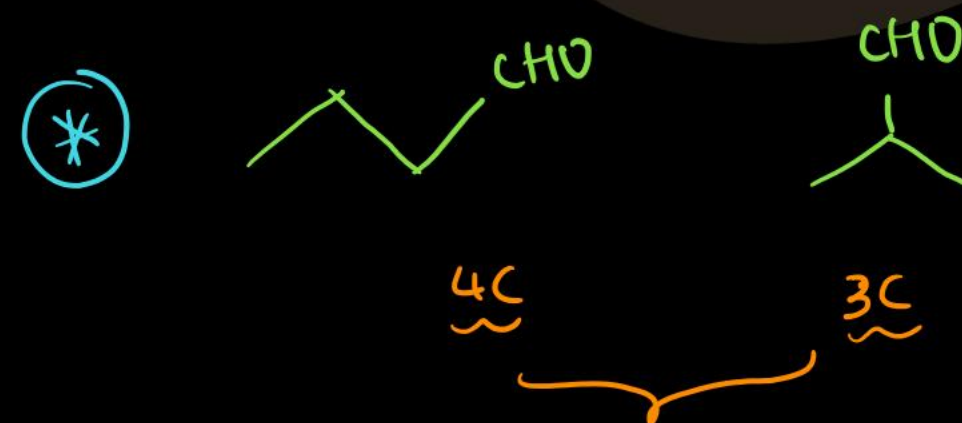
2) Position:

Parent chain must be same



(diff position of branch)
of non Carbon FG

Ex:- NO, X, OH, NH₂



∴ they are chain, not position

If Carbon containing, (CHO, COOH, -)

↓
Parent chain becomes diff

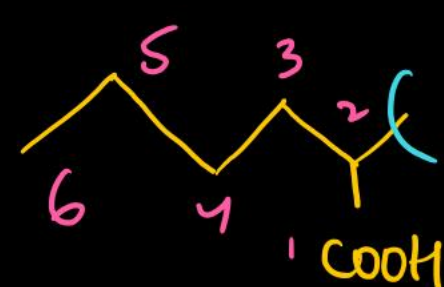
* Magic no. of PI

$\begin{matrix} \text{xy} \\ \swarrow \searrow \\ \text{No. of C in parent chain} \\ \text{No. of branches} \end{matrix}$

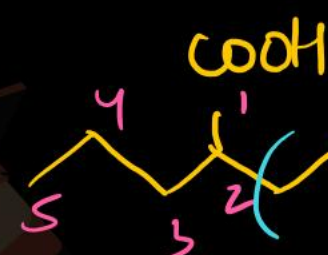
Same $\Rightarrow$ PI

otherwise $\Rightarrow$ CI

Ex:-



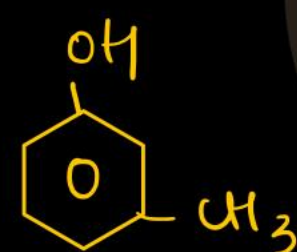
51



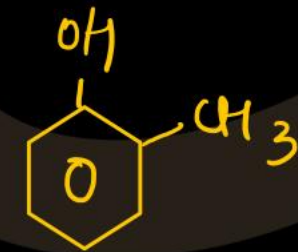
51

$\Rightarrow$ Not PI, they are CI

Ex:-



61



= 61

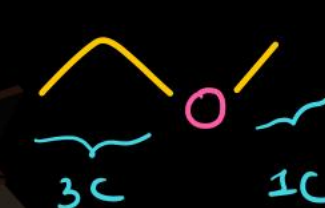
$\Rightarrow$ PI

3) Metamersm : diff arrangement of grp/atoms from either side of Bridging FG

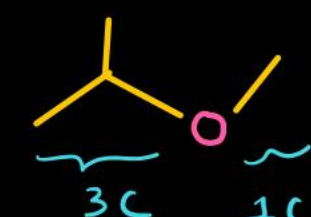
BFG



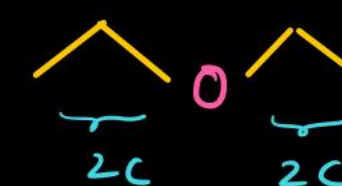
Ex:-



(Normal)

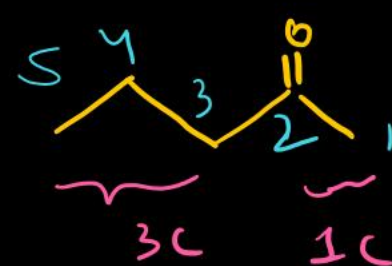


(branch)

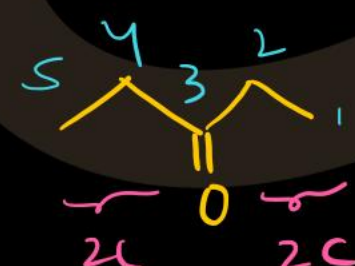


Metamers

Ex:-



50



= 50

metamers

=> PI also

(Priority)

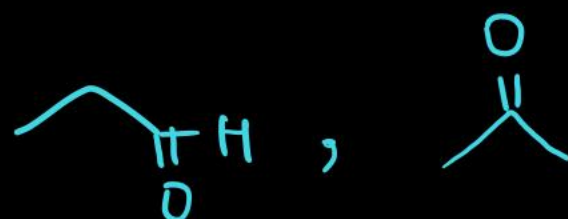
MI > CI > PI

4) Functional Isomerism → Same MF
→ Diff FG

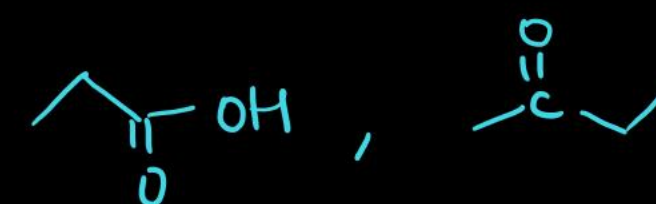
Ex: 1) alcohol & ether



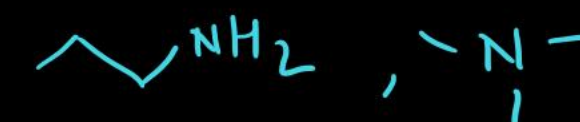
2) aldehyde & ketone



3) Acid & ester



4) 1°, 2°, 3° amines



Degree of Unsaturation:-

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

DU = 0 → straight chain

DU = 1 → 1π / 1 ring

DU = 2 → 2π / 2 ring
1π & 1 ring

DU = 4 → Benzenoid

* Ring chain isomerism

↳ (functional isomerism)

↔ MF same
↔ 1 ring, 2 chain

Ex:-



C₃H₆

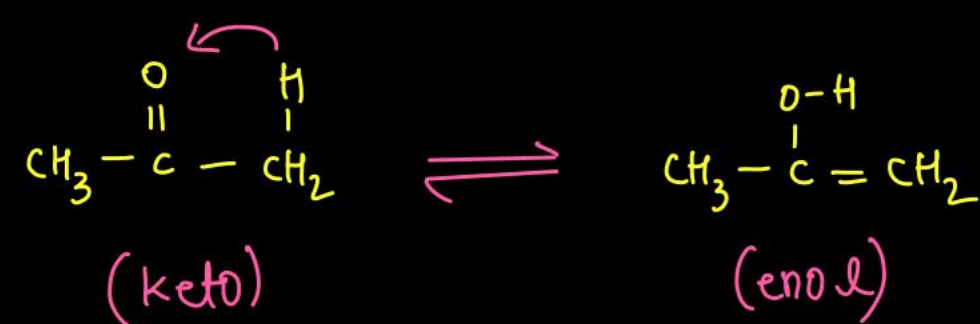


C₃H₆

5) Tautomerism $\rightarrow$ Intramolecular H^+ transfer

Conditions :-
 1) $\alpha-C : sp^3$
 2) $\alpha-H$

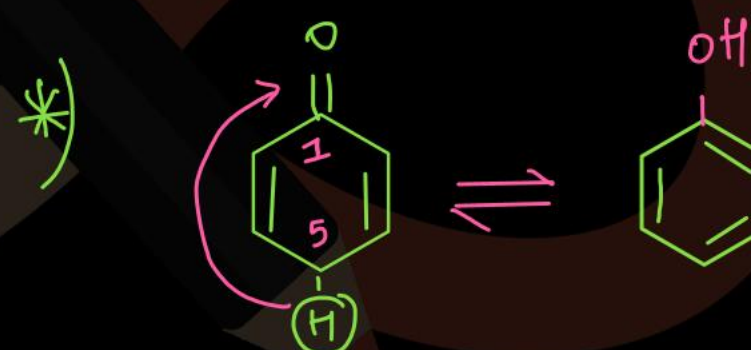
Case I > (1,3 system)



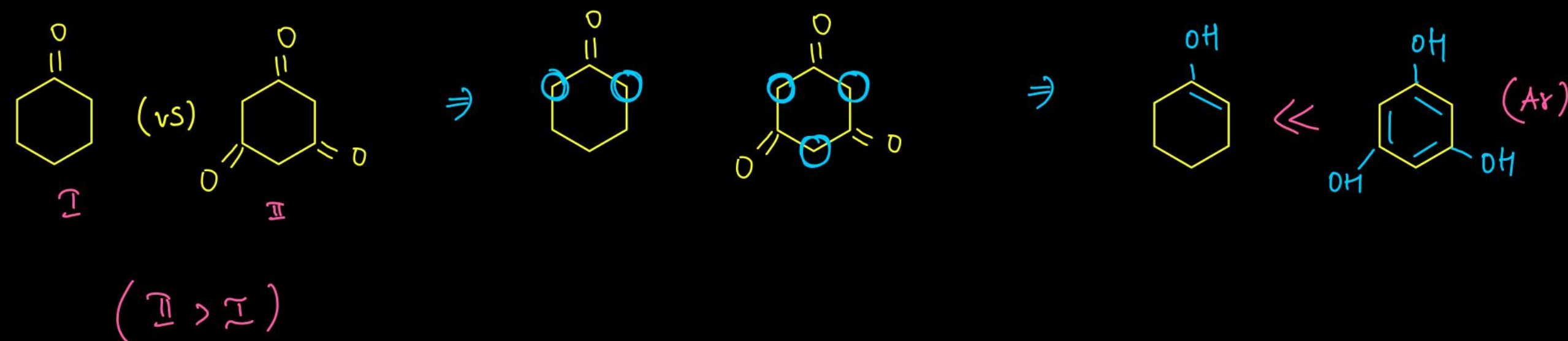
Case II > 1,5 system (1,3 $\rightarrow$ fail)



Case-III > 1,2 - system

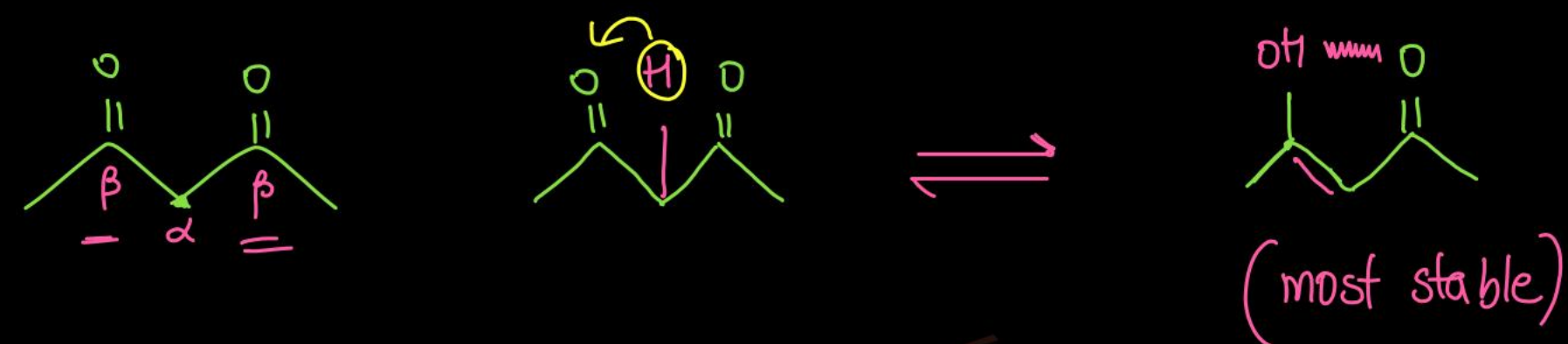


* End Content



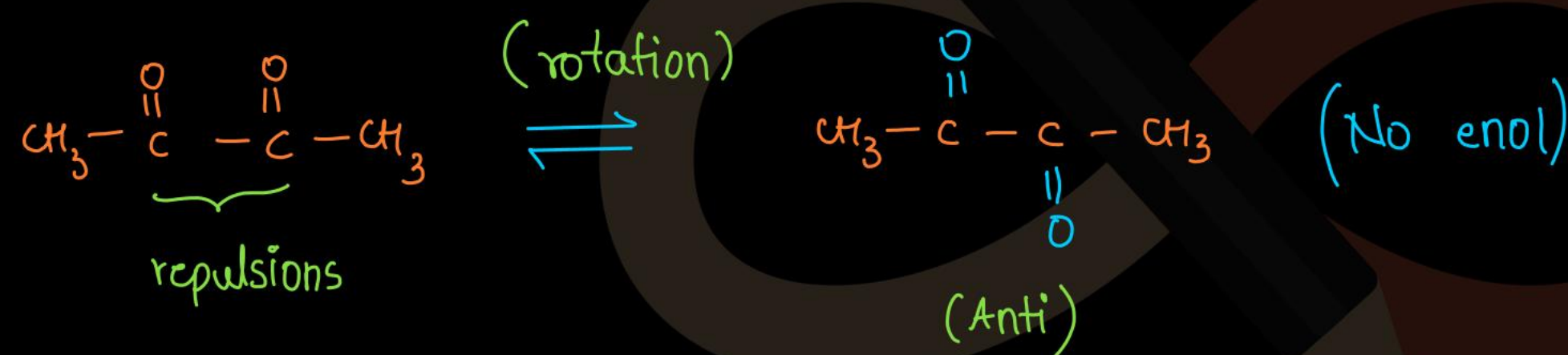
Note:-

1) Alicyclic beta diketones :-

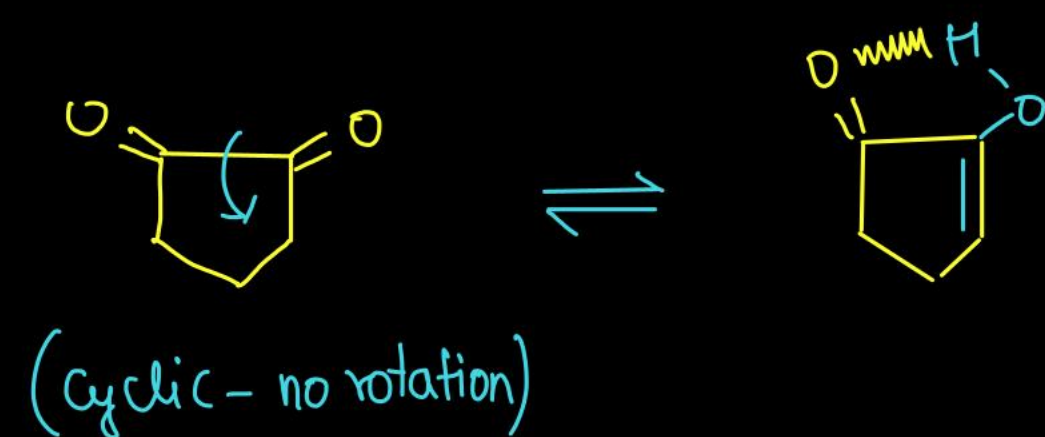


Enol Content $\propto$ EWG
 $\propto$ no. of $\text{C}=\text{O}$
 $\propto$ H... bond
 $\propto$ aromaticity

2) Alicyclic α -diketones



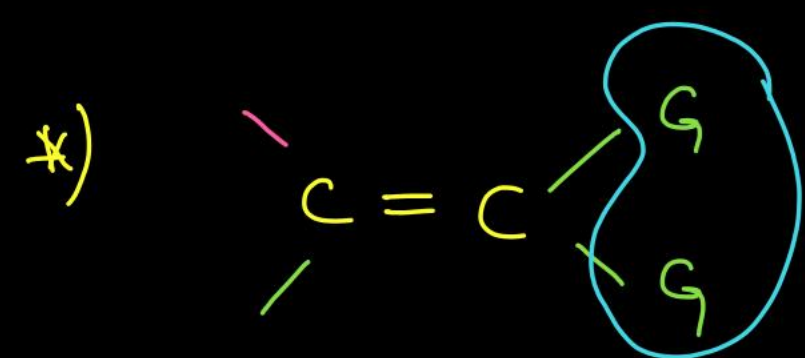
3) Cyclic α -diketones



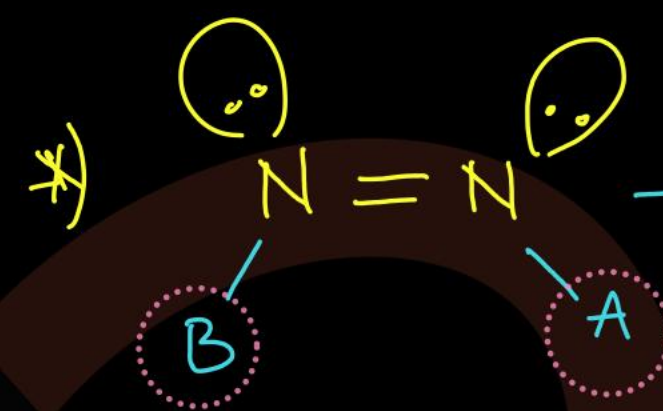
Geometrical Isomerism

1) Arises due to restricted rotation } can be on $C=C$, $N=N$, (cyclo alkanes)
 $C=N$, $C=O$,

2) Also known as diastereomers



same $\Rightarrow$ GI X



$\rightarrow$ always GI

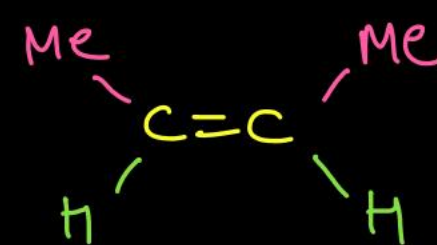
*) Cummulenes :-



odd no. of '=' $\rightarrow$ Planar

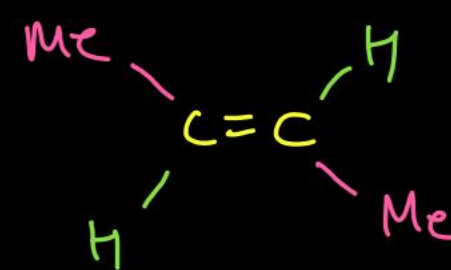
even no. of '=' $\rightarrow$ Non-planar

*) C=C



(cis)

($\mu \neq 0$)



(trans)

($\mu = 0$)

→ Not always but definitely $\mu_{trans} < \mu_{cis}$

physical prop

1) Dipole moment

cis > trans

2) B.P $\propto$ (DM)

cis > trans

3) Crystal lattice

T > C

4) MP $\propto$ (CL)

T > C

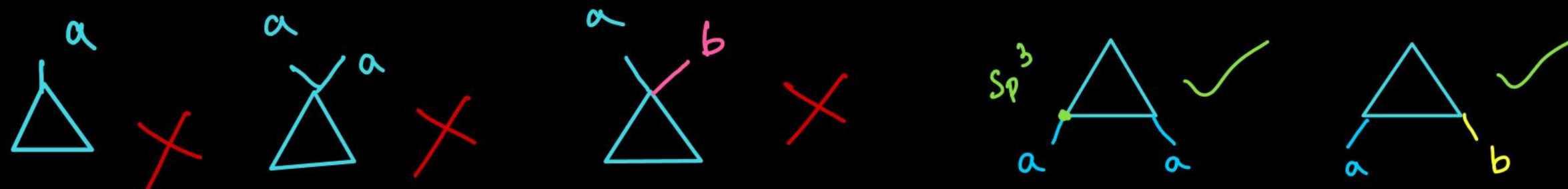
5) Stability

T > C

6) Solubility

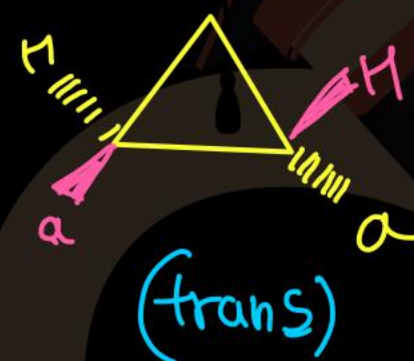
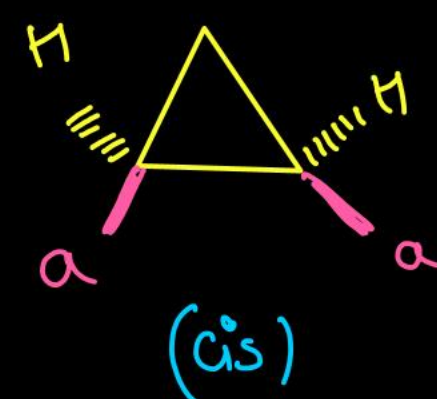
T < C

*) Cycloalkanes

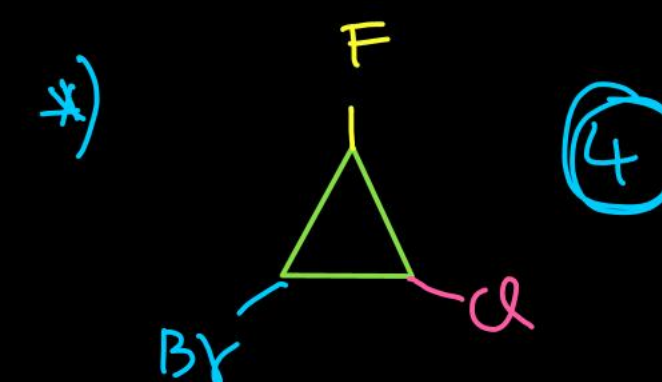
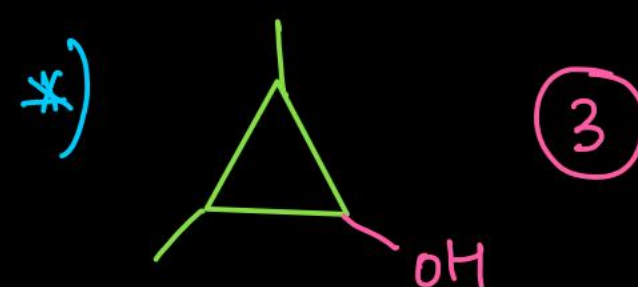
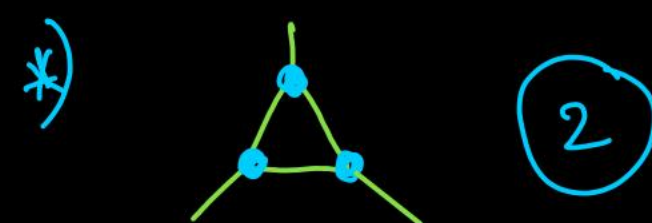
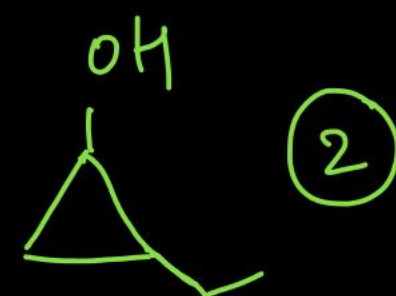


atleast 2 grp at
2 diff position
with sp^3 carbon

Ex:-



Note:-

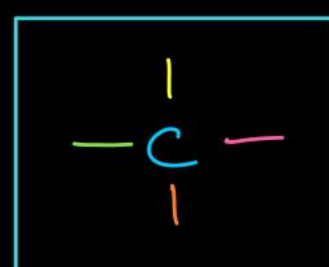


Optical Isomerism

* Chiral Carbon

→ sp^3

→ 4 diff grps



(asymmetric carbon)

Specific rotation :-

θ → observed rotation

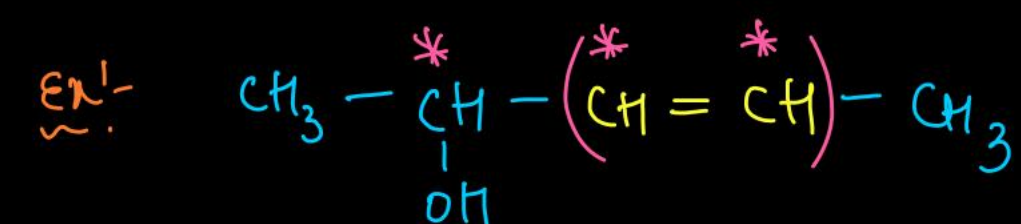
α → Specific rotation

$$\alpha = \frac{\theta}{c \cdot l}$$

$$\text{optical purity} = \frac{(\text{total rotation of mix})}{(\text{rotation of pure mix})} \times 100$$

Stereo :-

⇒ Chiral + 2 Center per GI

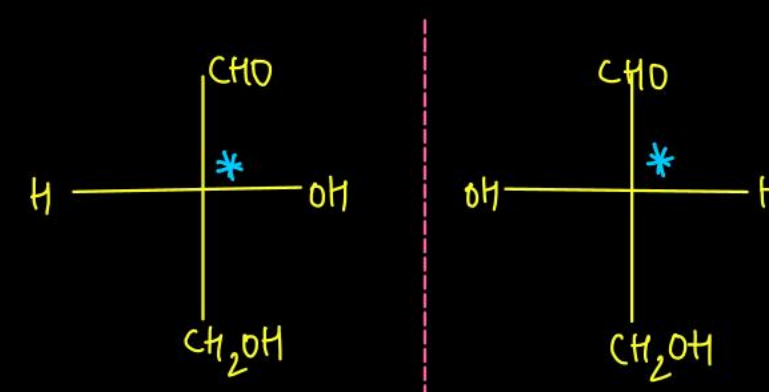


$$1 + 2 = (3)$$

* by Interchanging of 2 two grps we get

Stereoisomers then → Stereo centre

optical / Geometrical
* (chiral) (C=C)



Optical :- $\begin{matrix} \rightarrow d (+) \\ \rightarrow l (-) \end{matrix}$

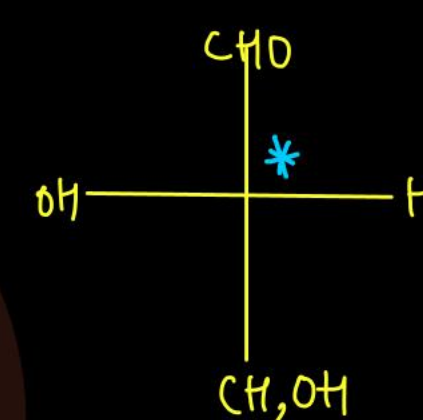
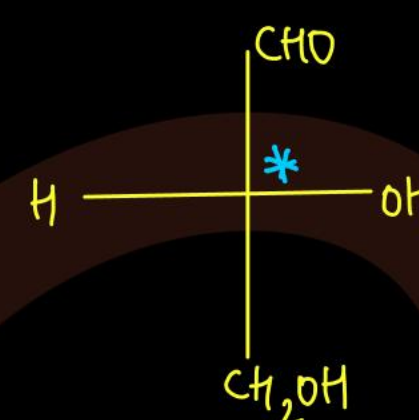
1) Plane of Symmetry $\times$

2) Centre of Symmetry $\times$

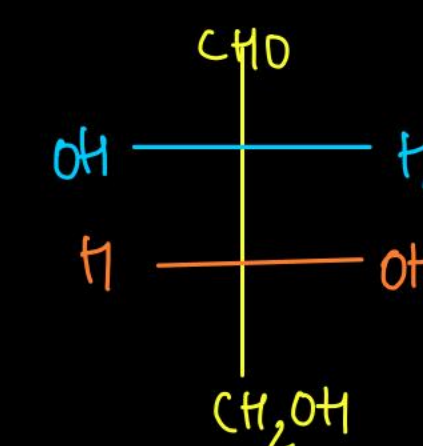
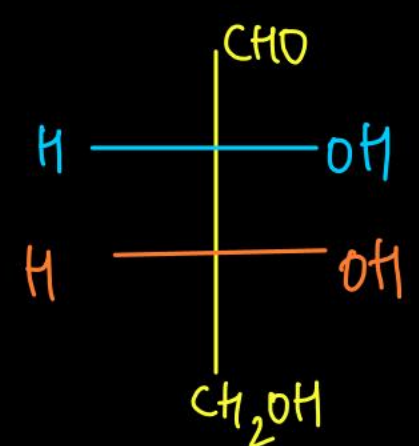
3) Axis of Symmetry $\times$

} then Comp is Optically active
*) 1 chiral $\longrightarrow$ optically active

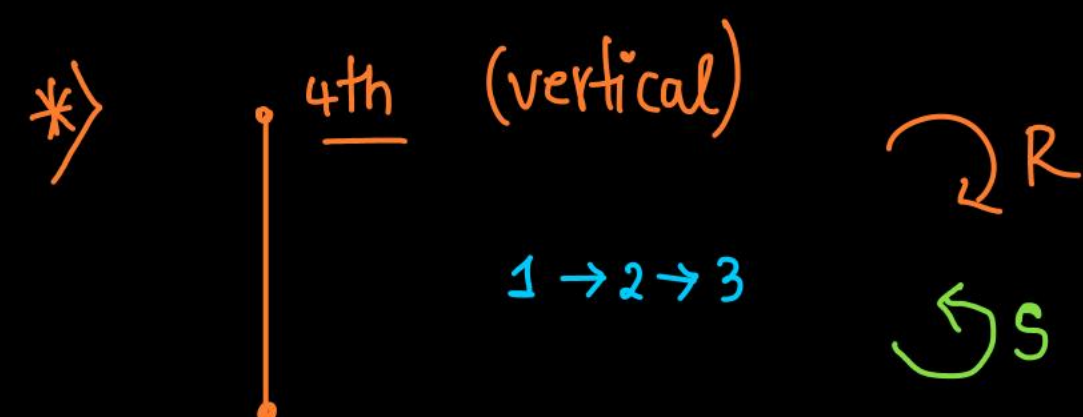
*) Enantiomers $\longrightarrow$ A & B
(non-superimposable mirror images)



*) Diastereomers $\longrightarrow$ C & D
(non-mirror images)



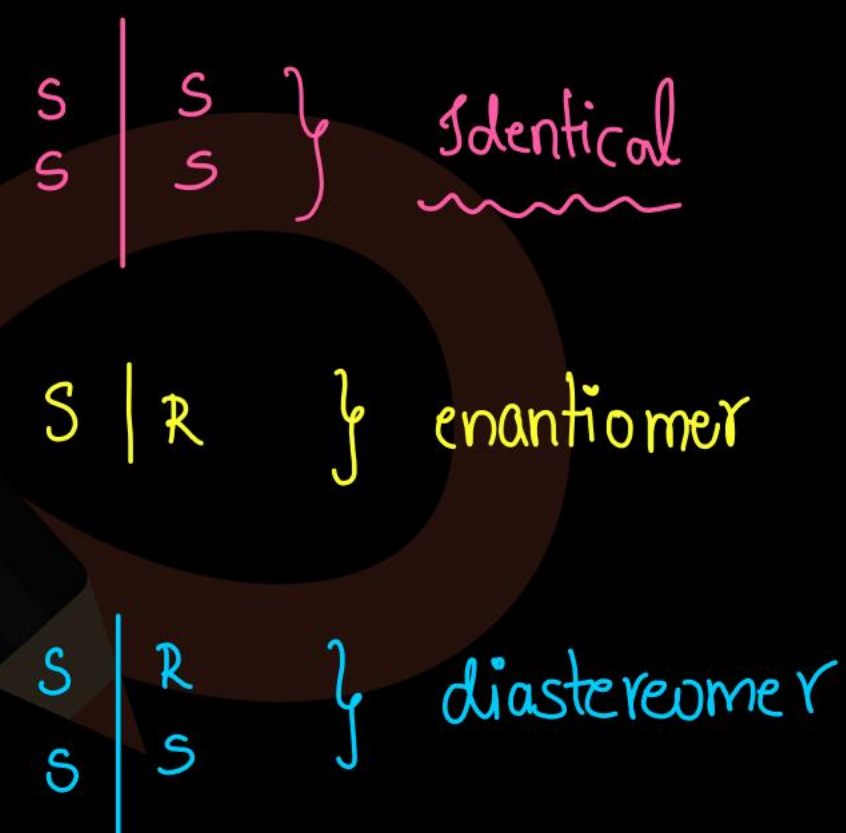
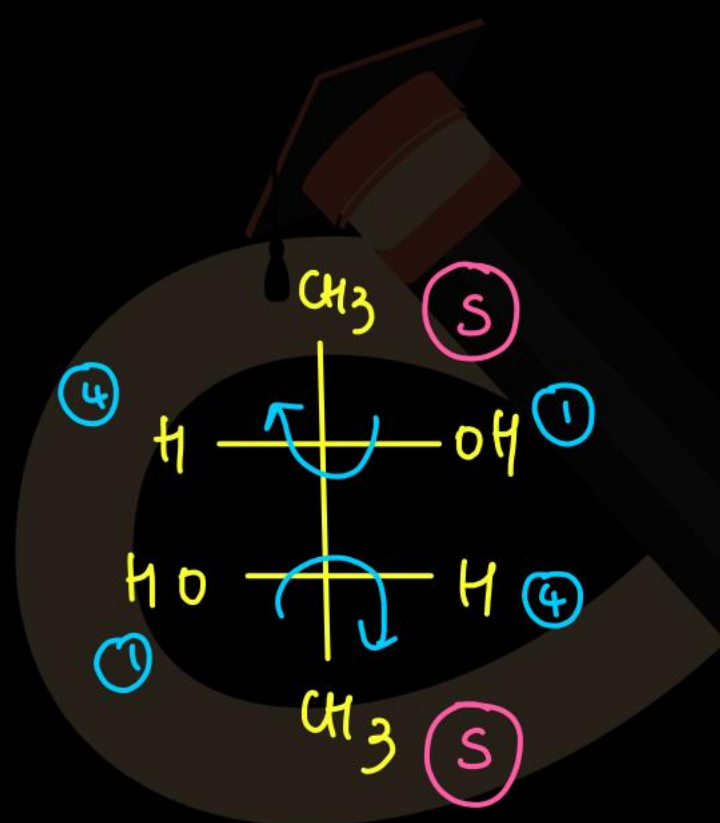
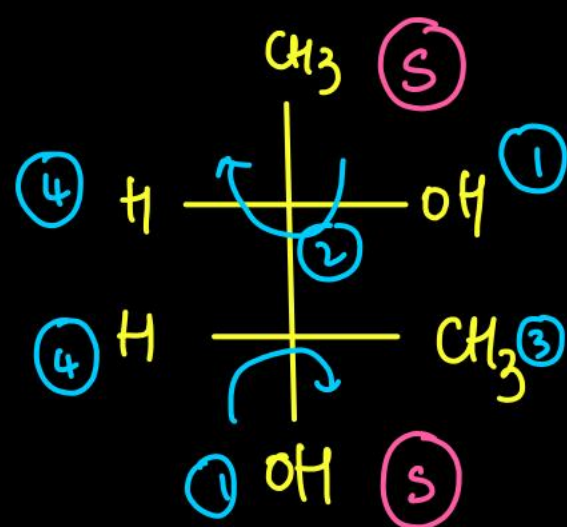
R,S Configuration :-



* even changes $\rightarrow$ no effect

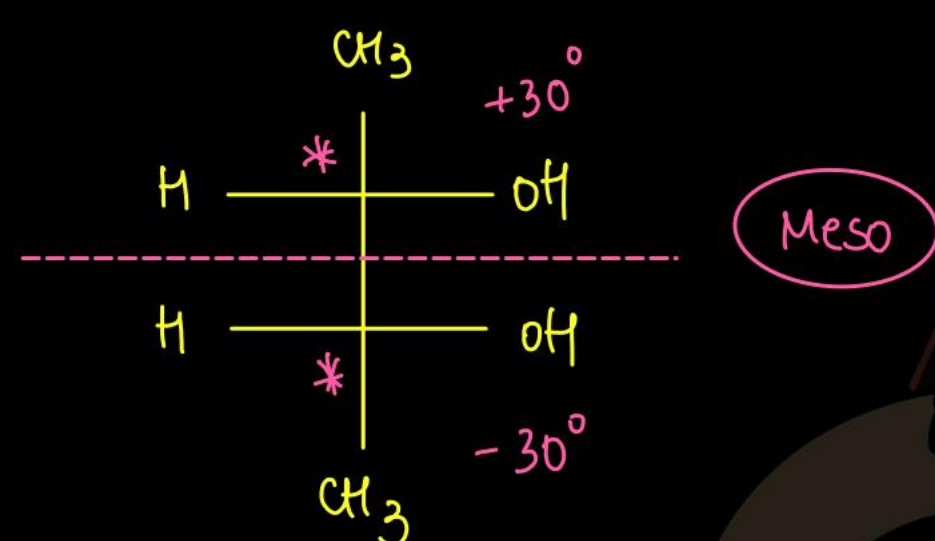
* odd changes $\rightarrow R \leftrightarrow S$

Ex:-



Meso Compounds :- chiral along with POS.

↳ *) optically inactive due to internal Compensation

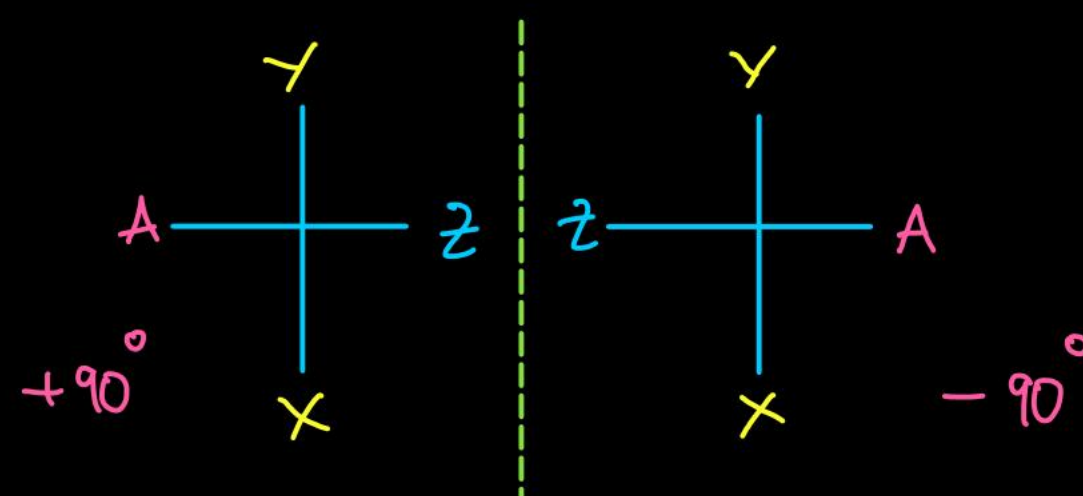


* chiral molecule :- OA $\begin{pmatrix} \text{POS} \times \\ \text{COS} \times \end{pmatrix}$

* achiral :- OIA

Racemic mixture :- Equimolar mixture of dextro & levo is called racemic mixture

↳ *) optically inactive due to external Compensation.

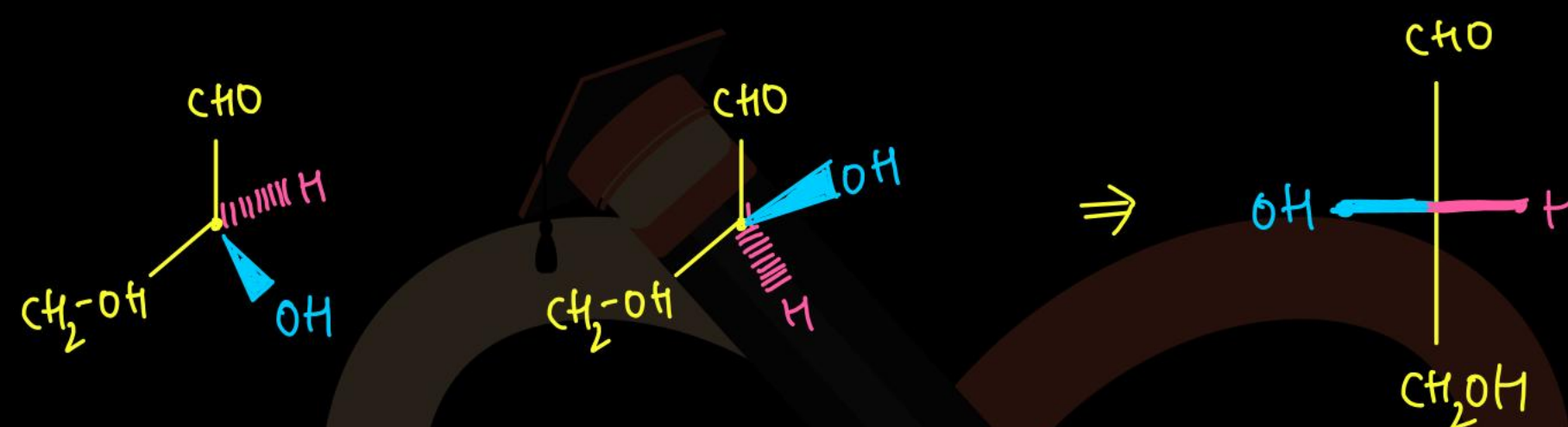


Conformational Isomerism

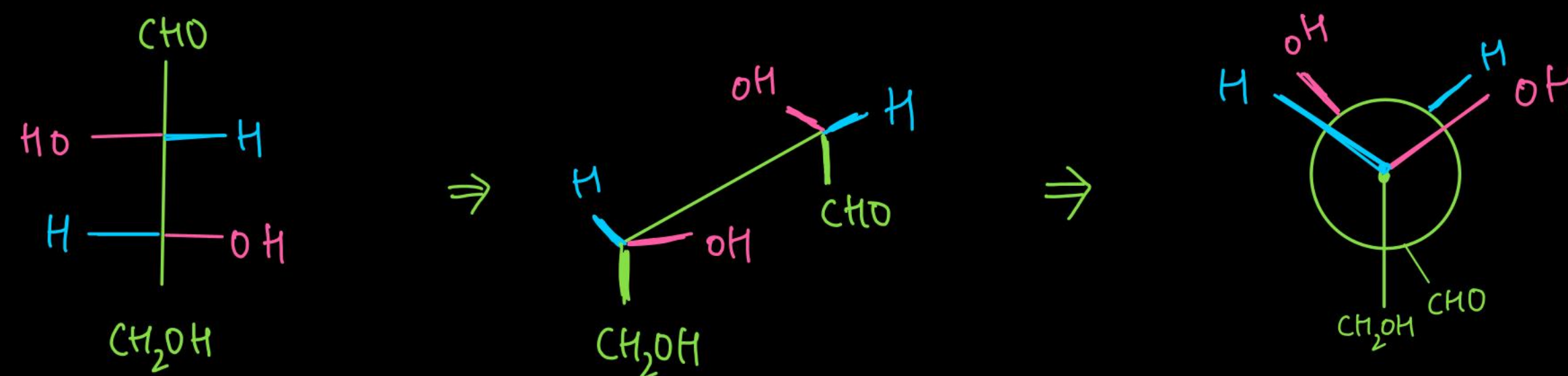
*) Conformers (rotomers)

*) c-c bond rotation

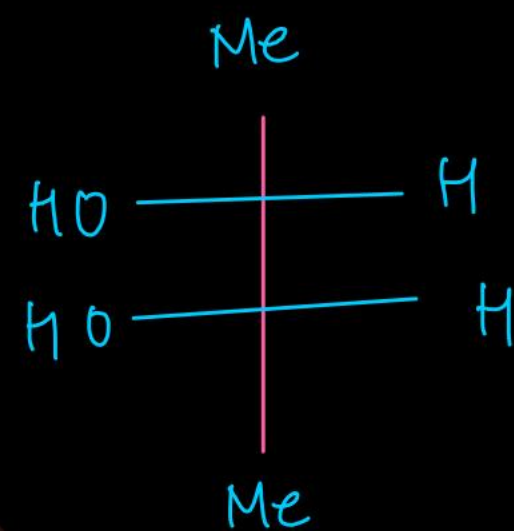
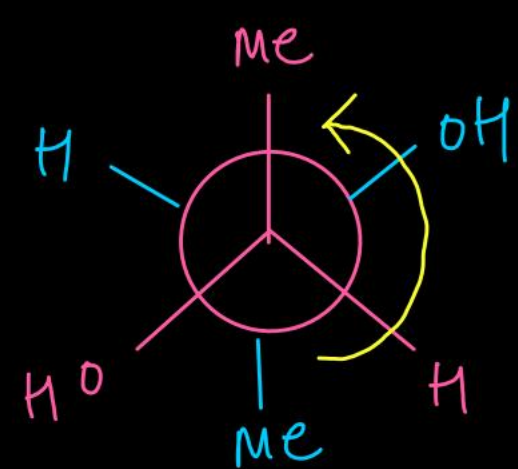
a) wedge dash to fisher



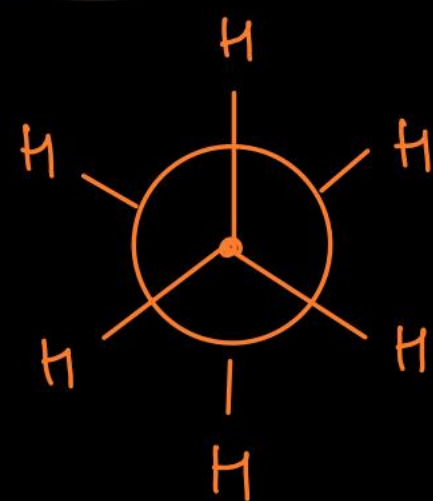
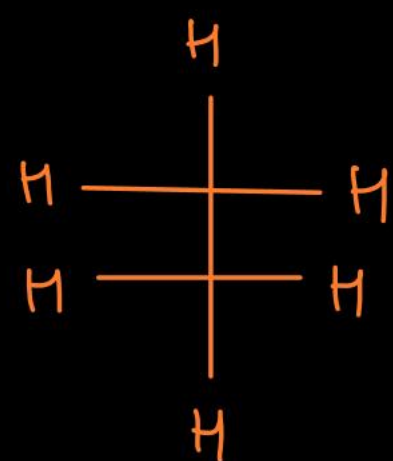
b) Fisher to Sawhorse & Newmann



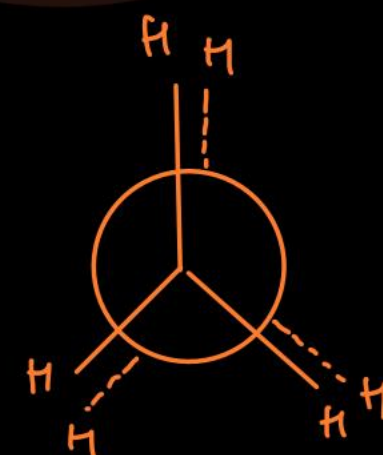
c) Newmann to fisher



* Ethane:-



staggered



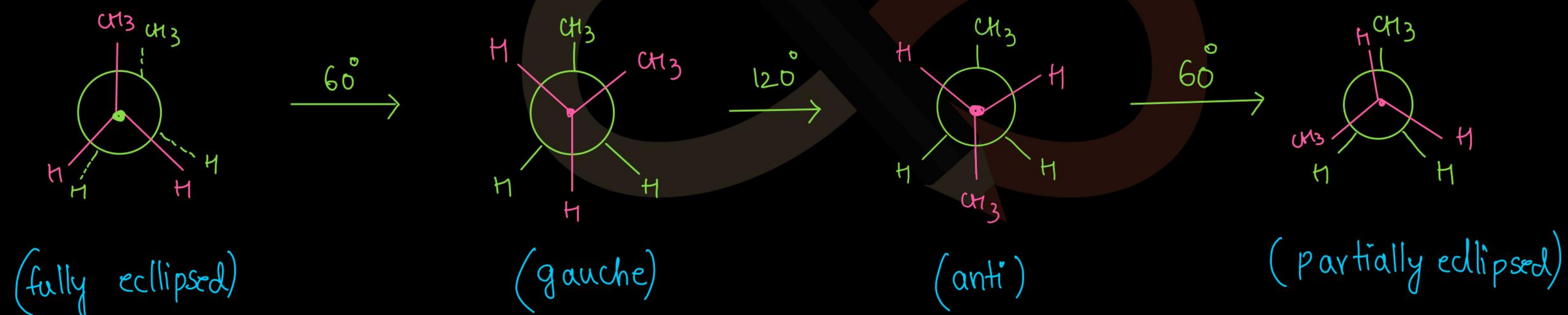
Eclipsed

Note :-

Torsional strain :- repulsion b/w BP

Vandervaal strain :- repulsion b/w atoms (or) grps.

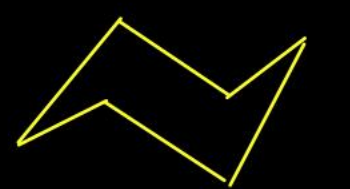
* Butane



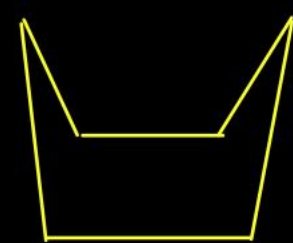
Stability :- $A > G > P > F$

Gauche effect :- hydrogen bonding $\Rightarrow$ $G > A > P > F$

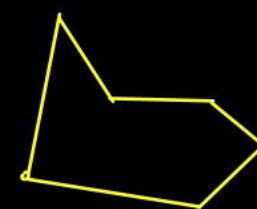
* Cyclohexane



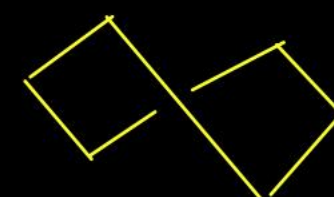
(chair form)



(boat form)



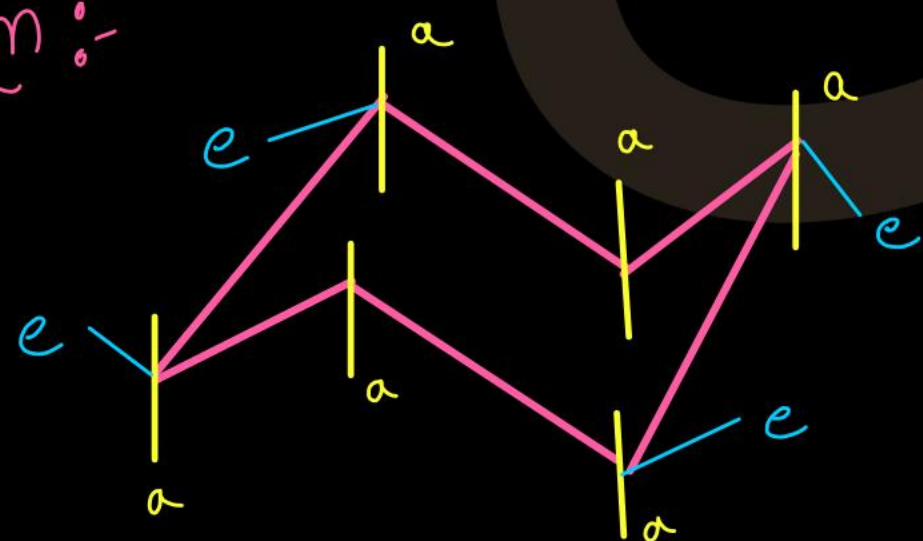
(half chair)



(twist boat)

stability :- chair > twist boat > Boat > Half chair

* chair form :-



(1a 2a) → trans (same even)

(1a 3a) → cis (same odd)

(1a 2e) → cis (diff even)