

Total dichloro derivatives

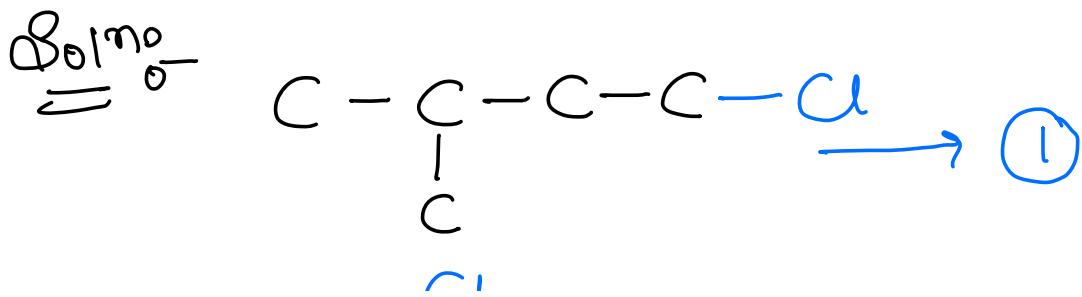
$$= 10$$

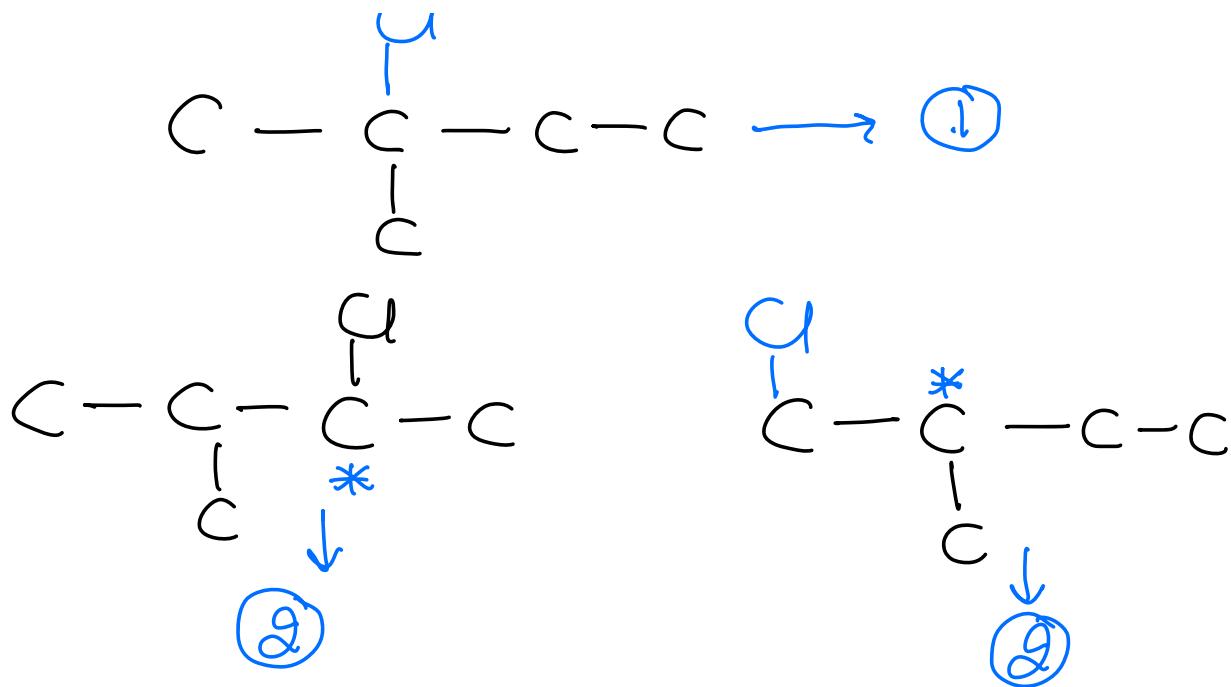
Total fractions = 7

Total optically active isomers = 6

Total racemic mix = 3

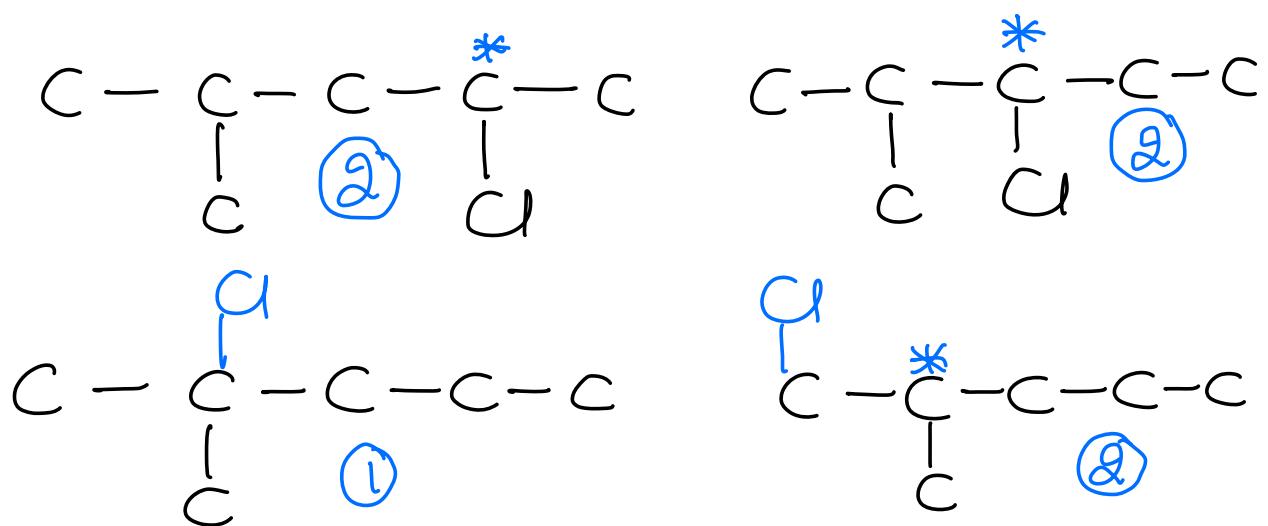
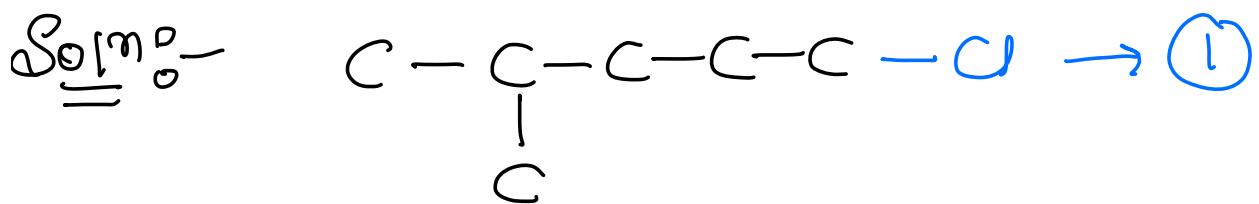
Ques. Find the total monochloro derivatives of α -methyl butane.





Total Isomers = 6

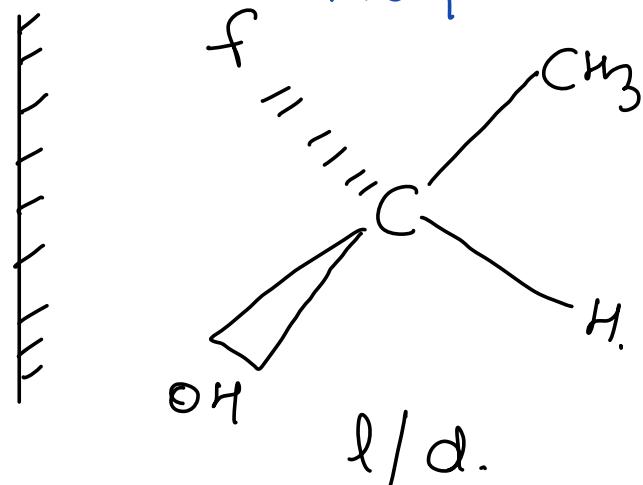
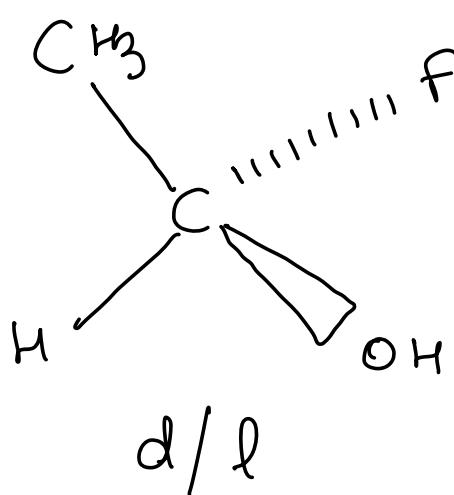
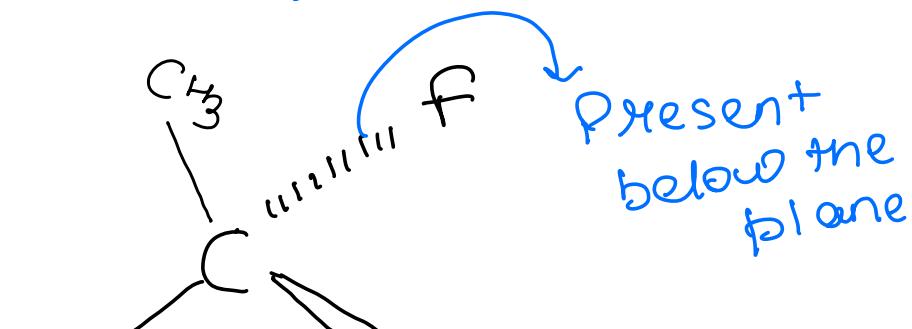
Queso - Find monochloro derivatives of α -methyl pentane.



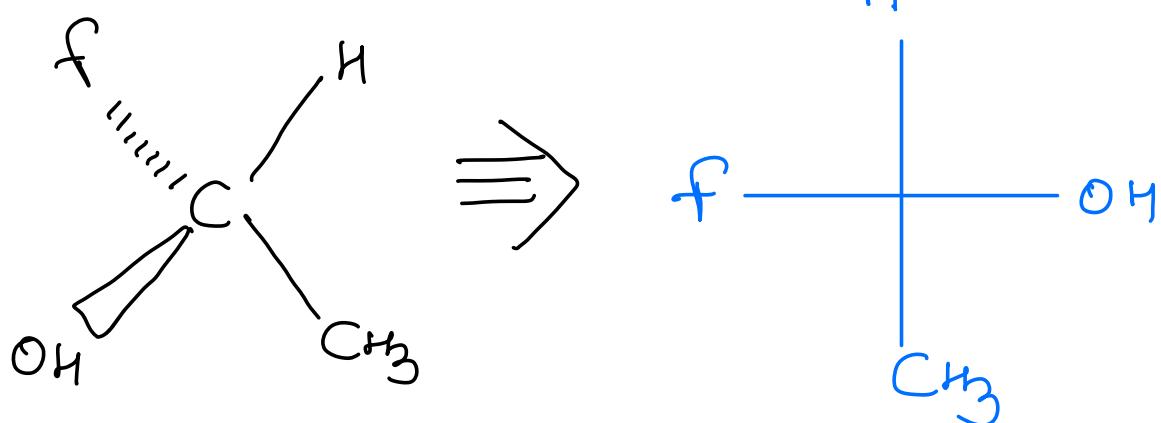
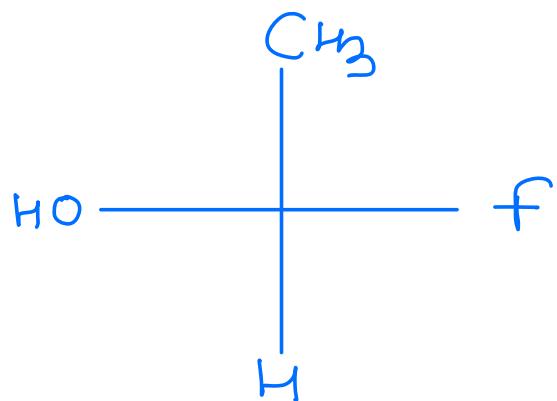
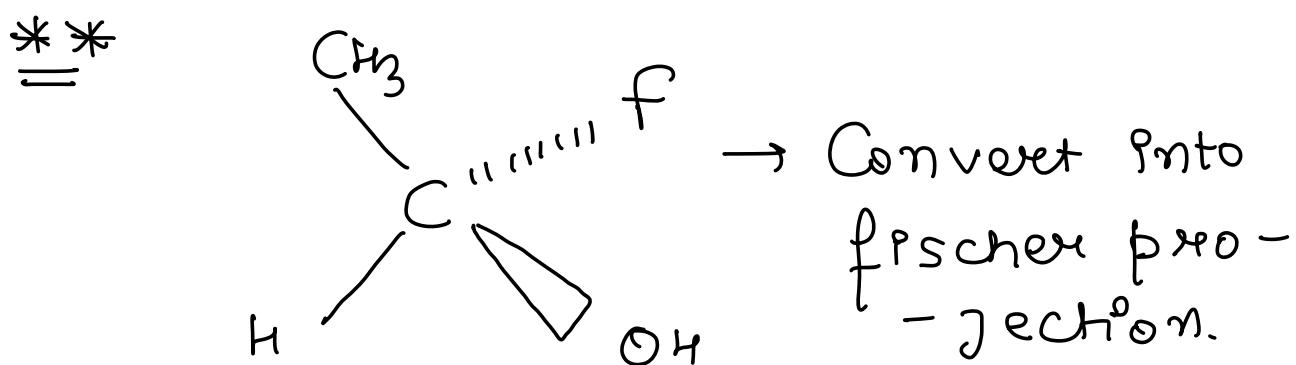
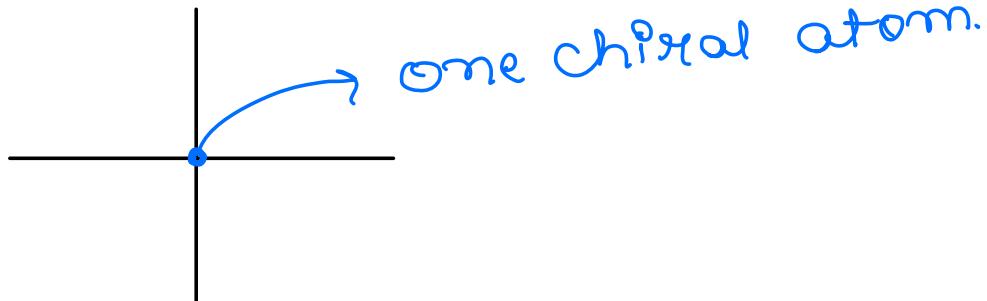
Total PIsomers = 8

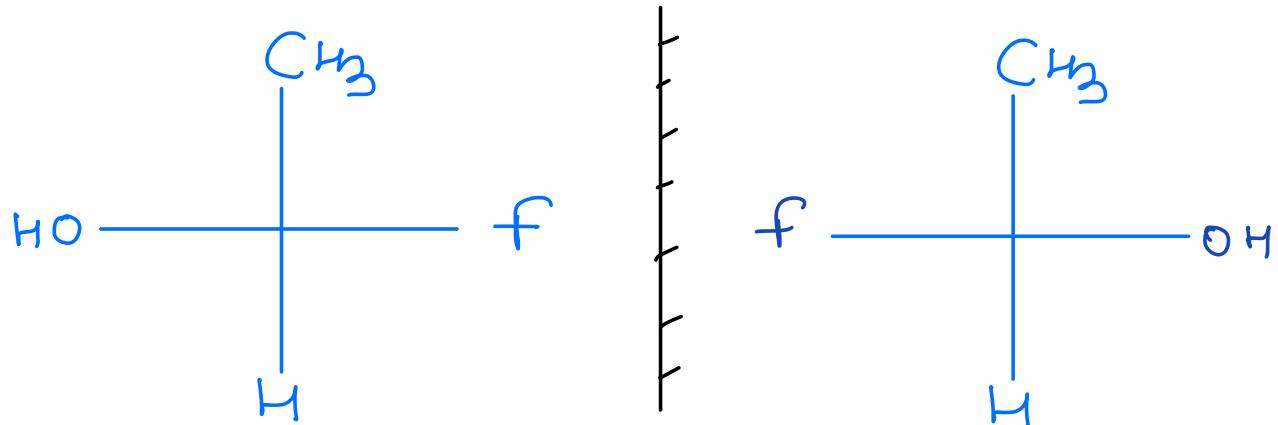
Different types of representation
of chiral Compounds :-

1) Wedge-Dash formula :-
(Perspective formula)



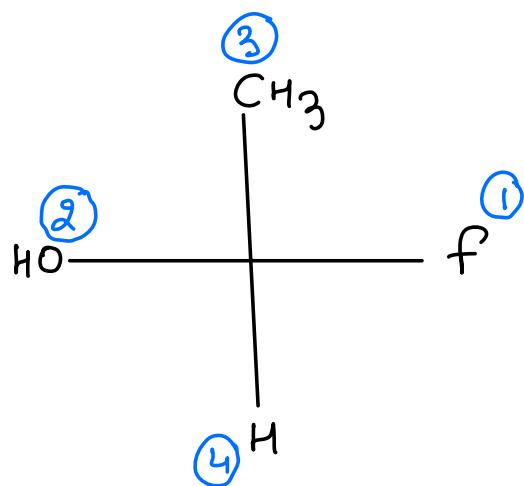
Fischer's projection



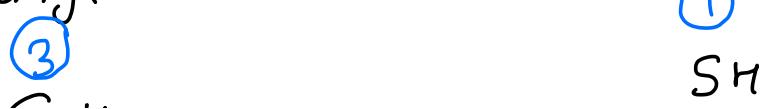


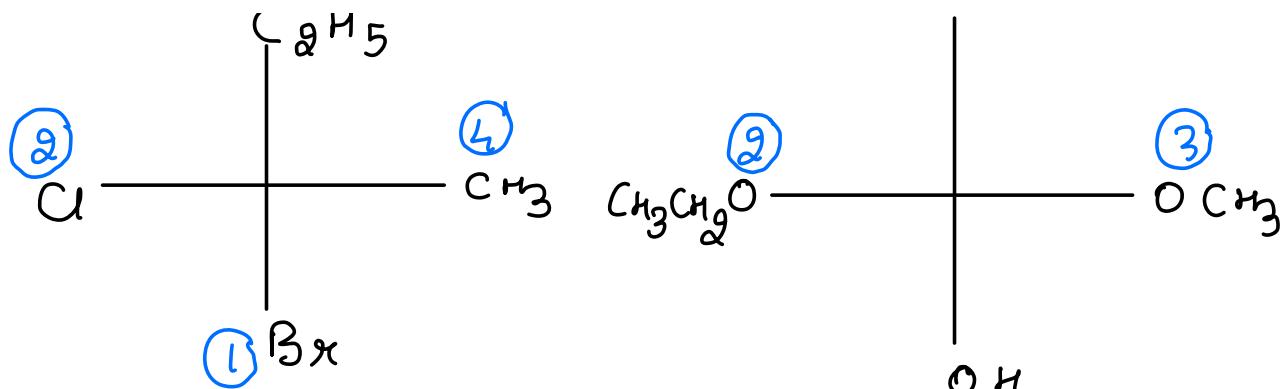
C.I.P Rule :- (Priority order)

1> Check the atomic no. of the atoms which are directly bounded with the carbon atom. Higher the atomic no. more will be the priority.

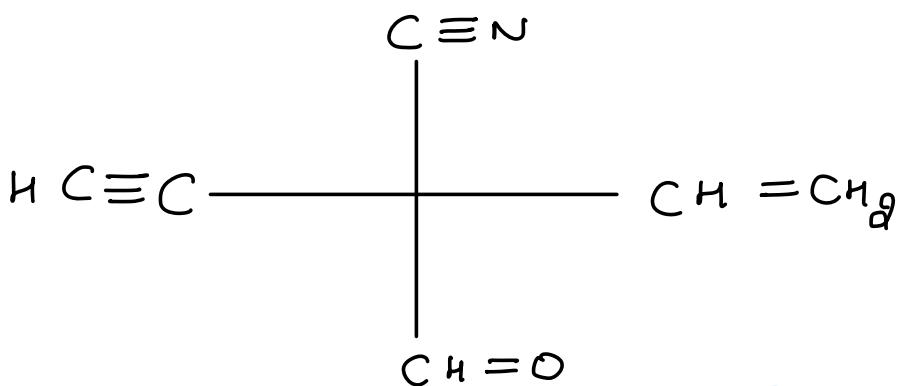


2> In case of isotopes, higher the atomic mass, more will be the priority.



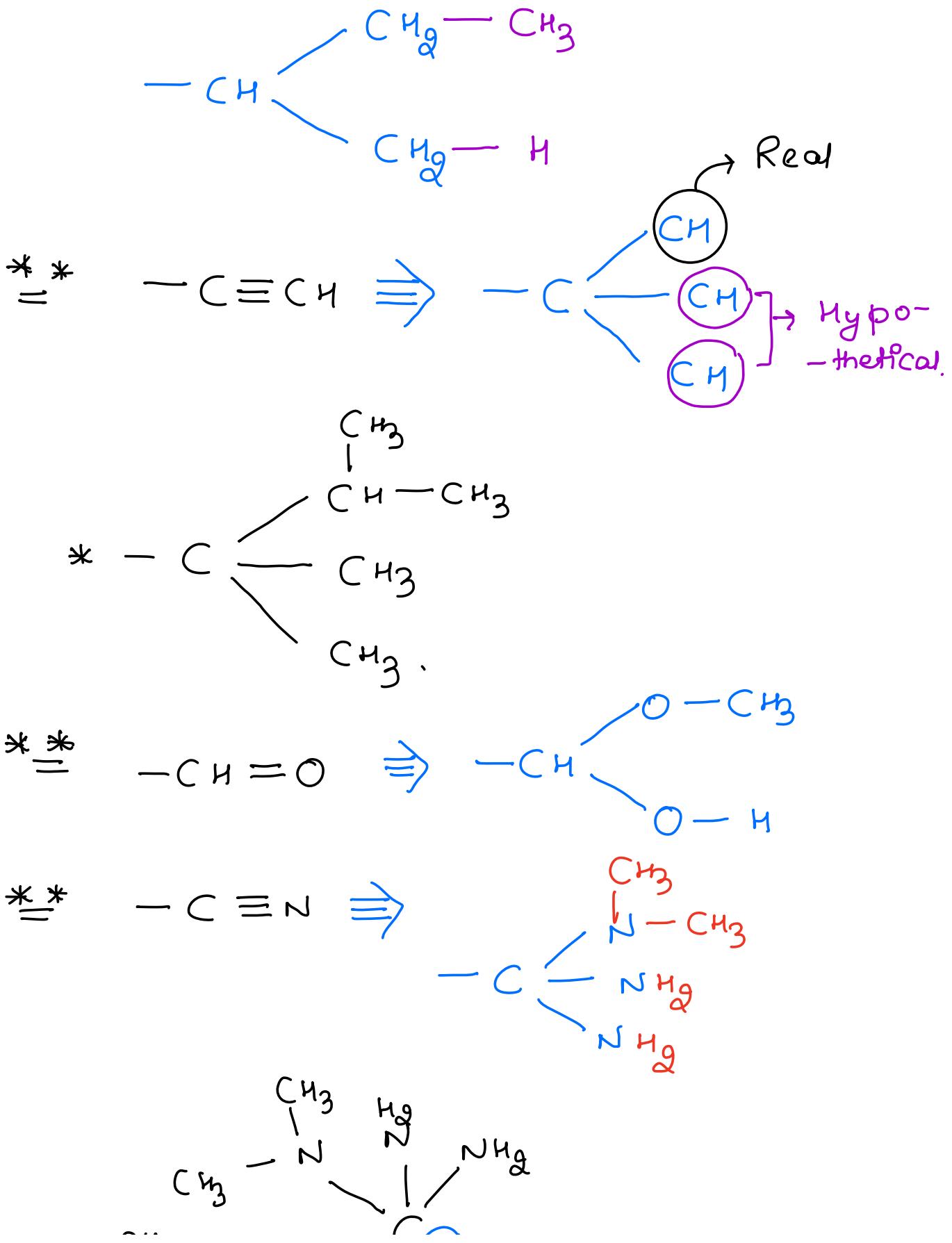


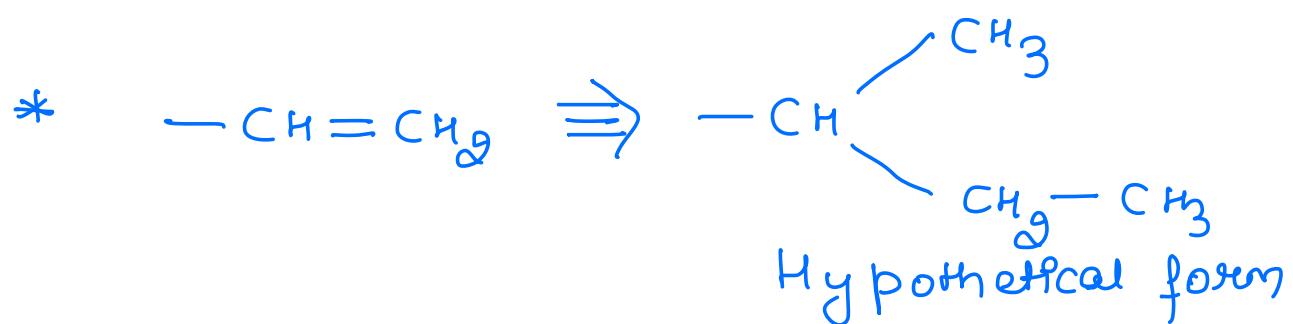
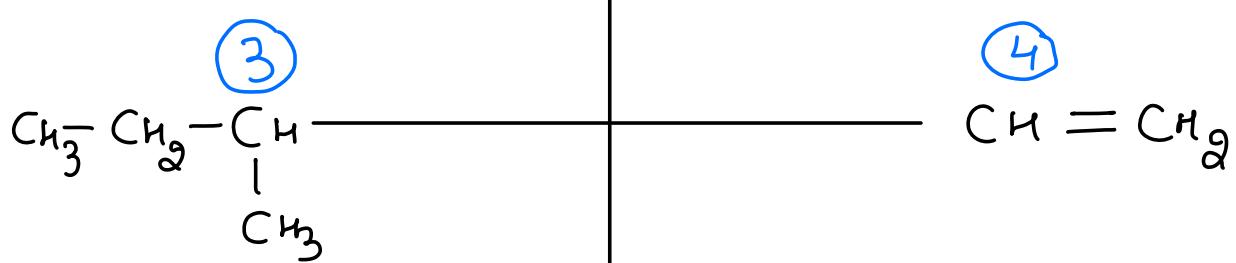
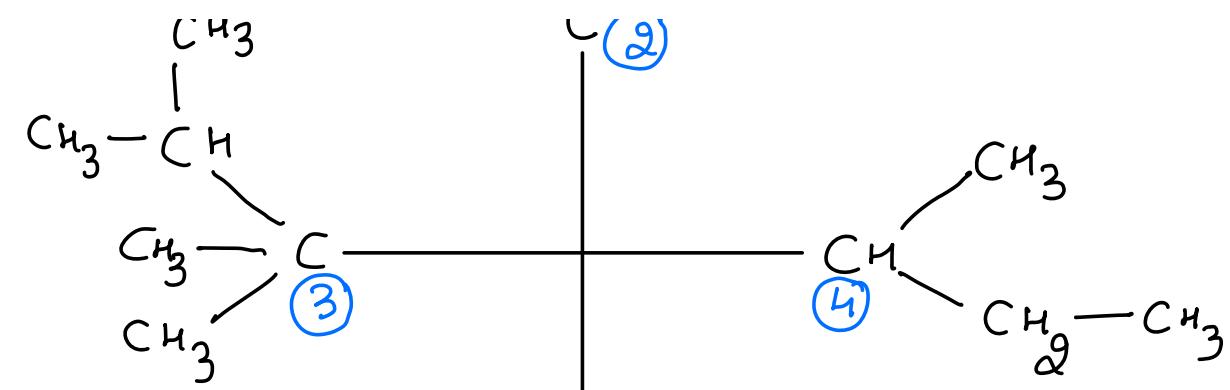
* In case of multiple bonds, it is converted into hypothetical structure.



* $-CH=CH_2 \Rightarrow -CH-$ 

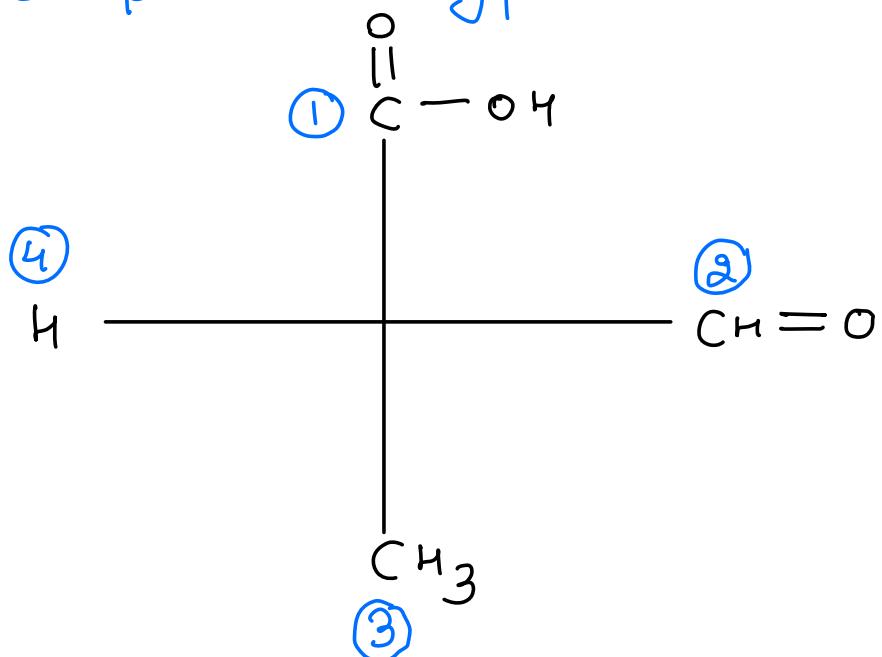
"Now satisfy the valency of real atom / group with $-CH_3$ group and satisfy the valency of hypothetical atom / group with $-H$ atoms"



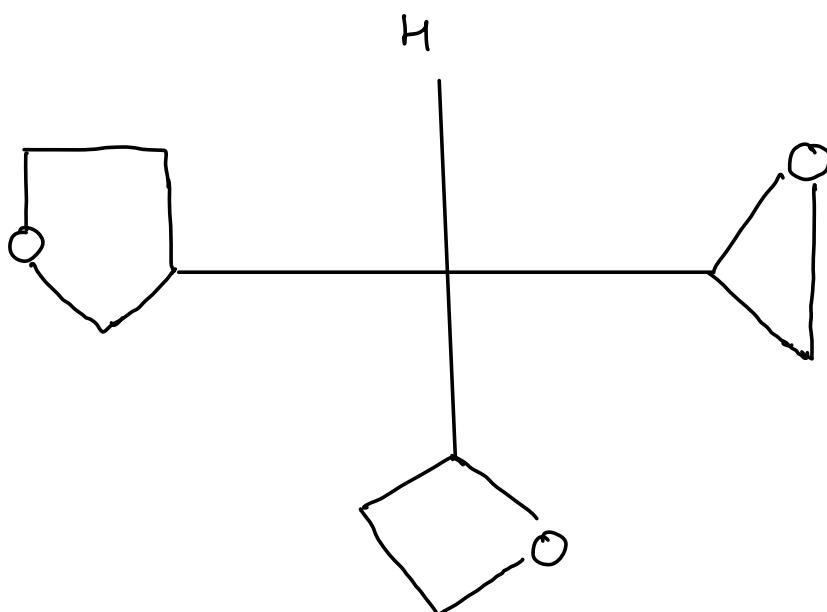


" If hypothetical and real are same
then priority of real will be more

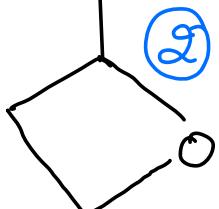
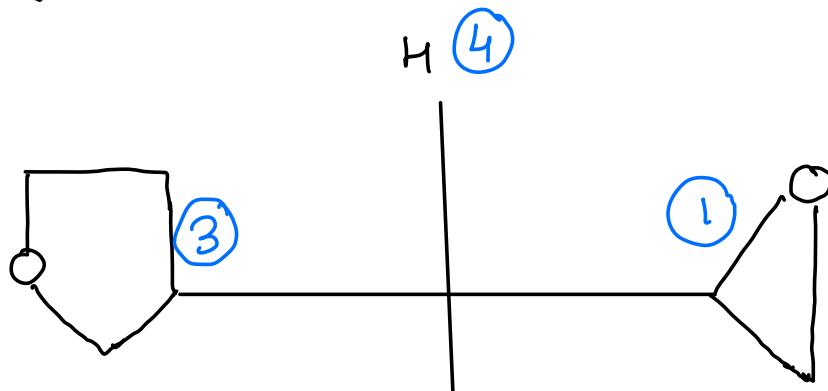
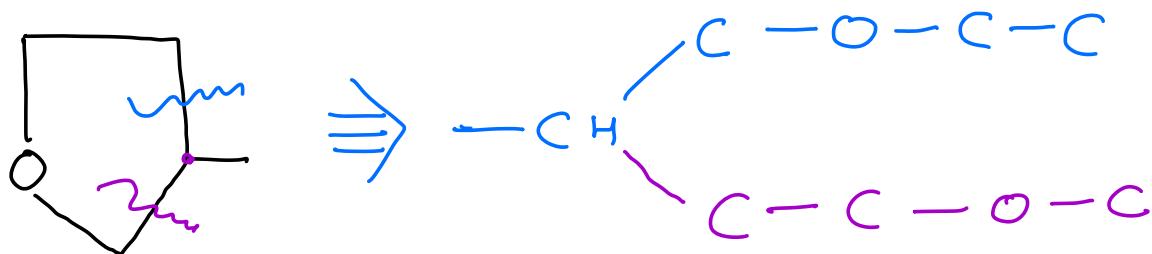
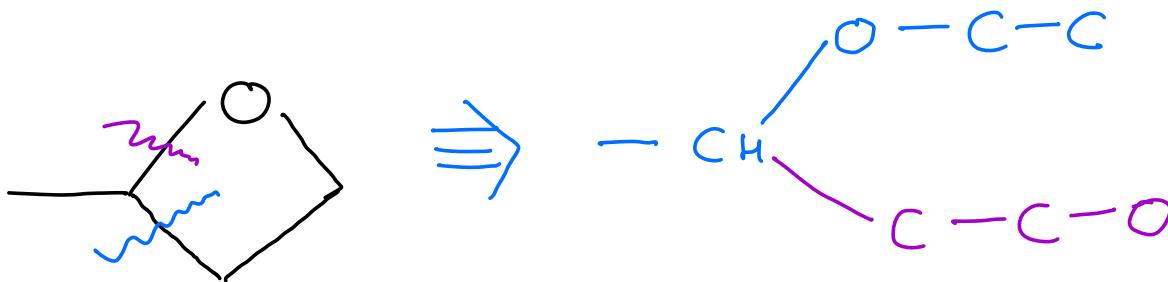
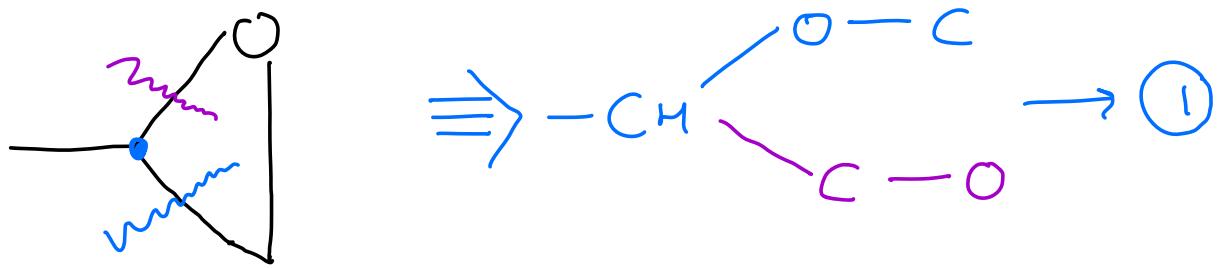
as Compare to "hypothetical"



Priority of heterocyclic rings

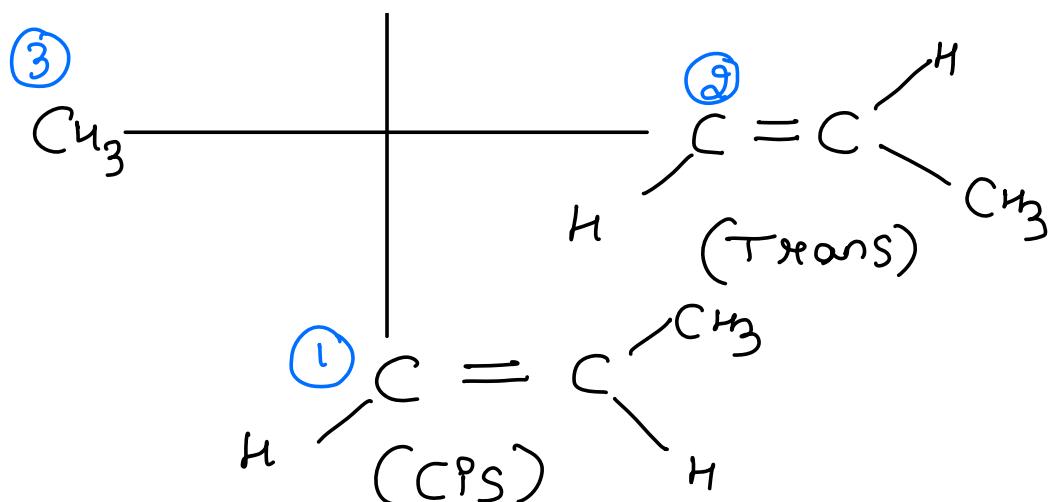


"Convert heterocyclic rings into their hypothetical forms"



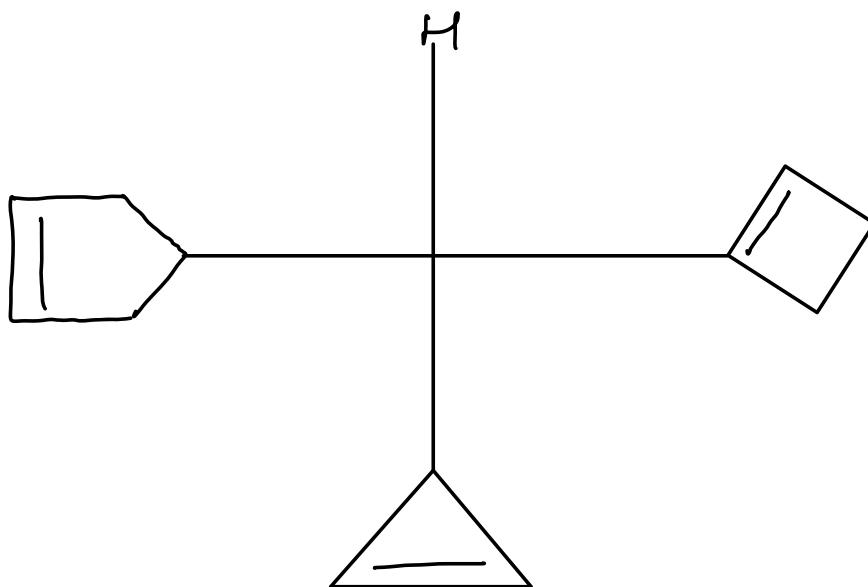
H 4

* * *

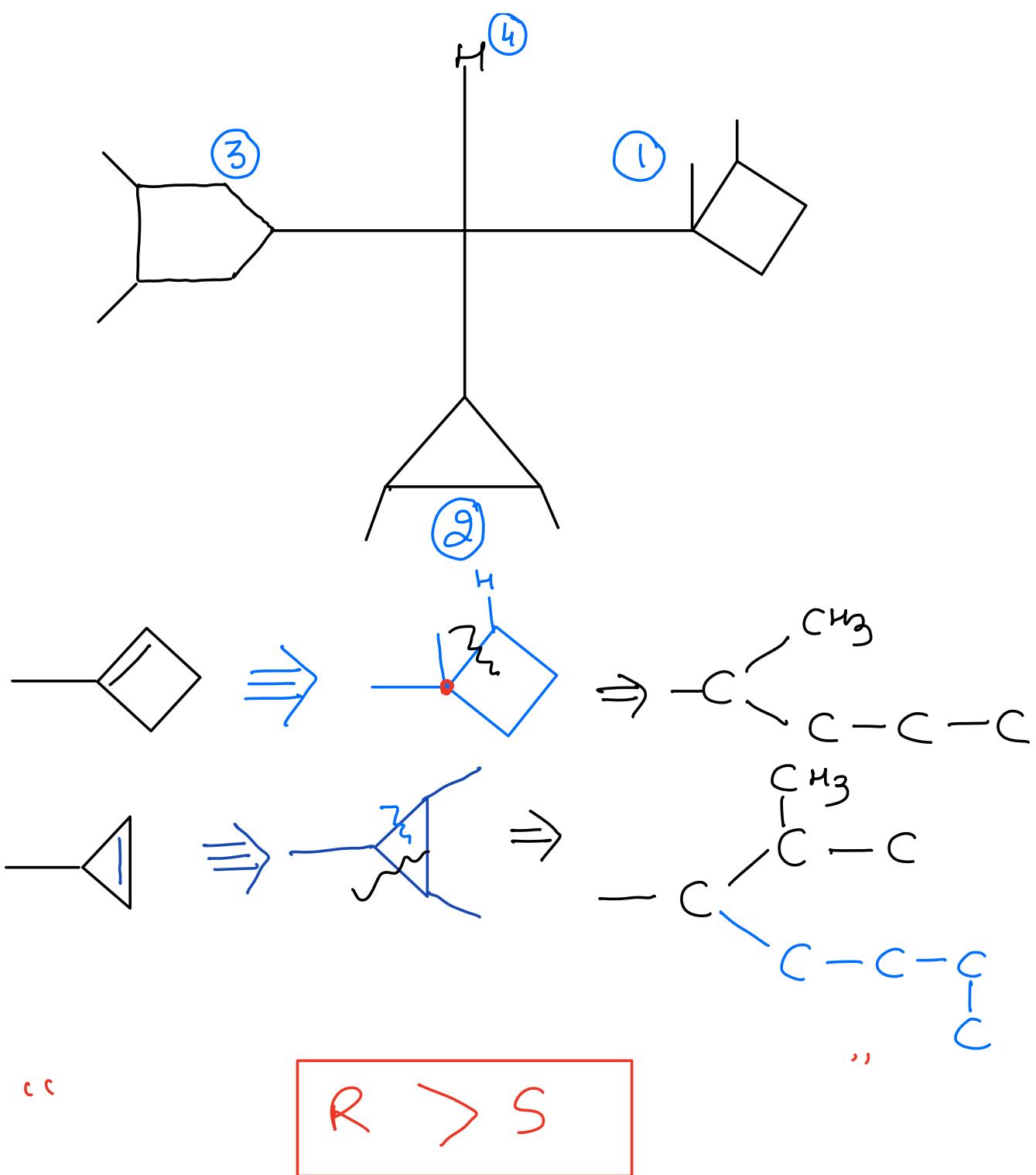


* Priority \Rightarrow Cis > Trans

\Rightarrow Priority of ring with multiple bond O^-

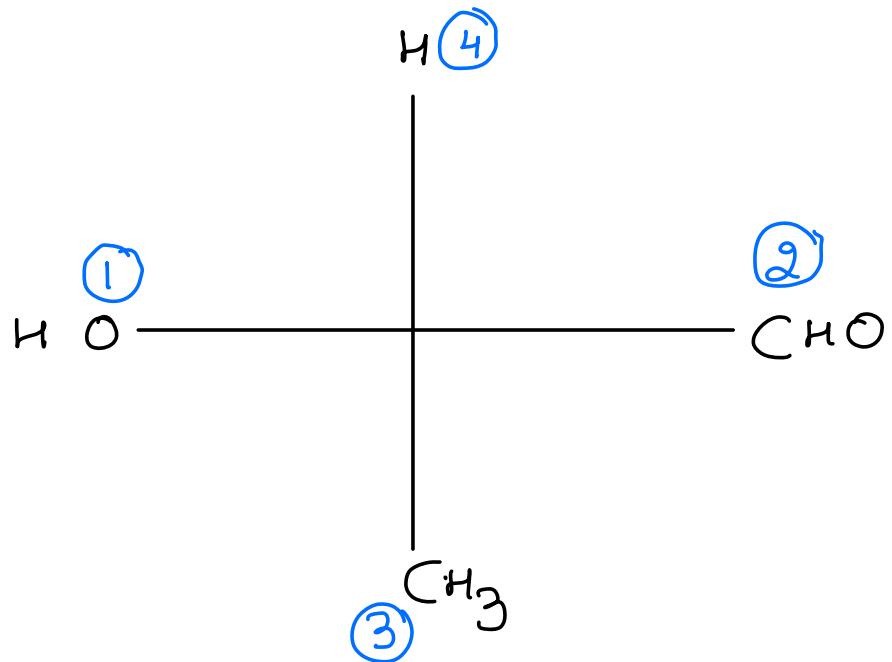


"Again Convert multiple bounded rings into hypothetical forms"

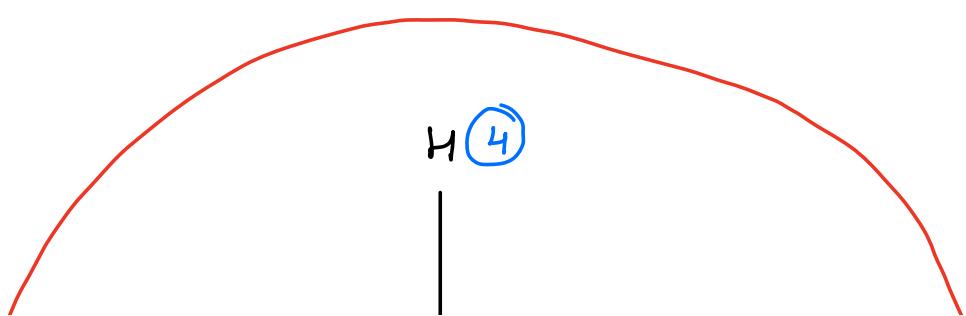


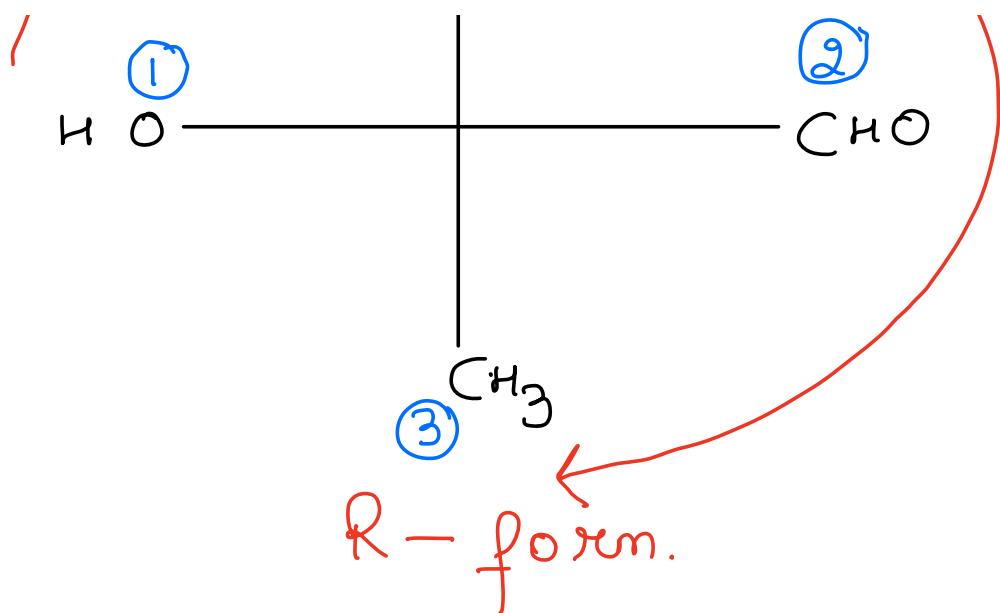
Priority of 'R' Configuration
Is always more as compare
to 'S' Configuration.

R-S Configuration

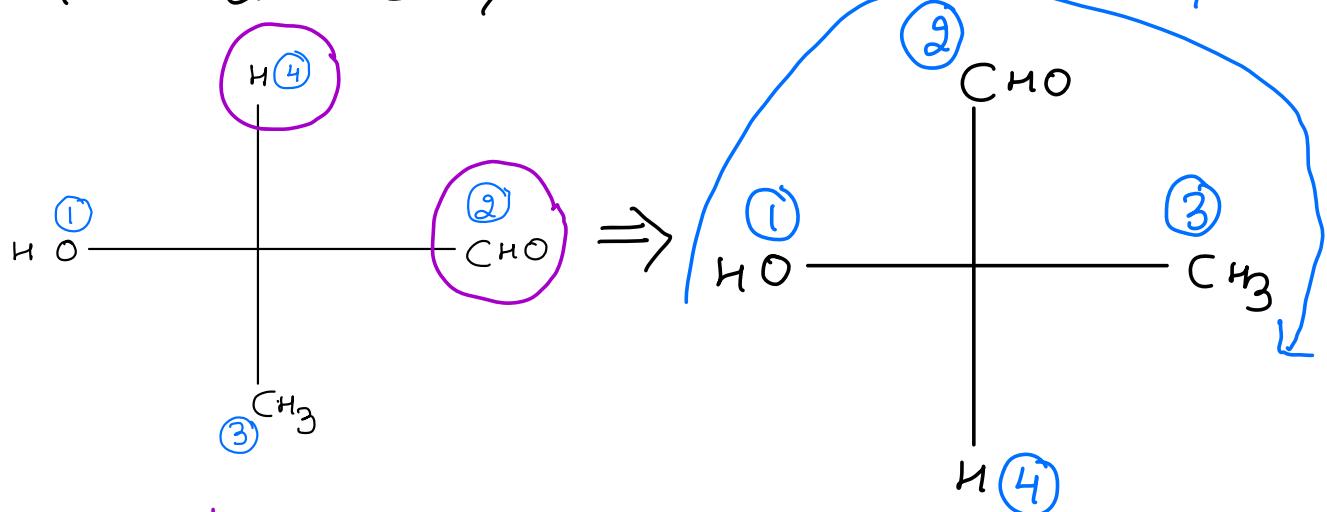


"If lowest priority is on vertical line, & we are moving 1 - 2 - 3 (By crossing 4th priority)
 If movement is clockwise then R- Configuration, & if we are moving in anticlockwise direction then S- Configuration"

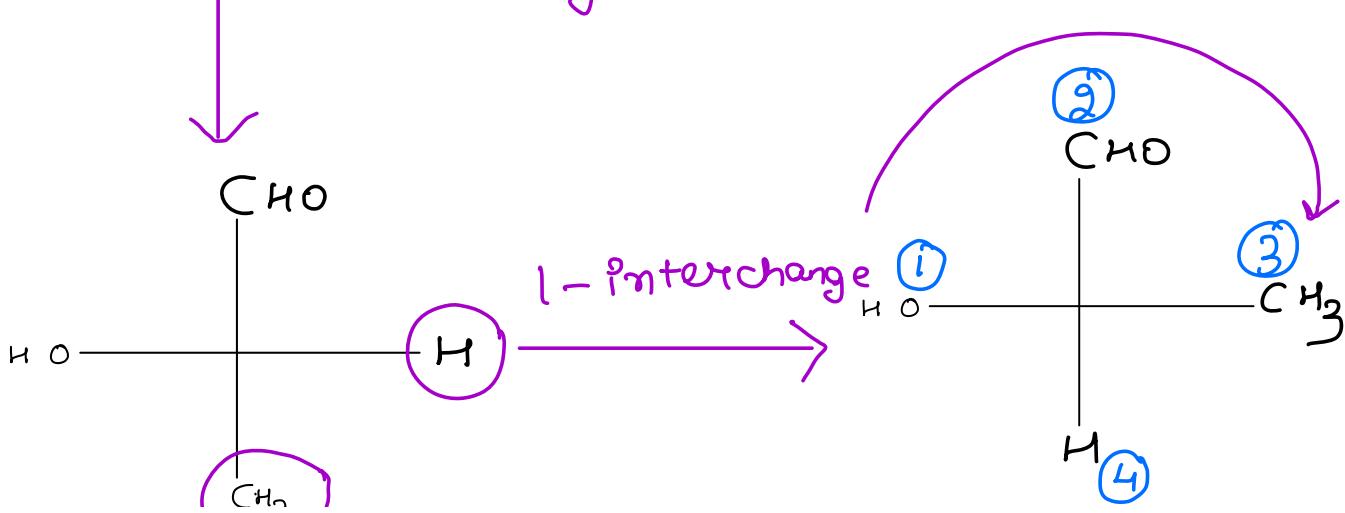




1 — 2 — 3 \Rightarrow Anti-clockwise \Rightarrow S-form.



1-interchange



1-interchange

(-)

R-form

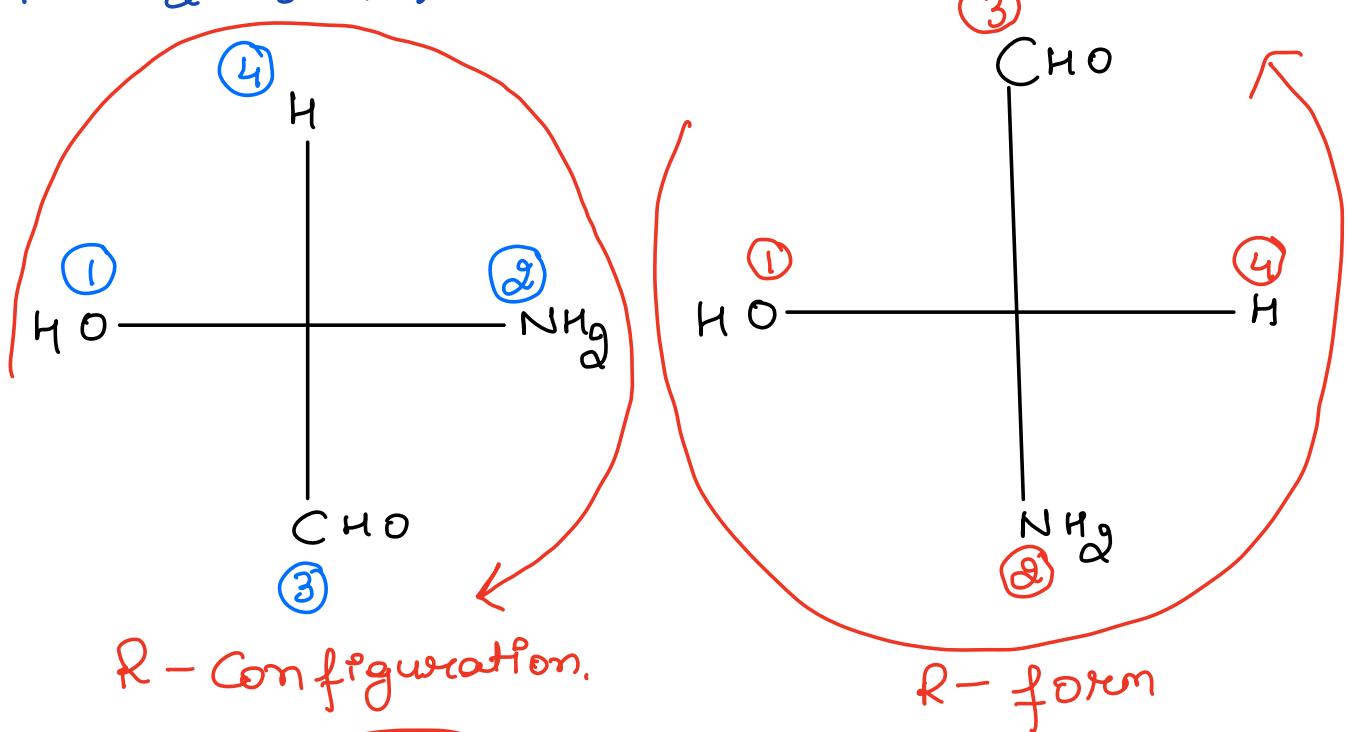
"During even Interchange Configuration remains same"

"During odd Interchange Configuration changes"

⇒ If 4th priority is on horizontal line →

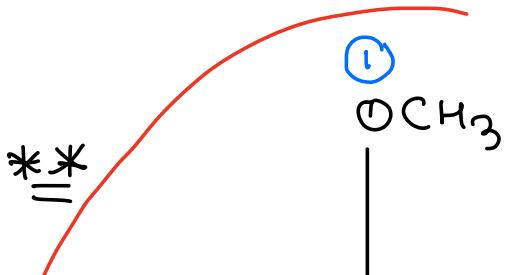
* 1 - 2 - 3 → Clockwise ⇒ S-Config.

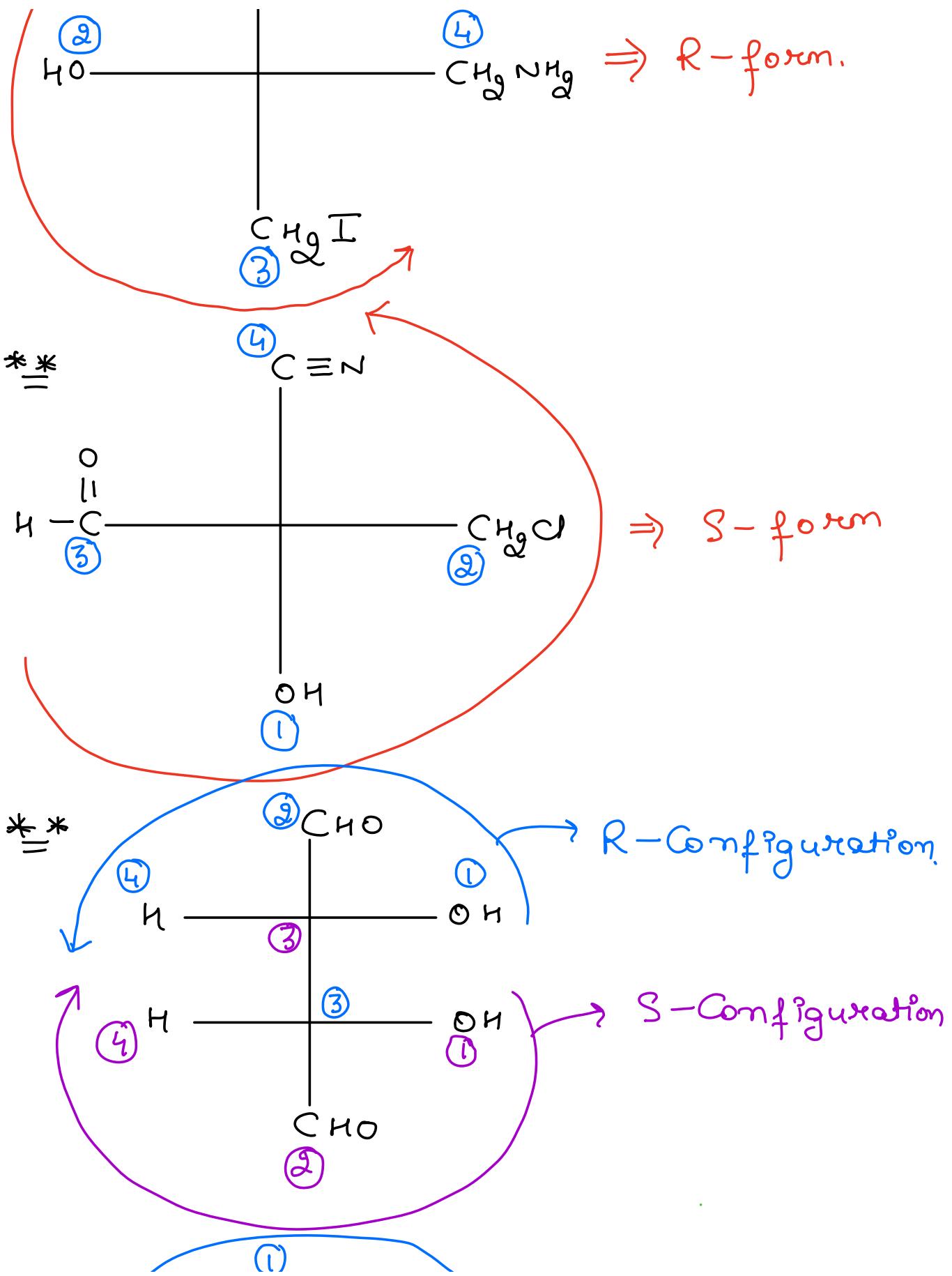
* 1 - 2 - 3 → Anticlockwise ⇒ R-Config.

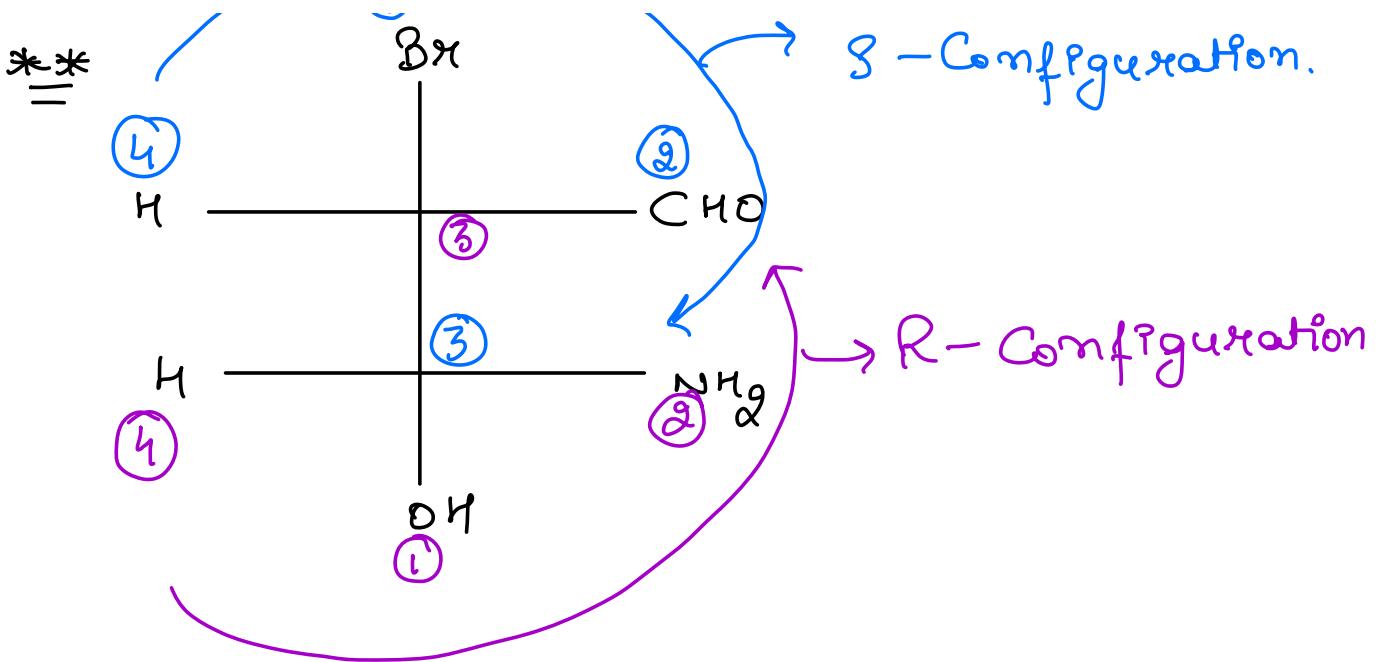


R-Configuration.

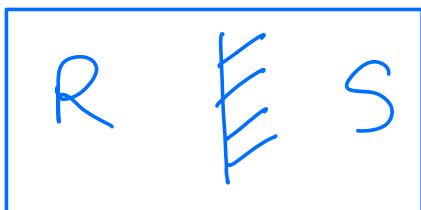
R-form







- * R \Rightarrow Rectus \Rightarrow Right
- S \Rightarrow Sinister \Rightarrow Left



Dextro-rotatory \rightarrow Rotation of PPL in
clockwise.

Levo-rotatory \rightarrow " " " "
Anticlockwise.

* R (+) \rightarrow means clockwise rotation
of PPL.

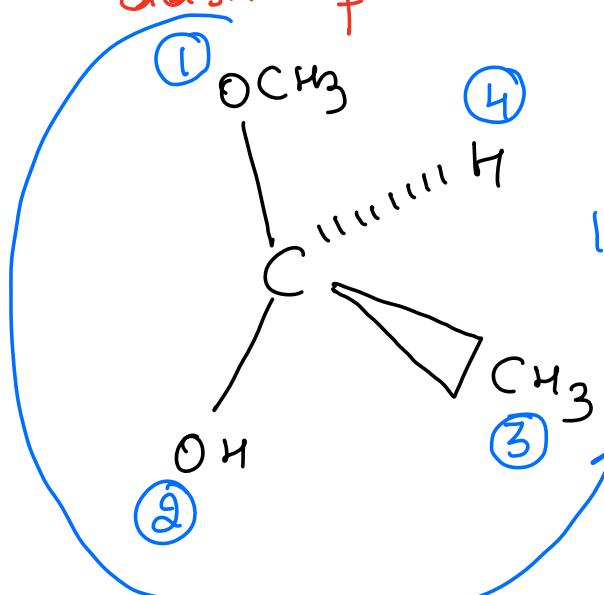
R (-) \rightarrow means anticlockwise
rotation of PPL.

$R(+)$ object $\not\rightarrow S(-)$ mirror image

$R(-)$ object $\not\rightarrow S(+)$ mirror image

$R-S$ Configuration in wedge

dash formula :-



* If lowest priority is on dash O^-

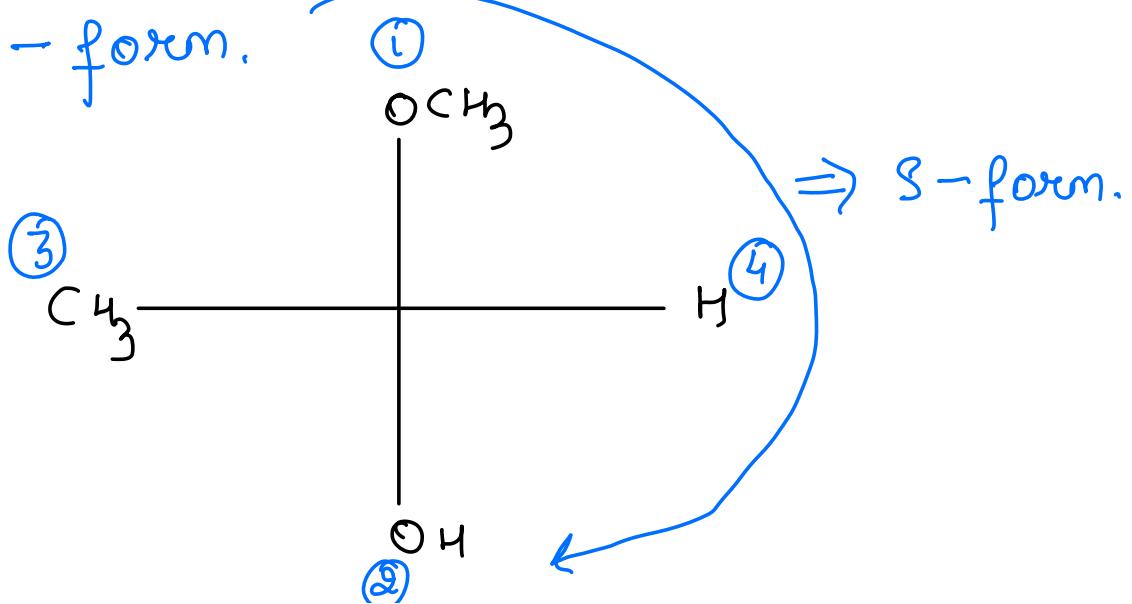
$1-2-3 \Rightarrow$ Clockwise

\Downarrow
 R -form

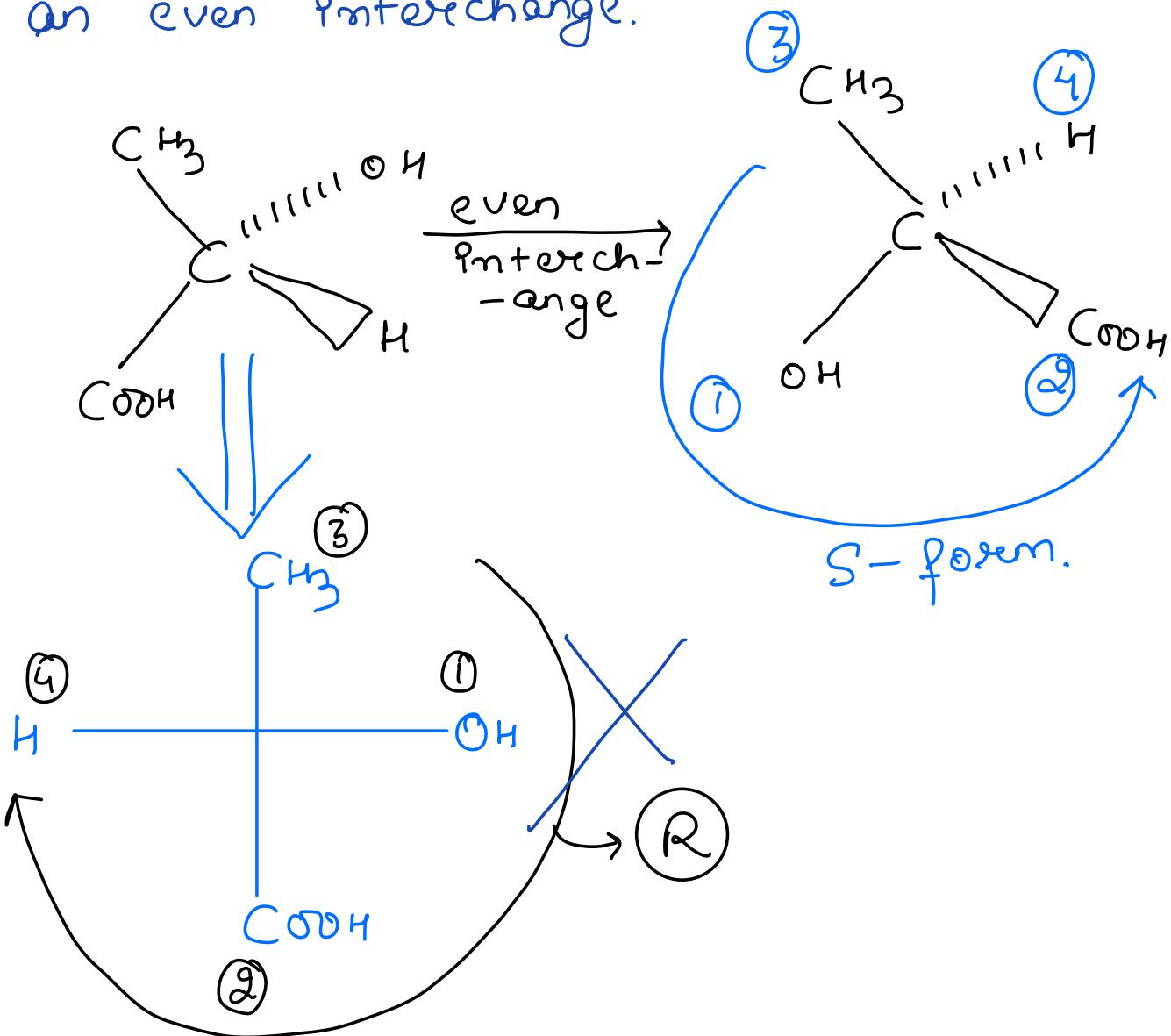
$1-2-3 \Rightarrow$ Anticlockwise

\Downarrow
 S -form.

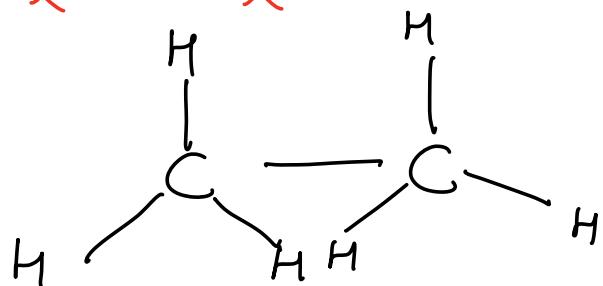
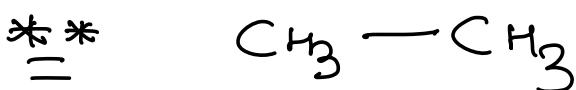
\Downarrow
 S -form.

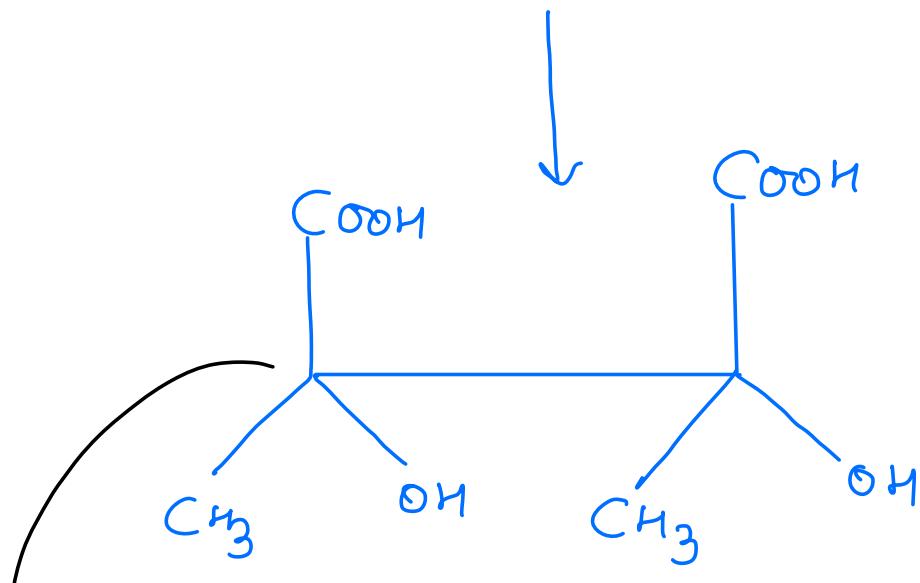
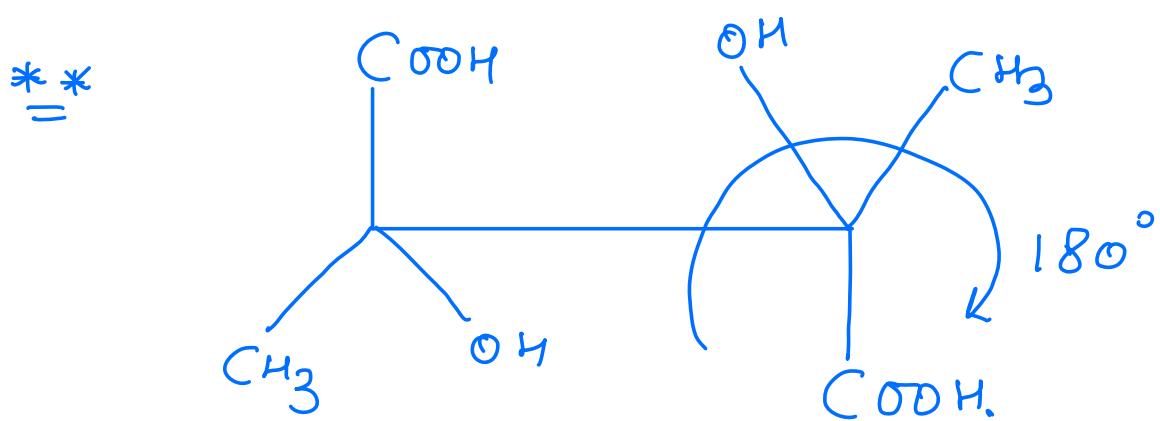
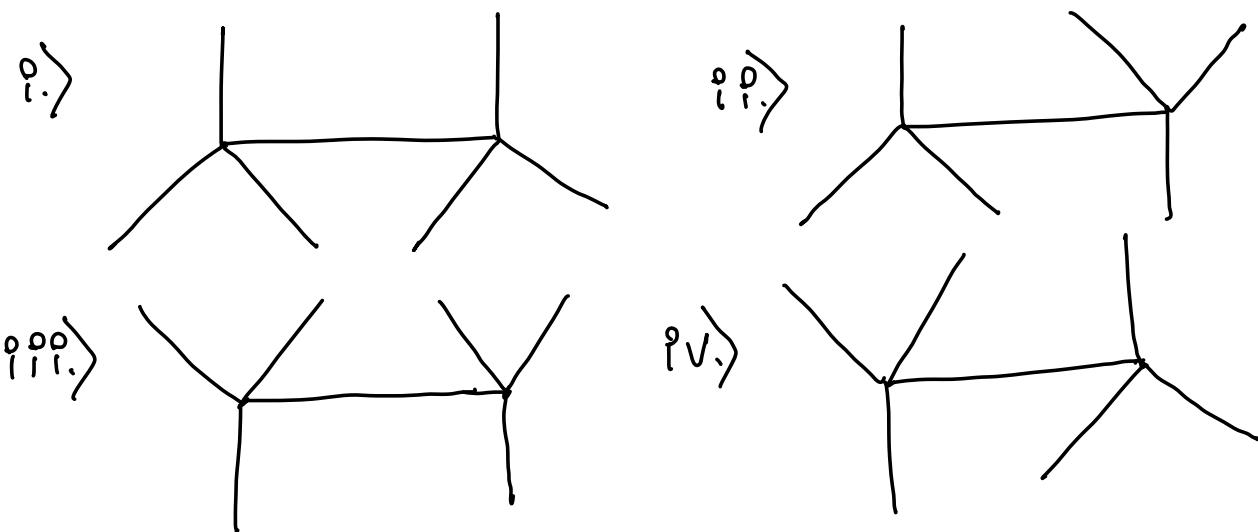


** If lowest priority is not present on the dash then simply make an even interchange.



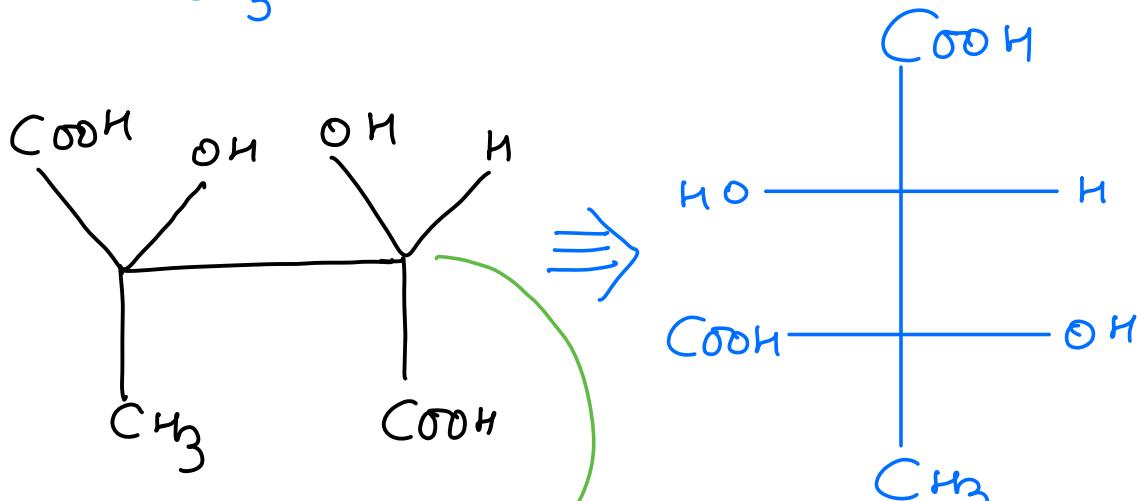
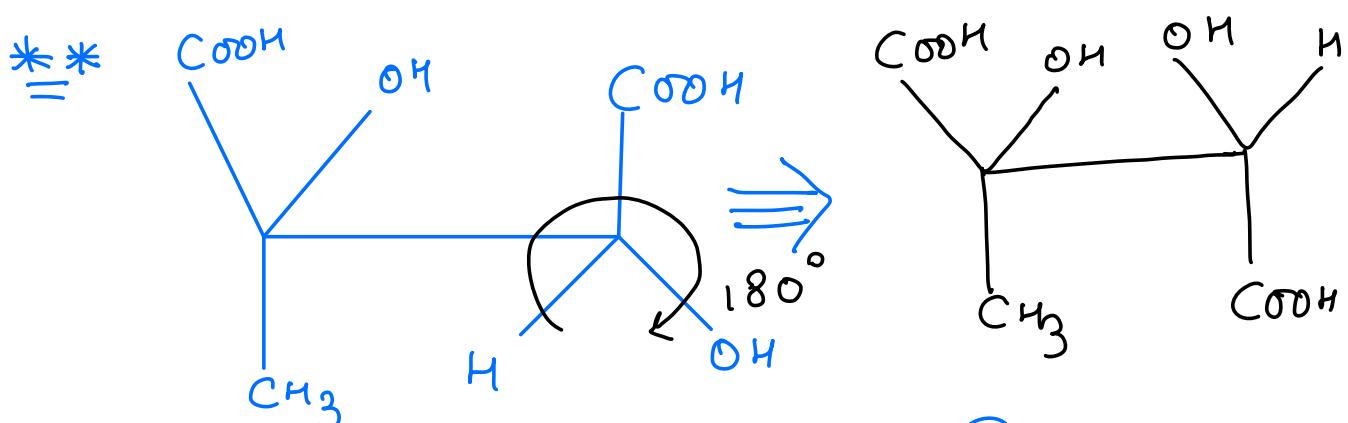
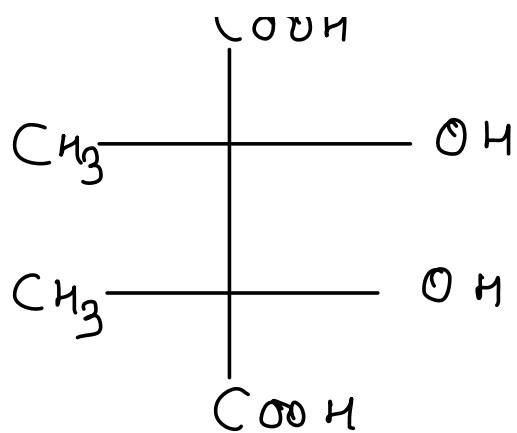
Saw horse projection



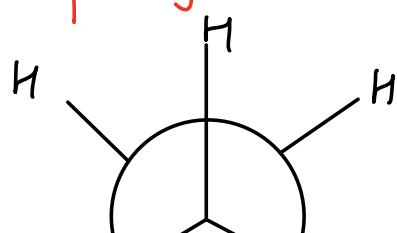
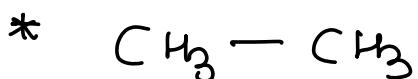


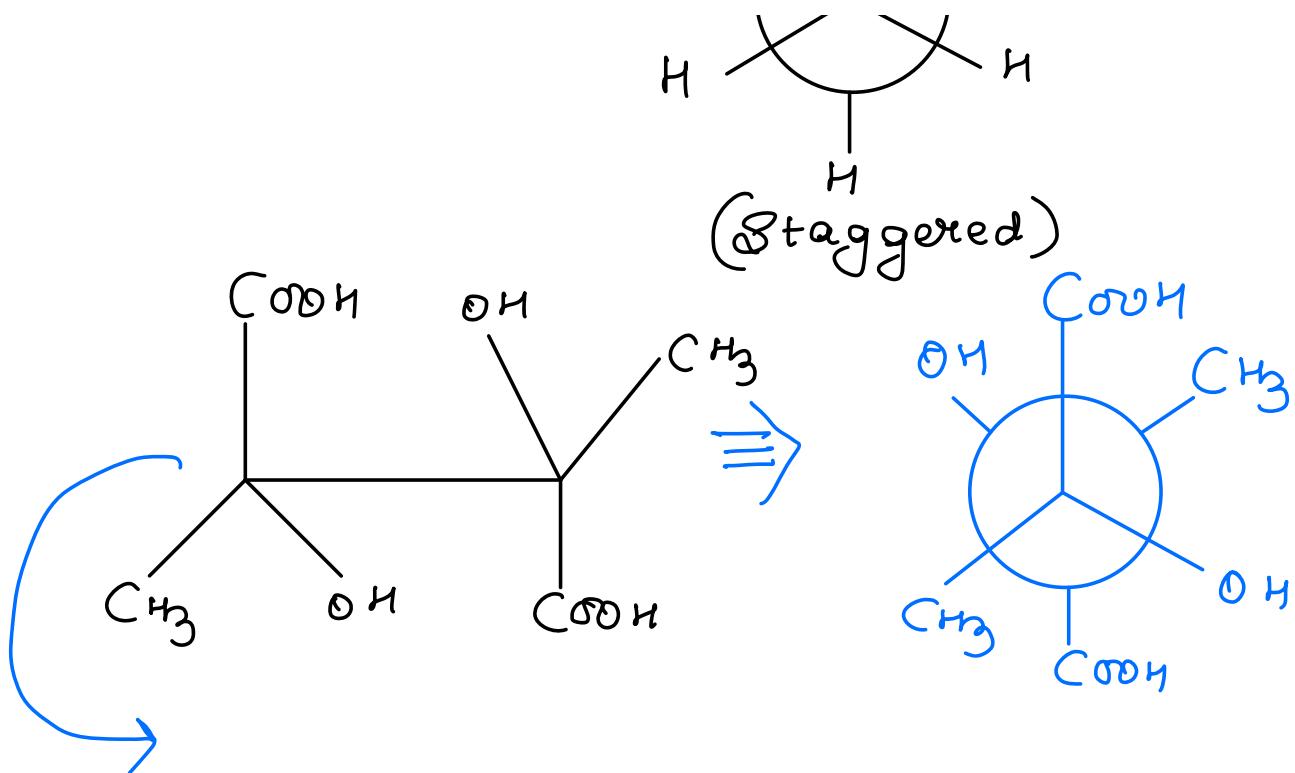
→ observe molecule.

Ans.



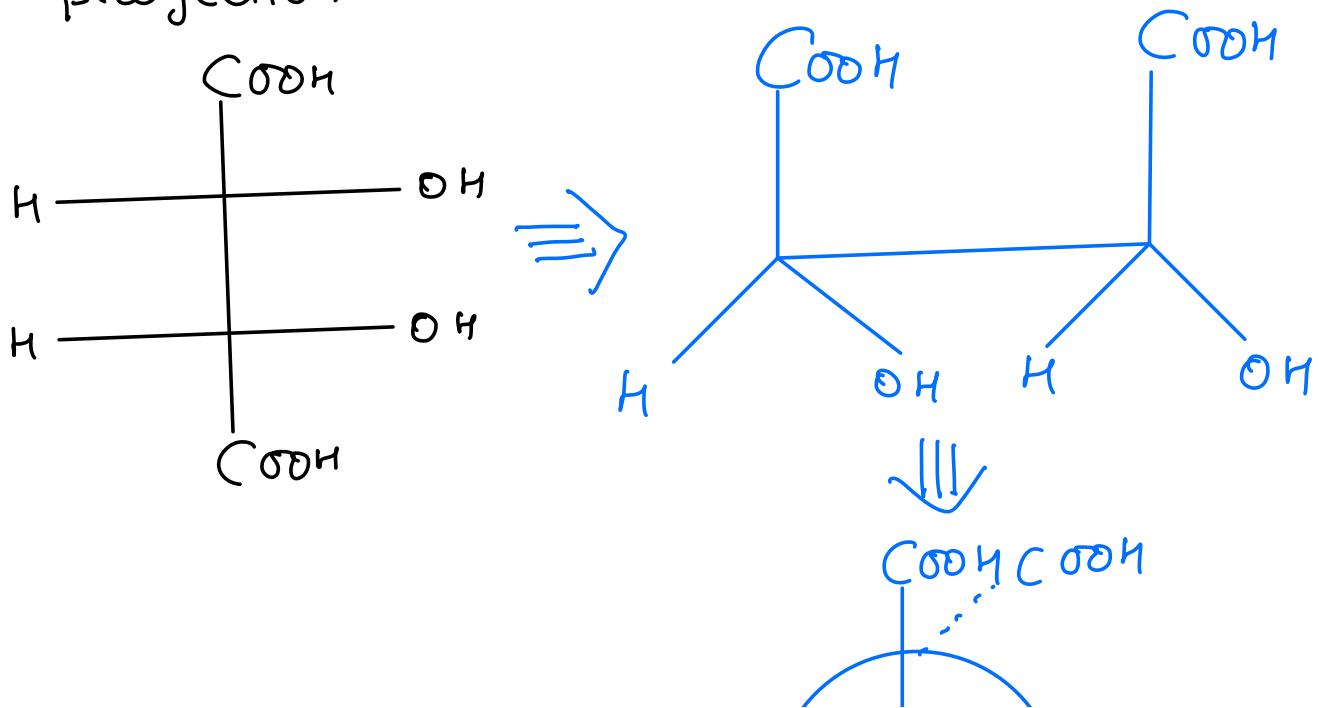
Conversion of Saw horse projection
into Newmann's projection :-

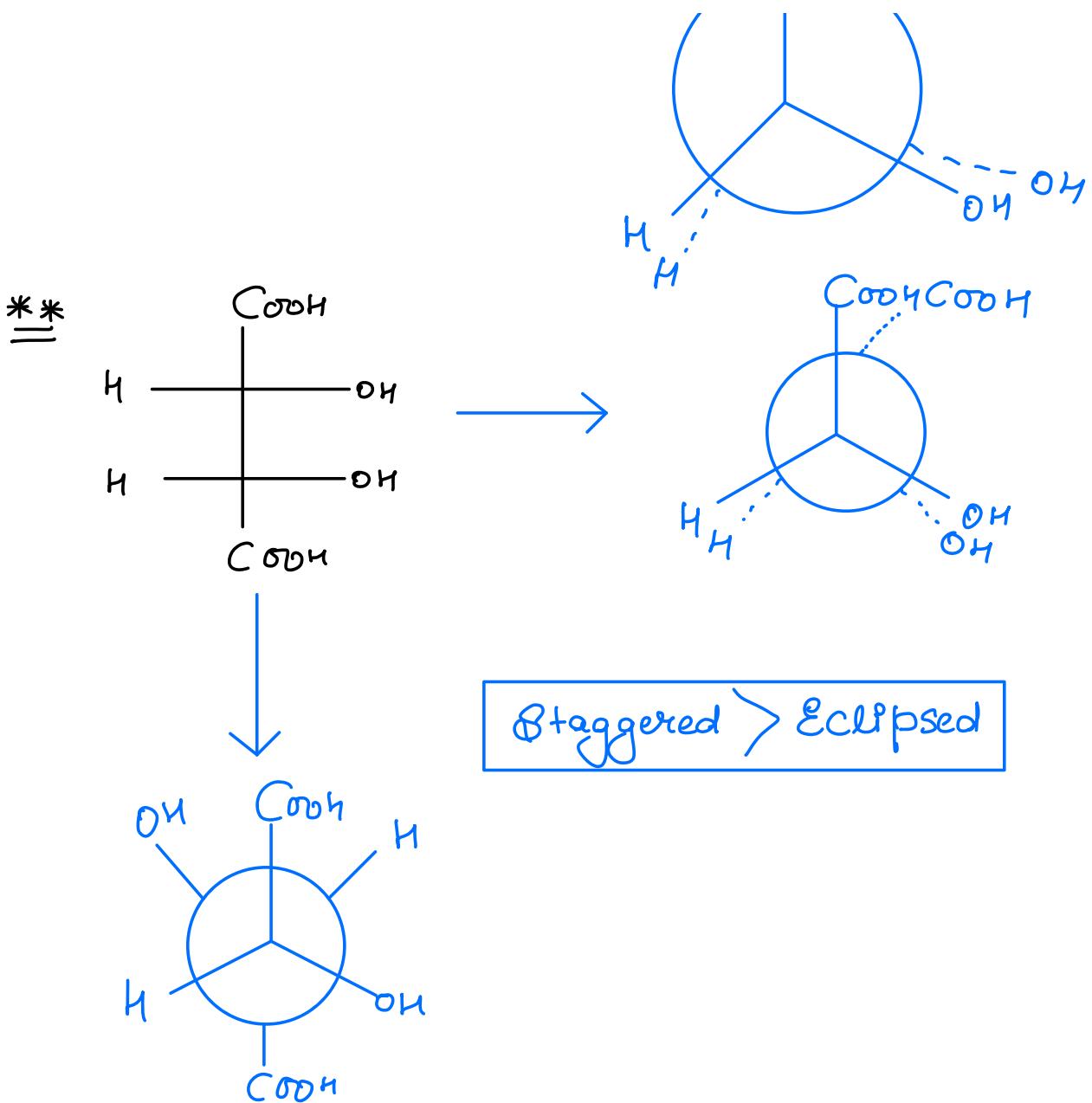




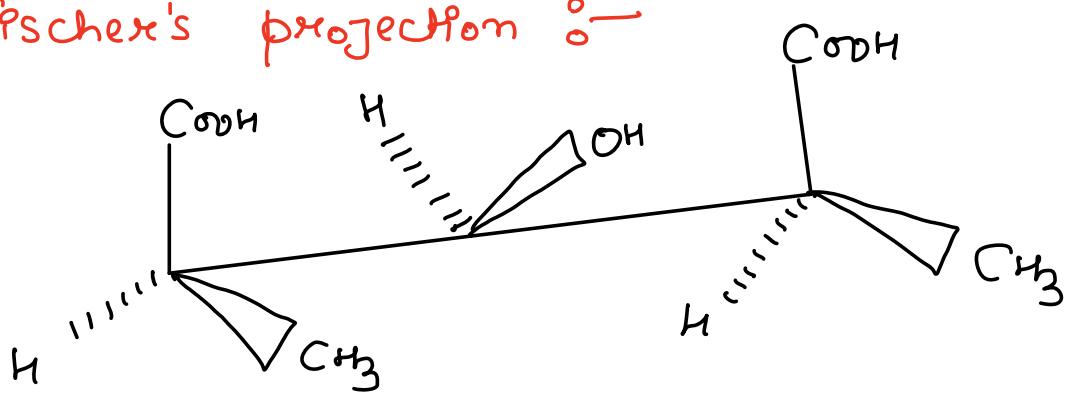
Conversion of Fischer projection
into Newman's projection :-

"First of all Convert given Fischer
projection into Saw horse projection"

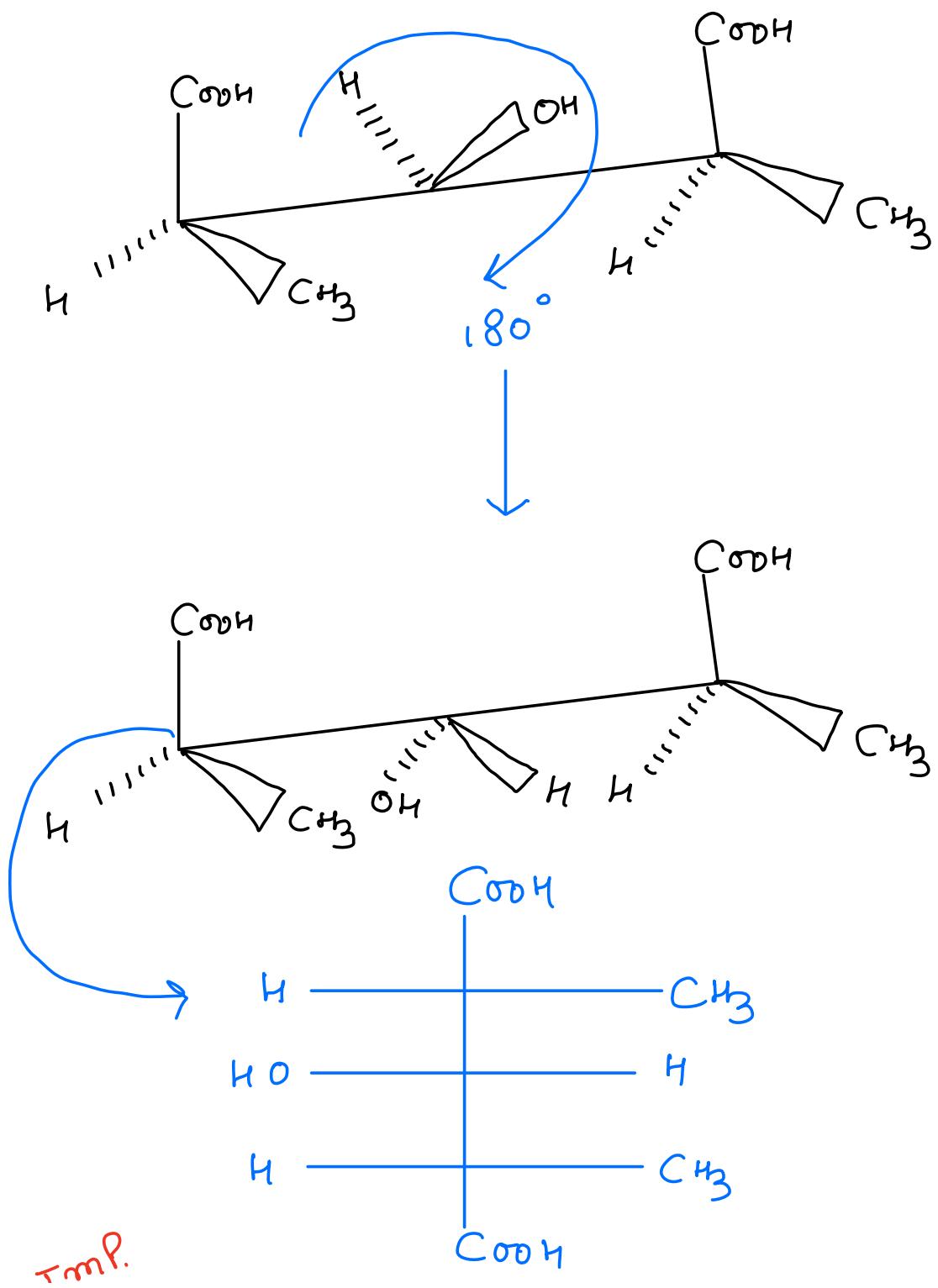




Conversion of Perspective formulae into Fischer's projection



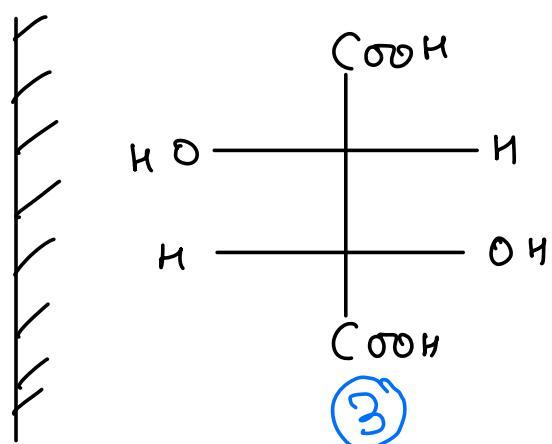
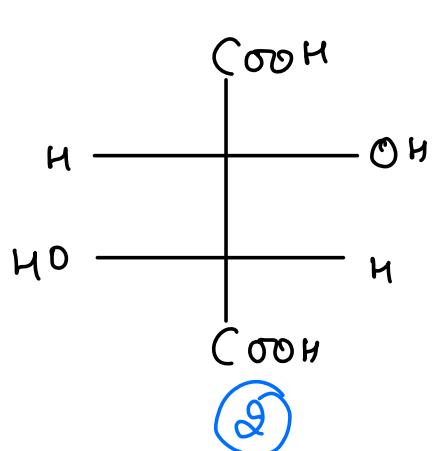
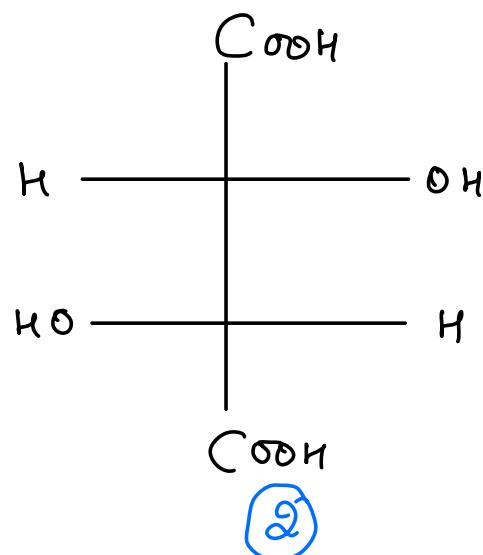
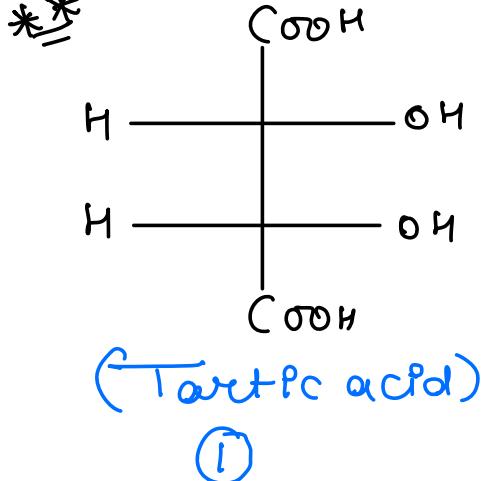
" For Converting Perspective formula into Fischer projection, all the Carbon atoms present in the perspective formula should look alike "



tmp.

~~#~~ Diastereoisomers

The stereoisomers of the same compound which are not related as object and its mirror image are K/A Diastereoisomers.

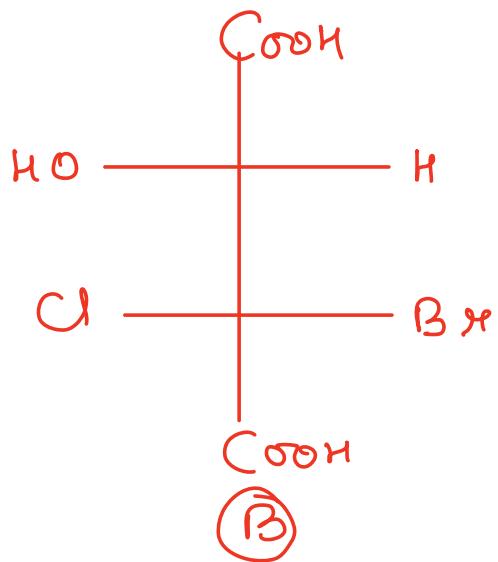
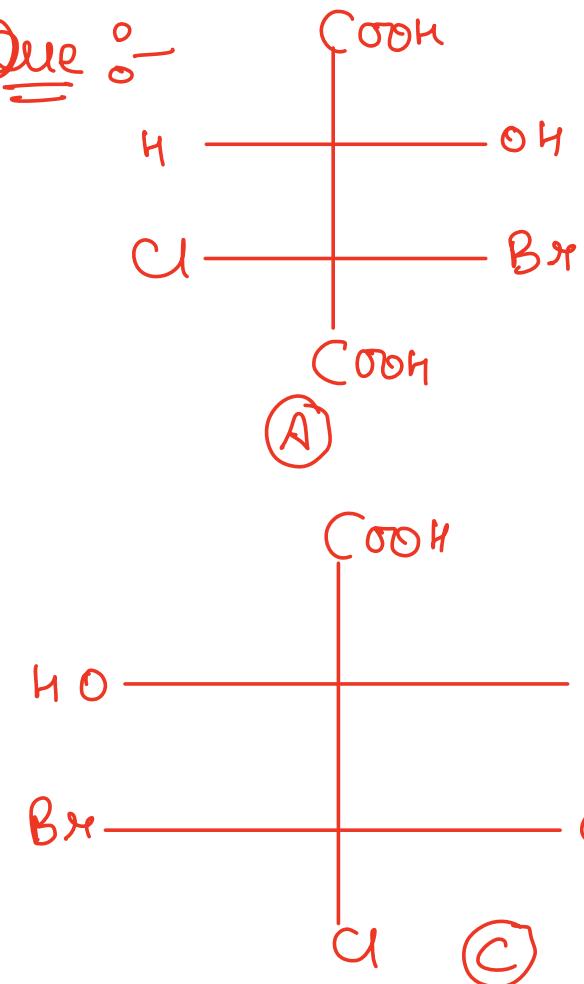


① & ② → Diastereoisomers

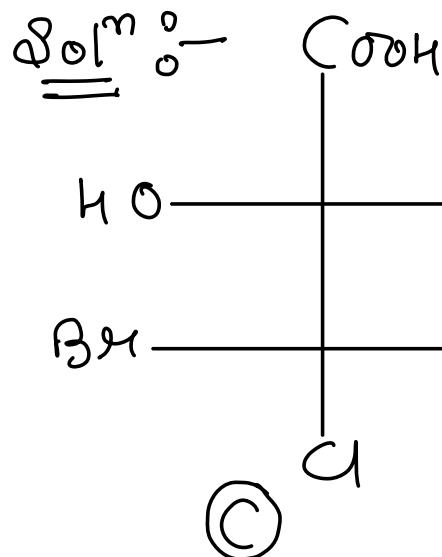
① & ③ → Diastereoisomers

② & ③ → Enantiomers.

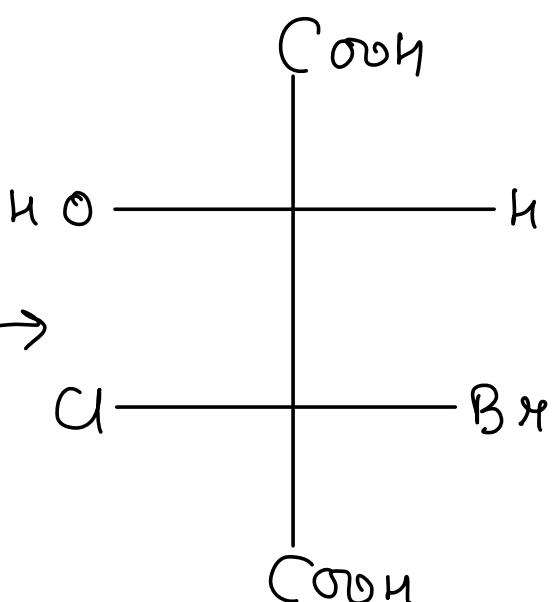
Ques :-



What is the relationship b/w (A)
(B) & (C) ?



$\xrightarrow{\text{even power}}$



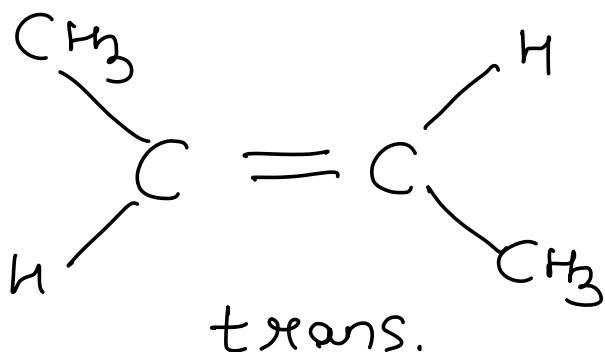
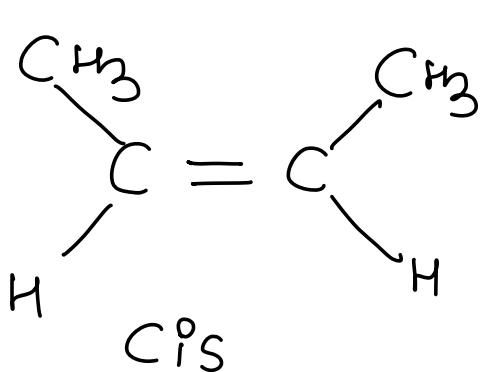
(C)

(A) & (B) \rightarrow Diastereoisomers.

(A) & (C) \rightarrow " "

(B) & (C) \rightarrow Identical.

* * Cis - 2 - Butene & trans - 2 - butene are ?



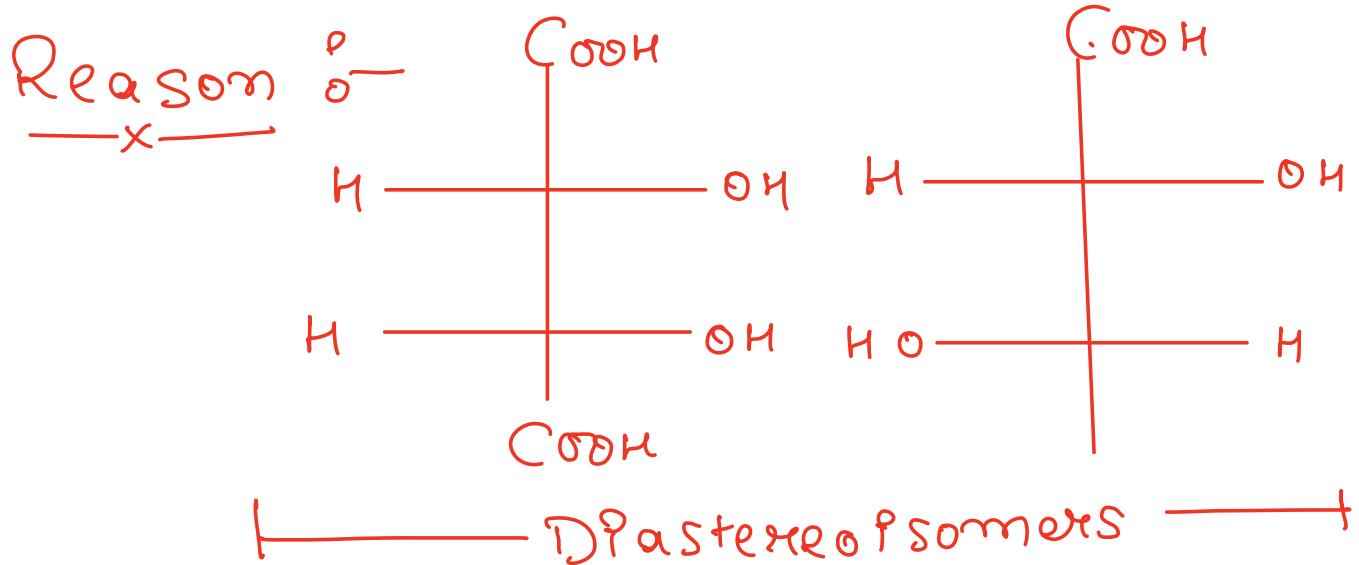
* G.I \rightarrow Stereoisomers

* Diastereoisomers.

Ques:-

Assertion :- For diastereoisomers at least two chiral

Centre must be present



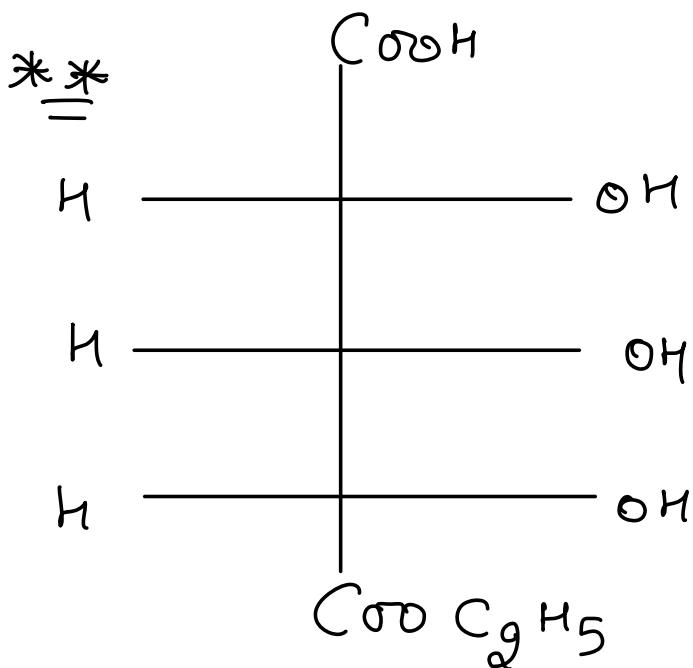
Solⁿ:

"Geometrical isomers are diastereo-isomers of each other"

Optical isomerism in a compound having 3 chiral centres

**
Symmetrical Compound having 2 chiral centres will have total isomers = 3

** Unsymmetrical Compound
having 2 chiral Centres
will have total Isomers = 4

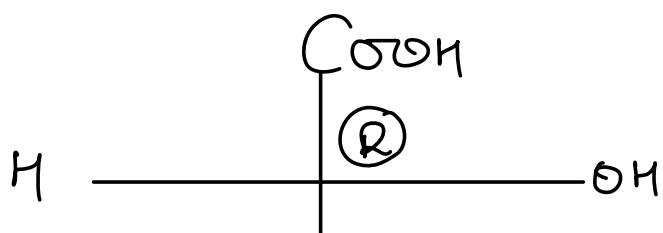


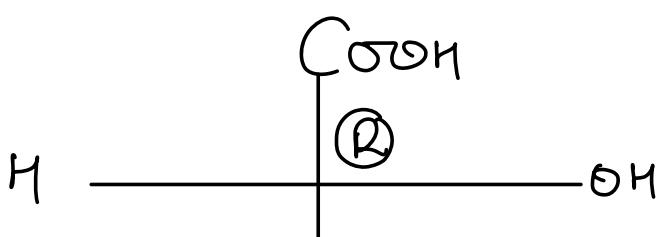
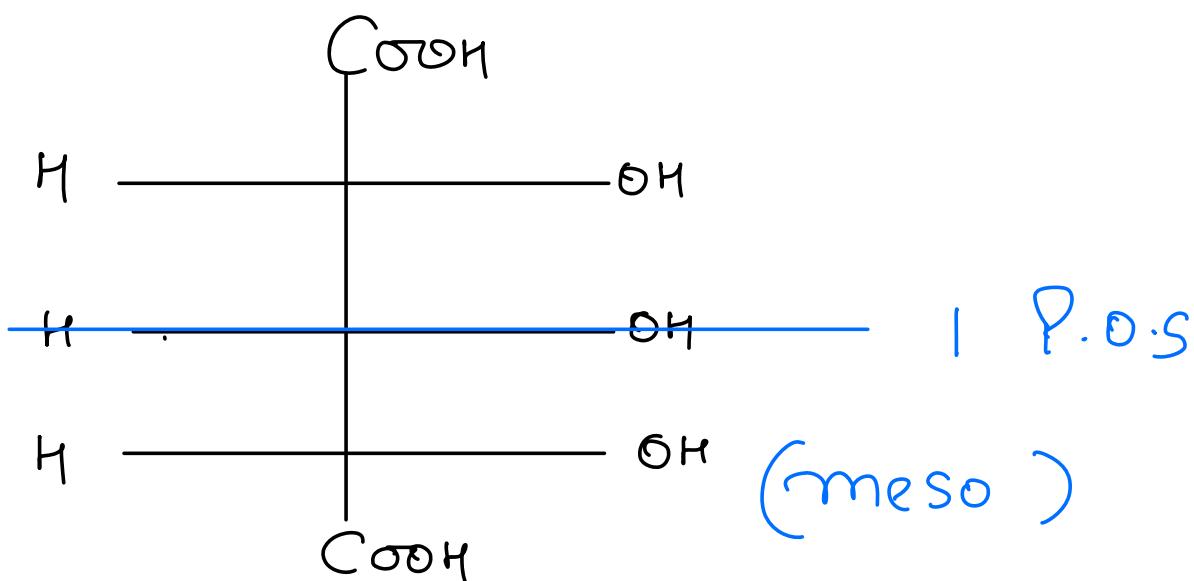
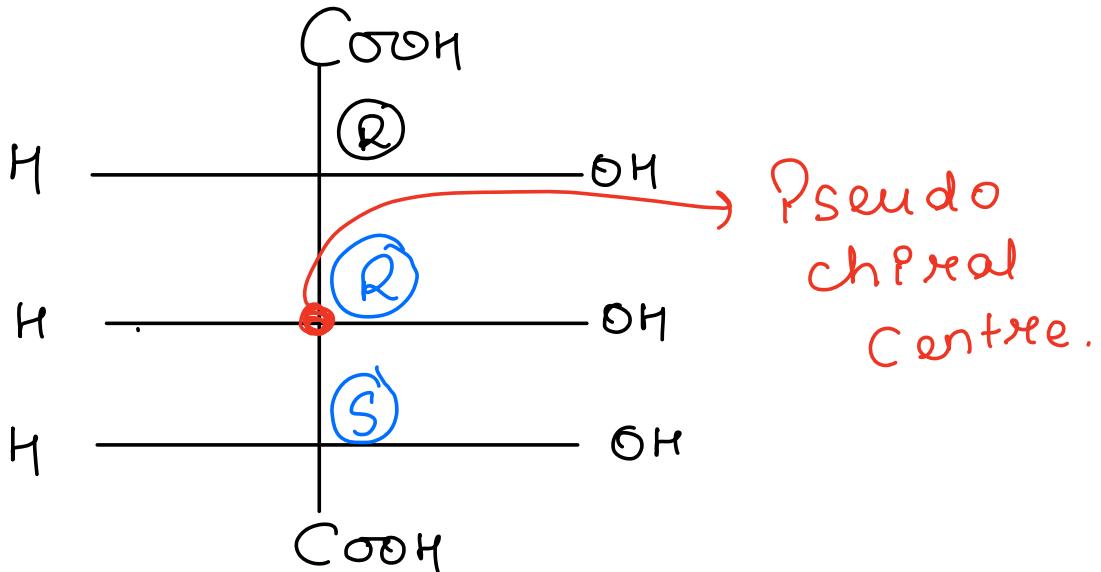
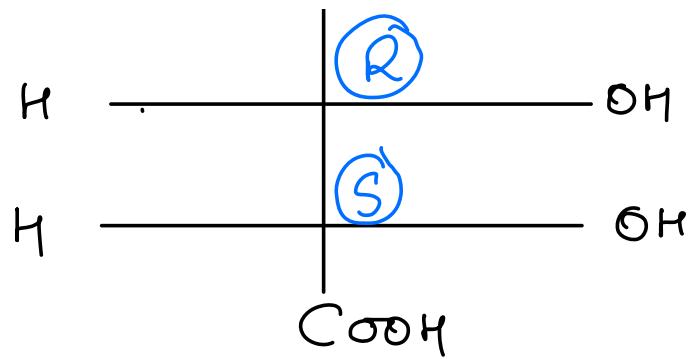
Compound having n no. of
Unsymmetrical Chiral Centres

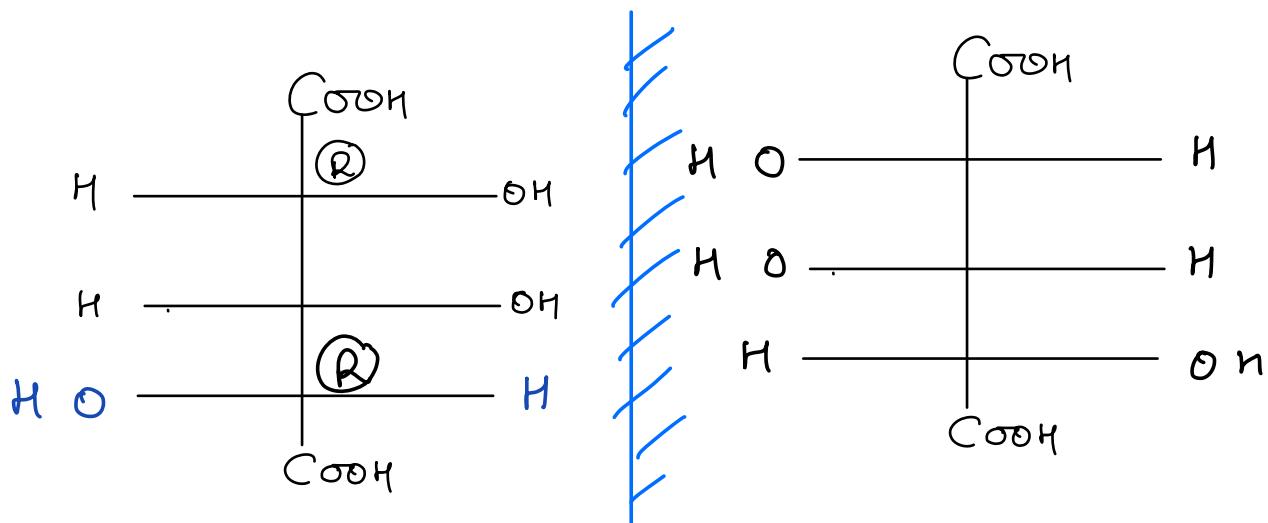
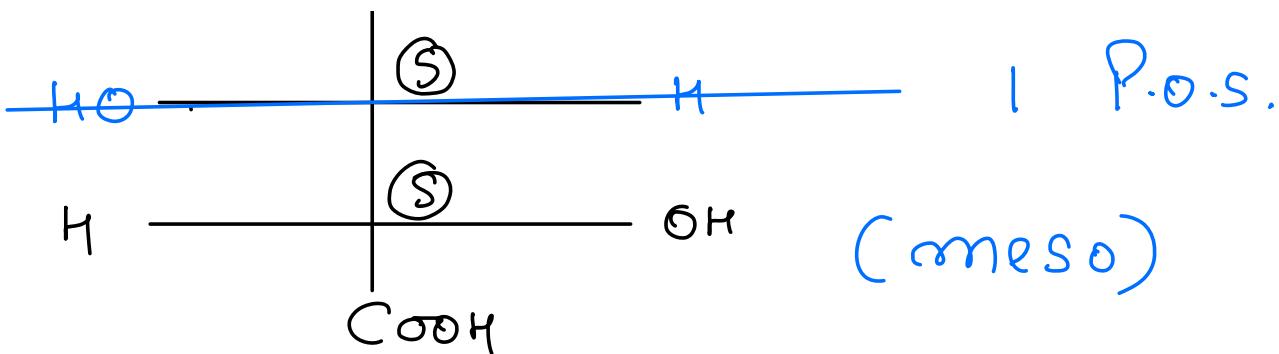
Total Isomers

$$= 2^n$$

** If Compound is Symmetrical.







→ Enantiomers

* Total Isomers = 4

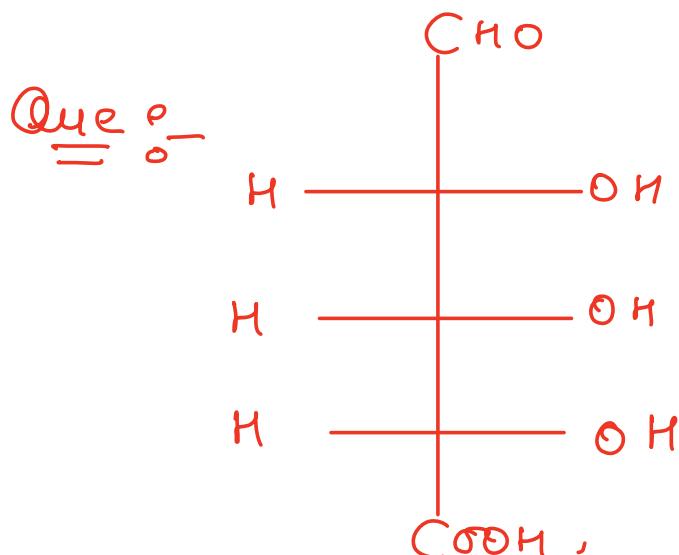
* Racemic mix = 1

* Meso Compounds = 2.

Calculation of total Stereoisomers :-

1) If a Compound have 'n' unsymmetrical chiral centres then total Stereoisomers = 2^n

$$* \text{ No. of racemic mix} = \frac{2^n}{2}$$

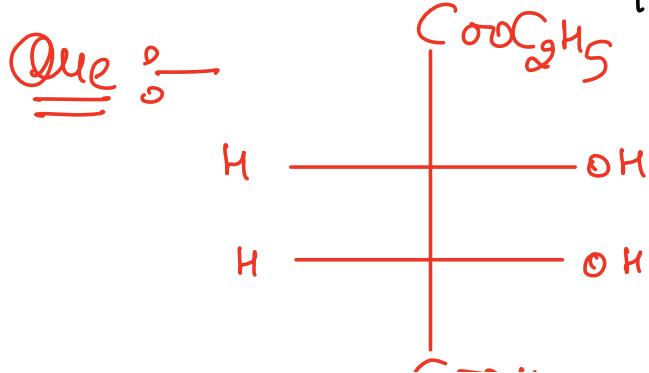


$$\text{Que} - \text{Total Stereoisomers} = 2^3 \\ = 8$$

$$\text{Racemic mix} = \frac{8}{2} = 4$$

$$8C_2 - 4 = 24$$

no. of diastereoisomers
pairs.



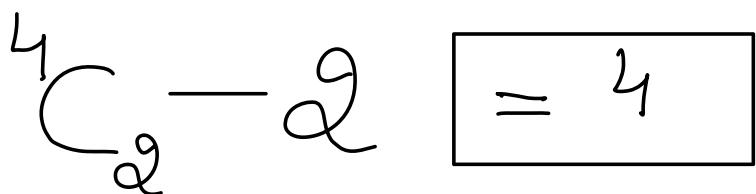
find no. of
diastereoisomers
pairs.

COOH

$\underline{\text{Soln}}$ —

$$\begin{aligned}\text{Total Stereoisomers} &= 2^n \\ &= 4\end{aligned}$$

$$\text{no. of racemic mix} = 2$$



- | | | |
|-----|---|----|
| (1) | R | R. |
| (2) | S | S |
| (3) | R | S |
| (4) | S | R. |

(1) S (3)
 (1) S (4)]
 (2) S (3)
 (2) S (4)

Diastereoisomers.

2.) If a compound have 'n' symmetrical chiral centres —

i.) when 'n' is even —

* Total optically active isomers

$$Q = 2^{n-1}$$

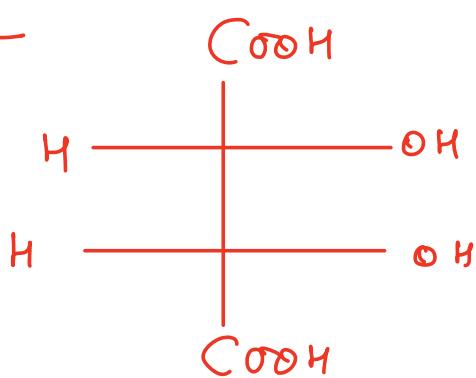
* Total meso forms

$$= 2^{\frac{n}{2}-1} = m$$

* Total stereo isomers = $Q + m$

$$= 2^{n-1} + 2^{\frac{n}{2}-1}$$

Que :-



Soln:- Total optically active isomers

$$= 2^{2-1} = 2$$

meso form = 1

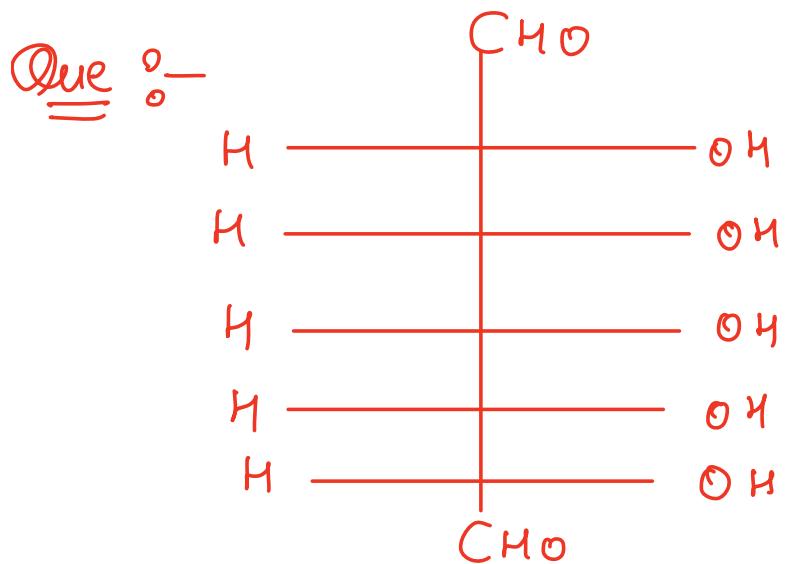
Q.) If 'n' is odd :-

* Total optically active isomers

$$= 2^{n-1} - 2^{\frac{n-1}{2}}$$

$$* \text{ Meso form} = 2^{\frac{n-1}{2}}$$

$$* \text{ Total optical isomers} = 2^{n-1}$$



Find total optically active isomers
meso forms, Racemic mix.

Soln :-

Total optically active isomers

$$= 2^{5-1} - 2^{\frac{5-1}{2}} = 12$$

$$= 12$$

$$\text{Total meso forms} = 2^{\frac{n-1}{2}}$$

$$= 2^{\frac{5-1}{2}} = 4$$

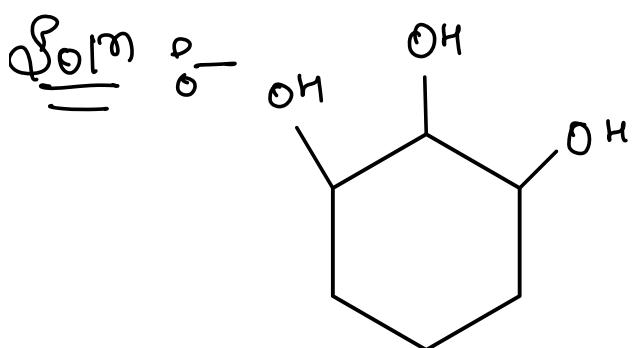
$$\text{Racemic mix} = 6$$

Ques :- If the diastereoisomers pairs in cyclohexane 1, 2, 3 triol = x

$$\text{meso forms} = y$$

$$\text{Racemic mix} = z$$

$$\text{then find } x + y - 2z$$



$$\text{Total optical isomers} = 2^{n-1}$$

$$= 4$$

Optically + meso
active

$$2 = y$$

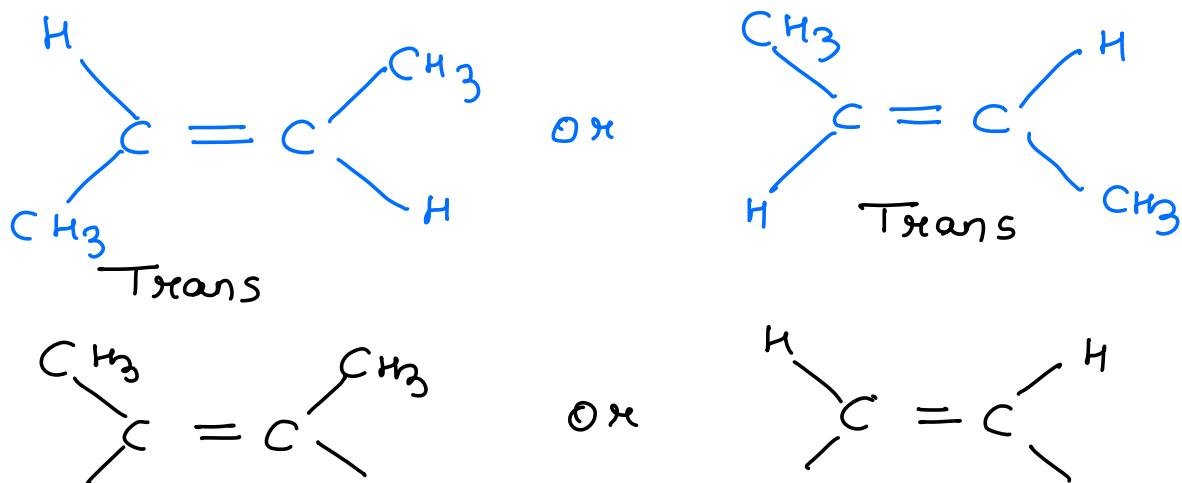
* Racemic mix $\boxed{= 1} = Z$

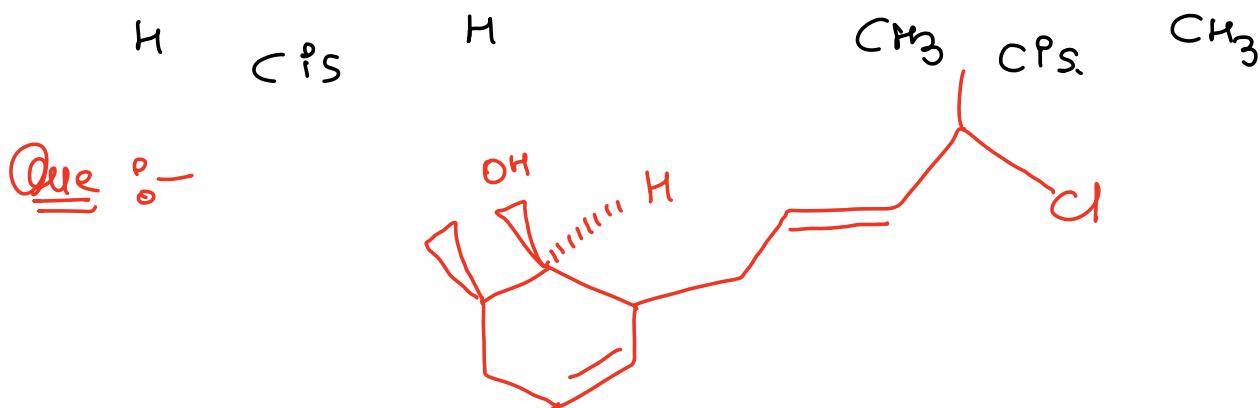
* Diastereoisomers $= {}^4C_2 - 1$
 $Z \boxed{= 5}$

$$x + y - 2z = 5 + 2 - 2 \\ \boxed{= 5}$$

Stereo Centre :-

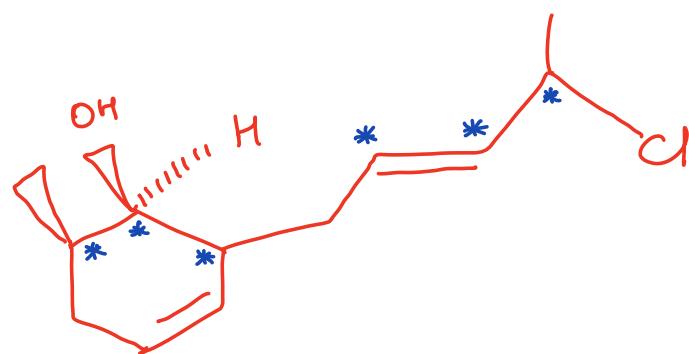
* The centre or atom in which two groups are interchanged & new stereoisomer is obtained then centre or atom is known as a stereocentre. Stereocentre may be chiral centre or double bond.





Find total no. of stereocentres.

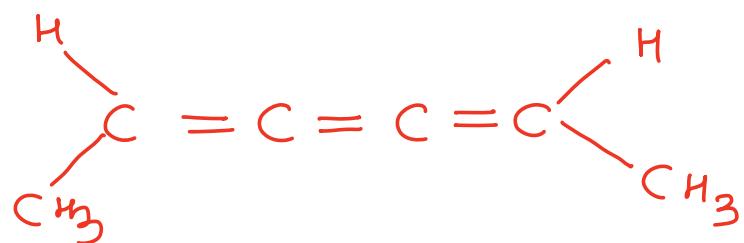
Soln :-



Total stereo centres = 6

Note Double bond of the cyclic ring will show G.I when minimum 8 carbon atoms are present in the cyclic ring.

**



Total stereo centres = 2.

Stereogenic area :-

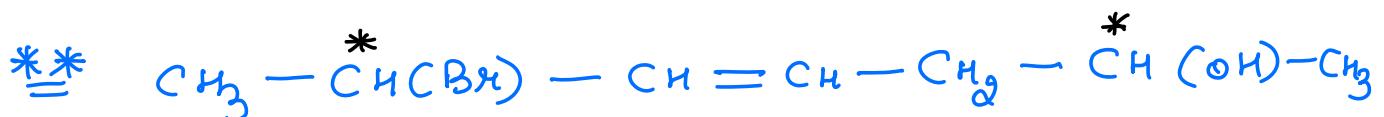
* The part of the compound which shows stereoisomerism is K/A stereogenic area. Stereogenic area may be chiral centre, double bond, alene system, spiro system, biphenyl system e.t.c.

Total no. of Stereoisomers :-

(Optical + Geometrical)

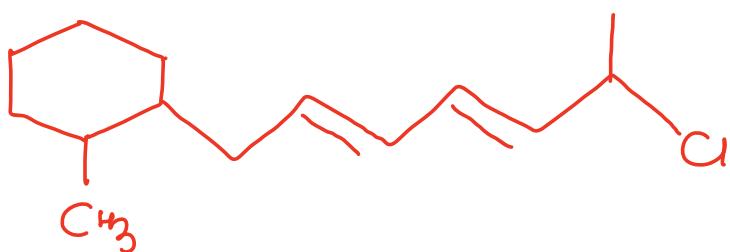
* If a compound have 'n' unsymmetrical stereogenic area.

$$\text{Total Stereoisomers} = 2^n$$



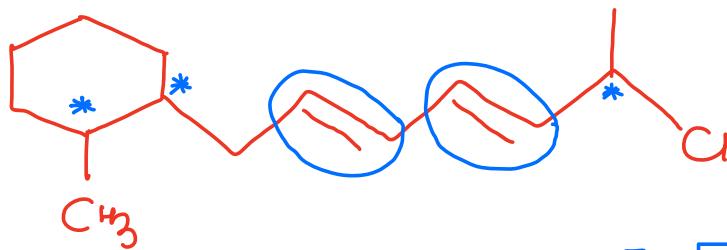
$$\begin{aligned}\text{Total Stereoisomers} &= 2^3 \\ &= 8\end{aligned}$$

Ques:-



Find total Stereoisomers.

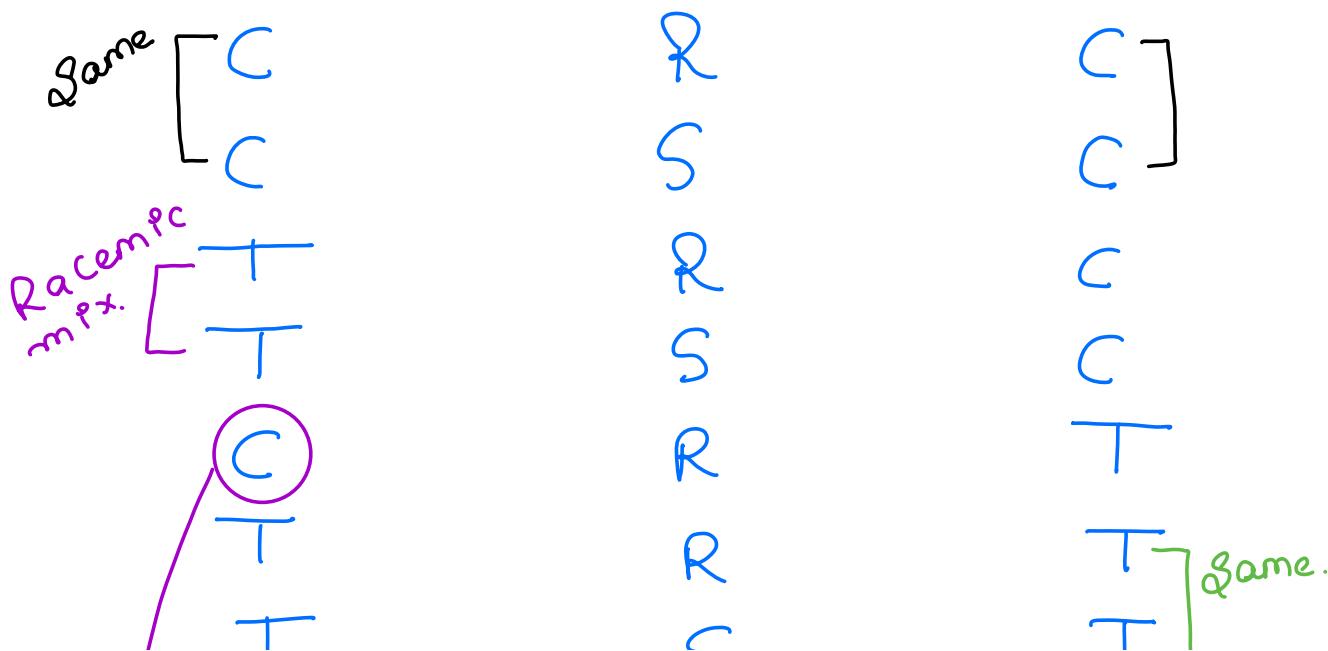
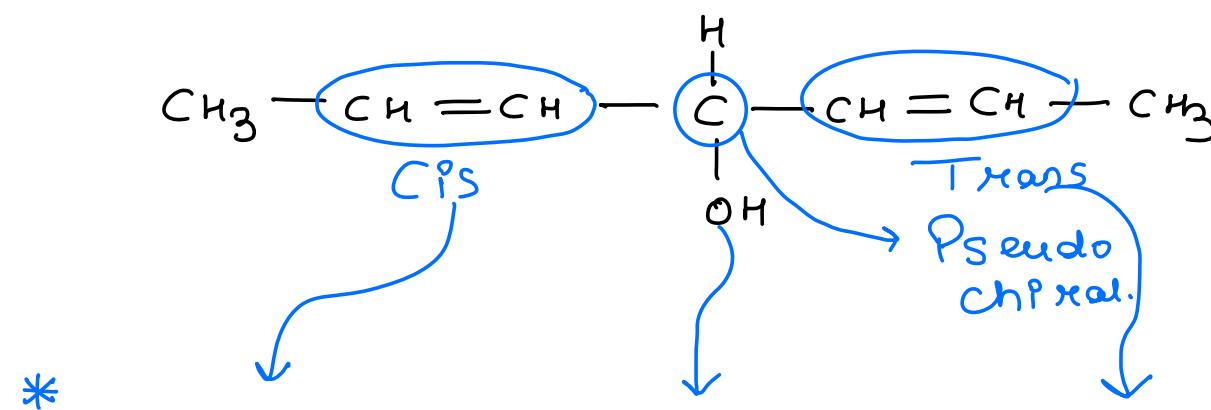
Sol :-



Total Stereoisomers = $2^5 = 32$

~~If~~ If a Compound have 'n' Symmetrical stereogenic area \Rightarrow

a) If 'n' ps odd \Rightarrow





* * Total Isomers = 4

* * Racemic mix = 1

* * meso form = 2.



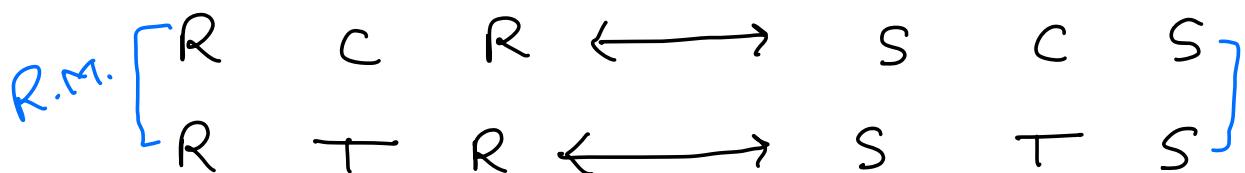
Ques :-



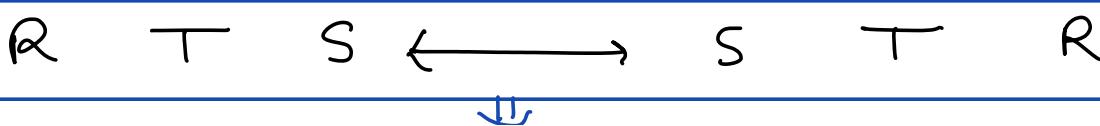
Find total no. of Stereoisomers

& Diastereoisomers.

Soln :-



Common.



Common.

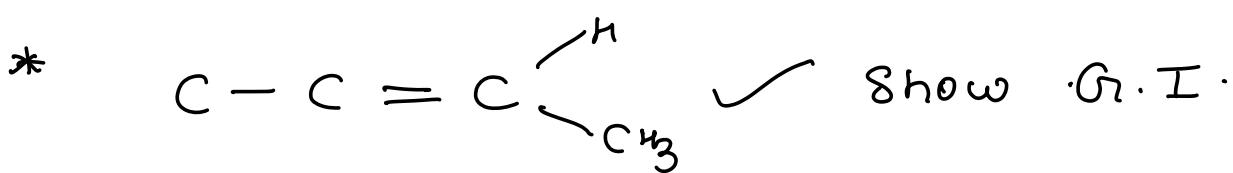
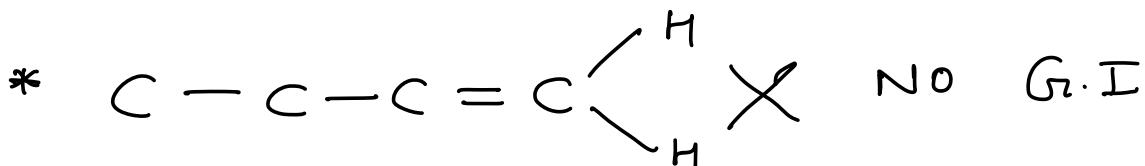
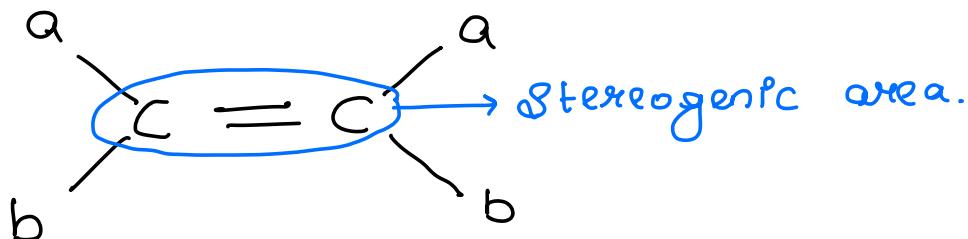
Total Stereo Psomers = 6

**
Total diastereoisomers = ${}^6C_2 - 2$
= 13

"If the geometry across the double bond is fixed to trans then find total racemic mix."

Total R.M = R + R \longleftrightarrow S + S
= 1

Calculation of total geometrical Psomers :-



* If a Compound have 'n' unsymmetrical geometrical areas

$$\text{Total G.I.} = 2^n$$



Sol :- Total no. of G.I. = 2^9
 $= 4$

** If a Compound have 'n' symmetrical geometrical areas :-

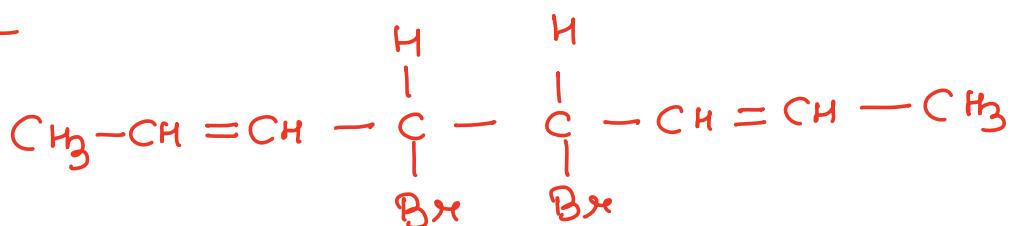
a) If 'n' is even :-

$$\text{Total no. of G.I.} = 2^{n-1} + 2^{\frac{n}{2}-1}$$

b) If 'n' is odd :-

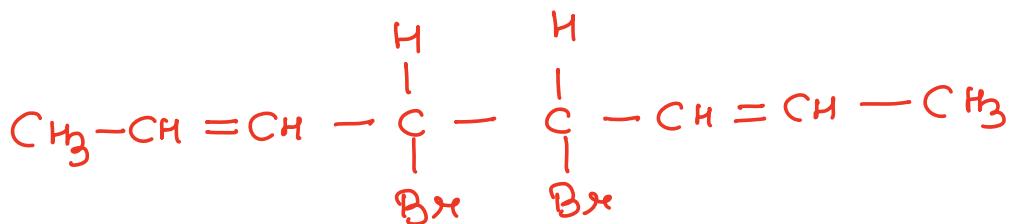
$$\text{Total no. of G.I.} = 2^{n-1} + 2^{\frac{n-1}{2}}$$

Ex :-



** If a Compound have 'n' even symmetrical stereogenic area then simply apply the formula of

geometrical & show Both O.I & G.I.



$$\begin{aligned}\text{Total S.I.} &= 2^{n-1} + 2^{\frac{n}{2}-1} \\ &= 2^{4-1} + 2^{\frac{4}{2}-1} \\ &= 10\end{aligned}$$

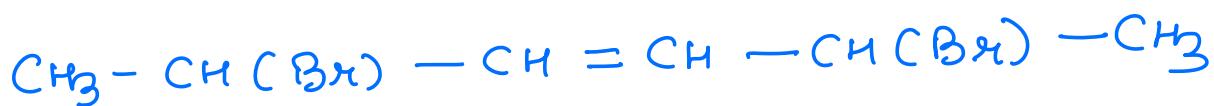
* If a Compound show Geometrical & optical both, then if Compound have even symmetrical stereogenic areas then for calculation of total stereoisomers, apply the formula of G.I. or O.I.

* If a Compound have odd no. of stereogenic area \therefore
(Showing O.I & G.I. both.)

i.) when chiral atom is in the middle



P.Q.) When double bond will be in the middle.



If chiral centre is present in the middle then apply the formula of optical isomerism.

$$a(\text{for odd}) = 2^{n-1} - 2^{\frac{n-1}{2}}$$



$$= 2^{3-1} - 2^{\frac{3-1}{2}}$$

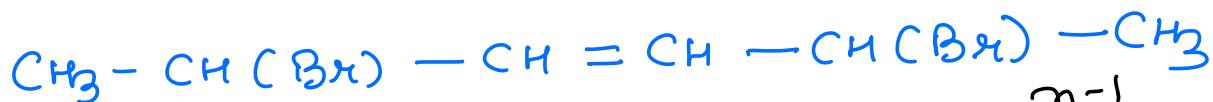
$$= 2$$

$$m(\text{meso}) = 2^{\frac{n-1}{2}} = 2$$

Total stereoisomers

$$= 4$$

If double bond is in the middle then apply the formula of G.I.



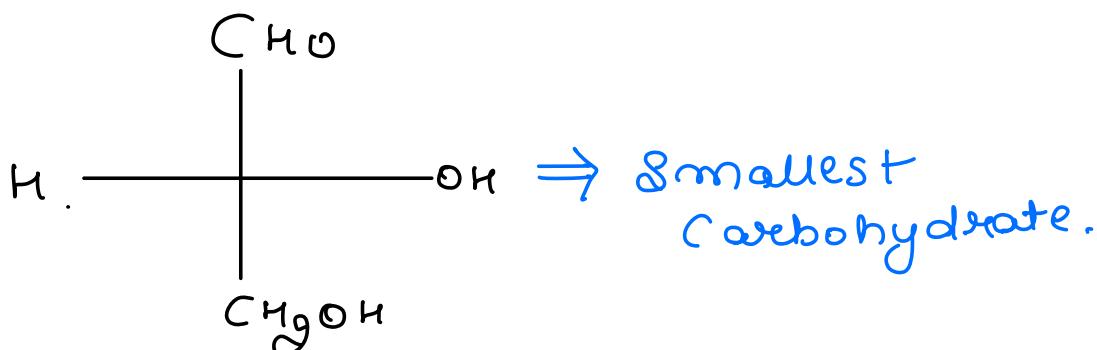
$$\text{Total stereoisomers} = 2^{n-1} + 2^{\frac{n-1}{2}}$$

$$= 6$$

D & L Configuration :-

** D & L Configurations are used in case of biomolecules (Carbohydrates & amino acids)

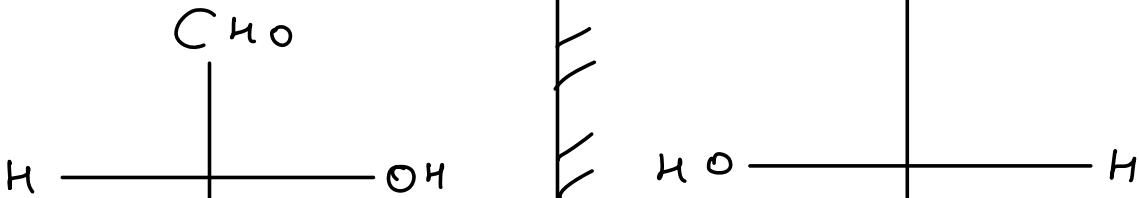
→ Carbohydrates are polyhydroxy aldehydes & Ketones.

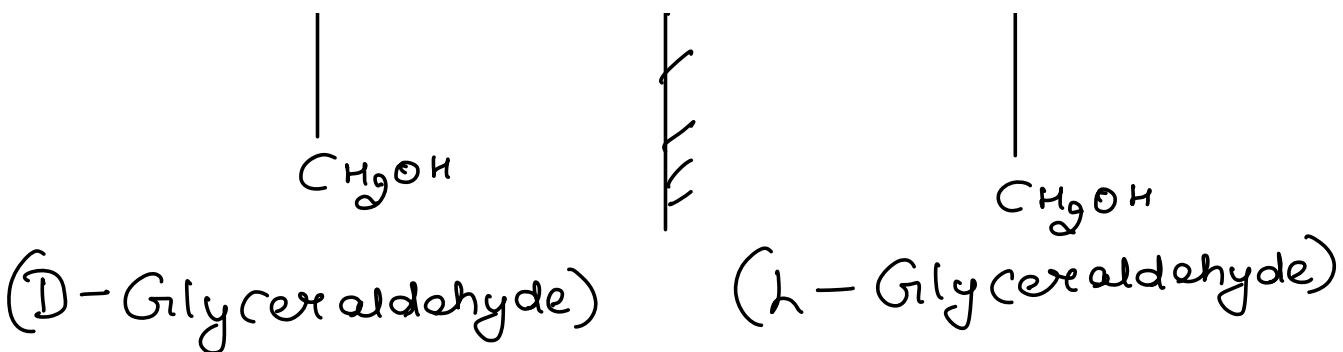


Glyceraldehyde.

** D & L form of the same compound are mirror image to each other.

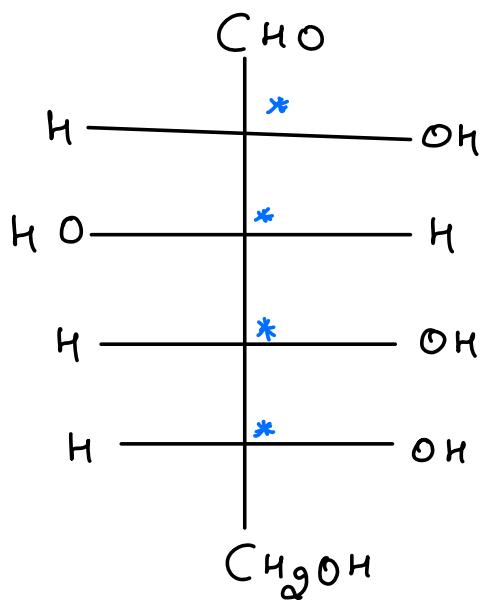
** D & L forms are derived from glyceraldehyde.





* If main F.G. is present at the top & remaining carbons on the bottom then check the position of -OH & -H of the last chiral centre.

- If OH is present at right side then it will be D-form.
- If OH is present at left side then it will be L-form.



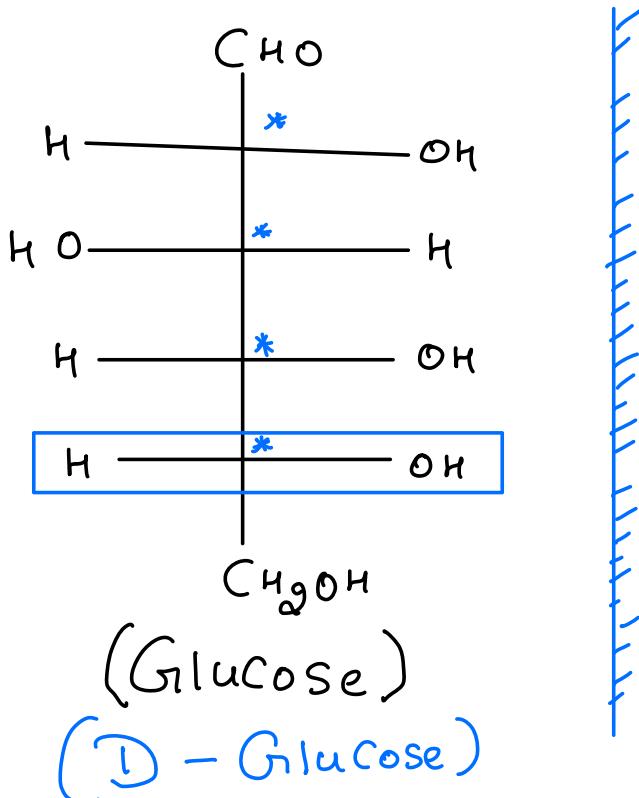
Total isomers = 2^4

= 16

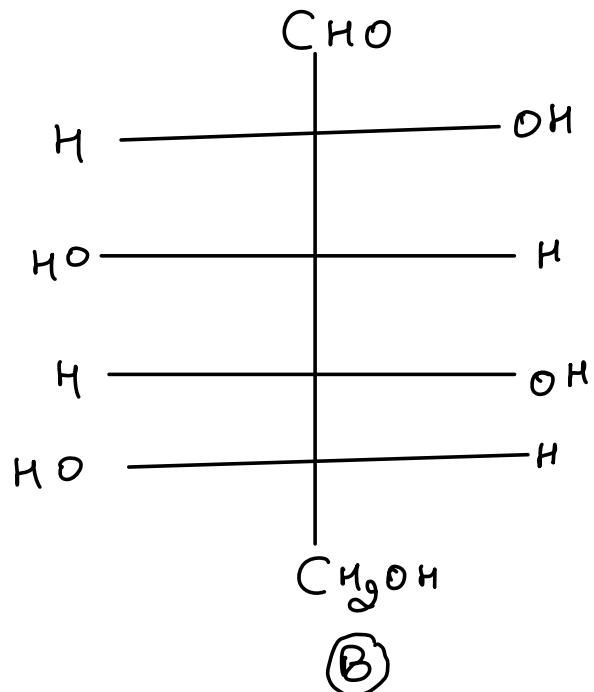
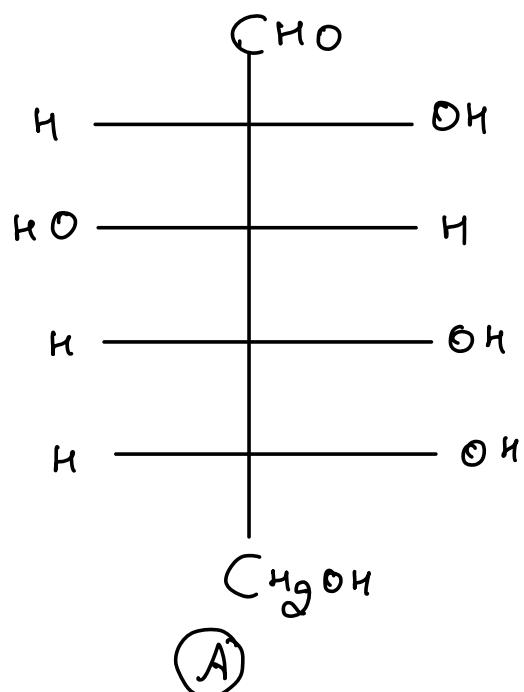
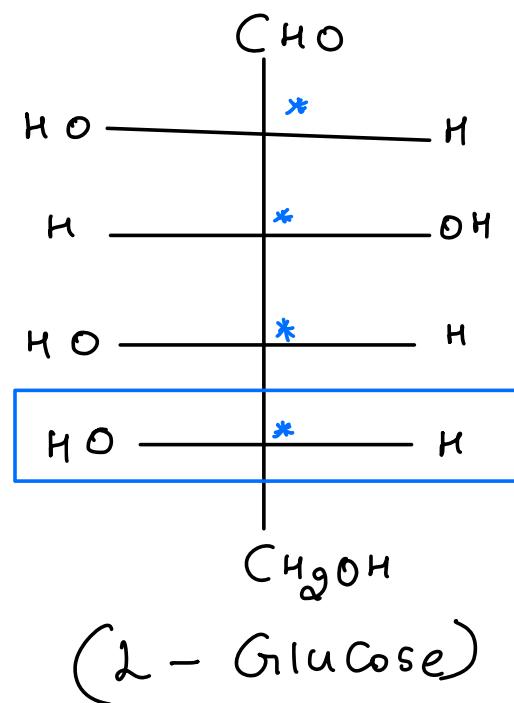
D	E	L
---	---	---

(Glucose)

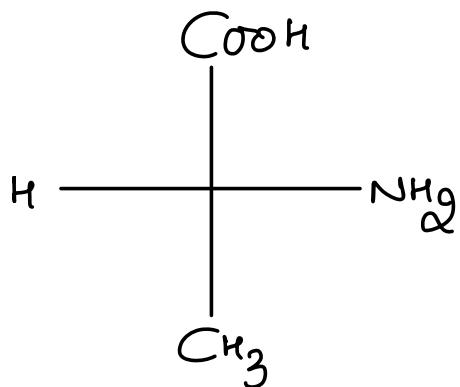
Total D-glucose
|| | L-Glucose



= 8
= 8
1



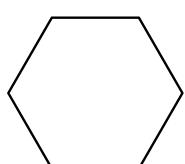
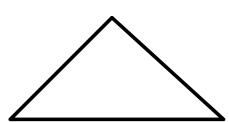
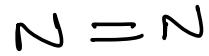
D & L form in amino acids



- * If main f.G. is present at the top & remaining carbon atoms at the bottom then check the position of NH_2
- * If NH_2 is at right then D-form.
if it is at left then L-form.

Geometrical Isomerism

** Geometrical isomerism is found in those type of compounds in which restricted rotation is present.

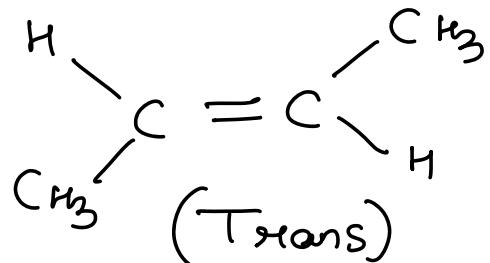
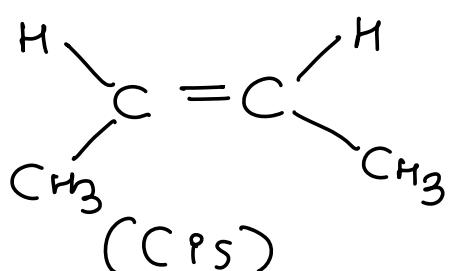
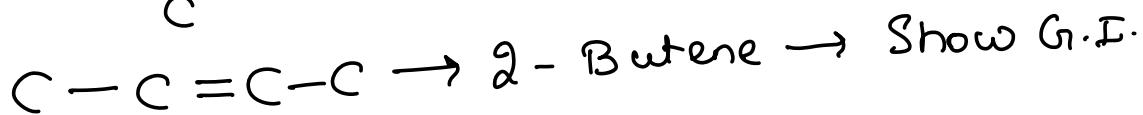
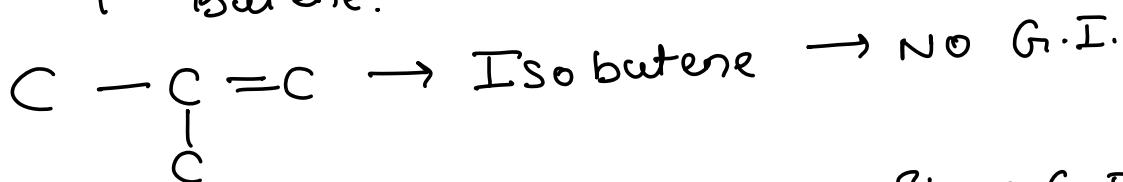
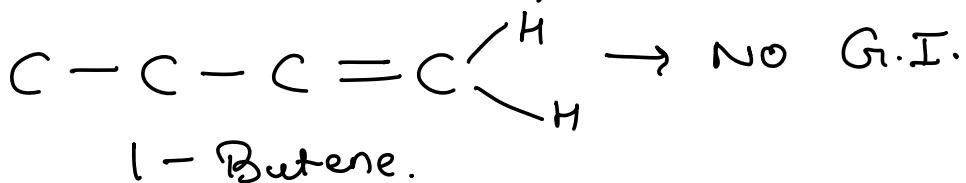


e.t.c.

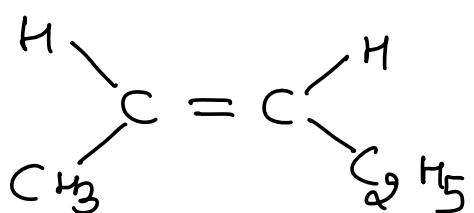
\Rightarrow Cis & trans form

** For G.I. terminal atoms should be in same plane & the two groups

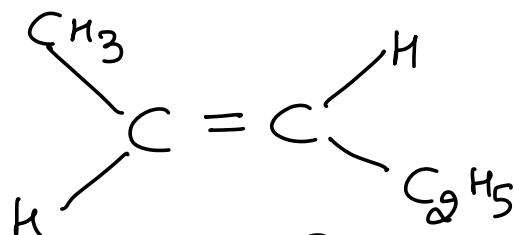
directly attached with terminal atoms must be different.



** Pent-2-ene.

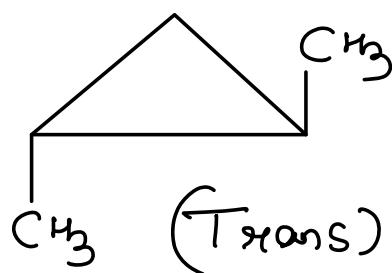
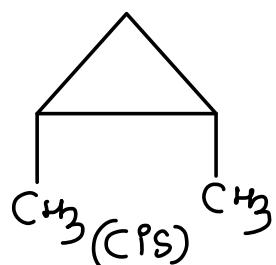


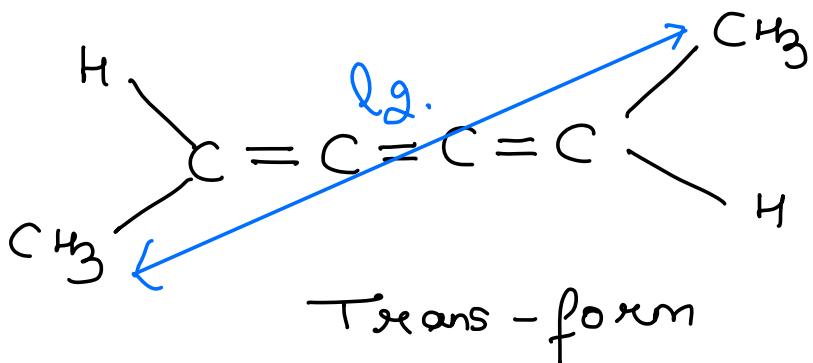
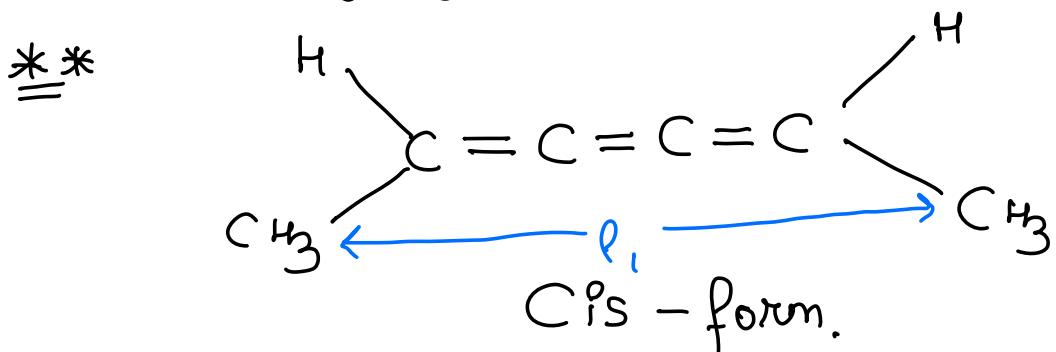
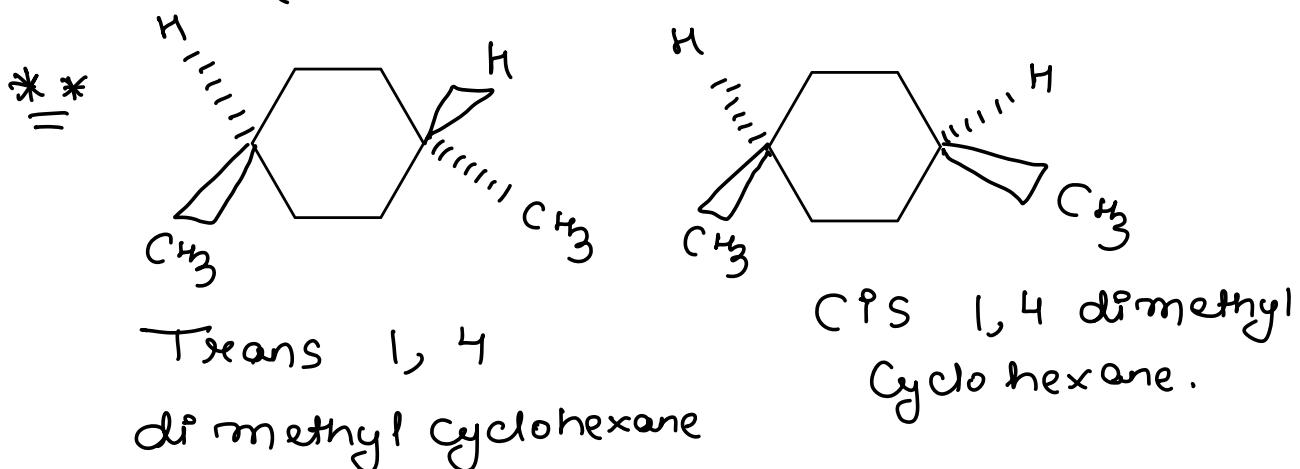
Cis Pent-2-ene



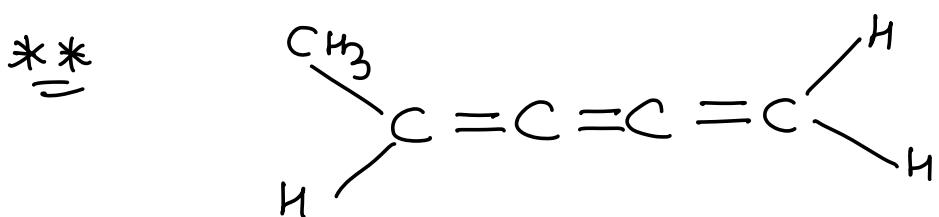
Trans Pent-2-ene

**

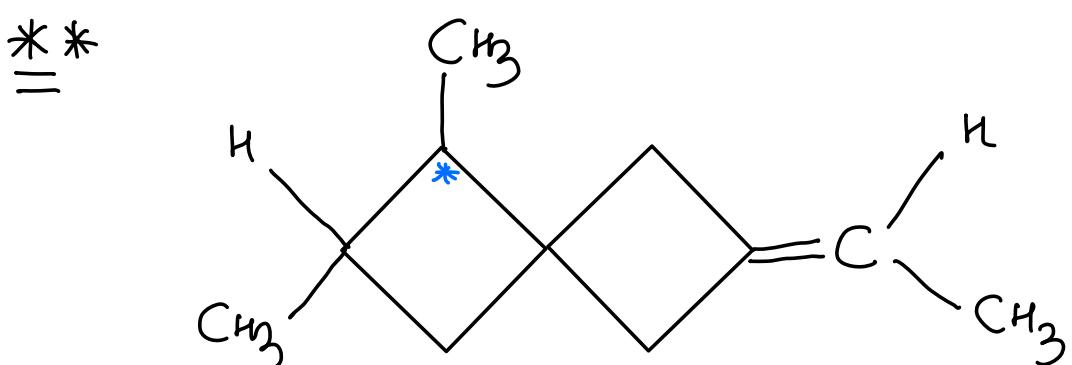
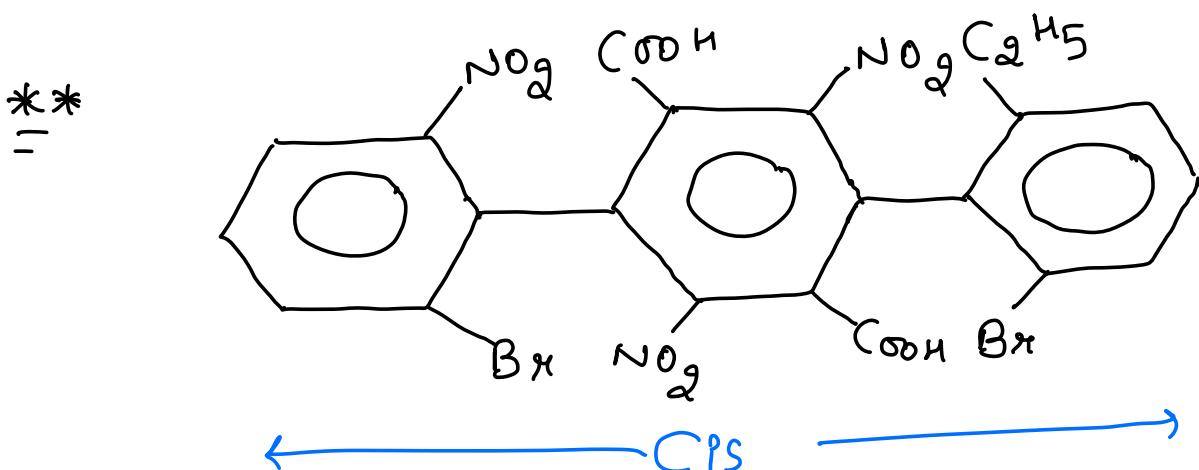
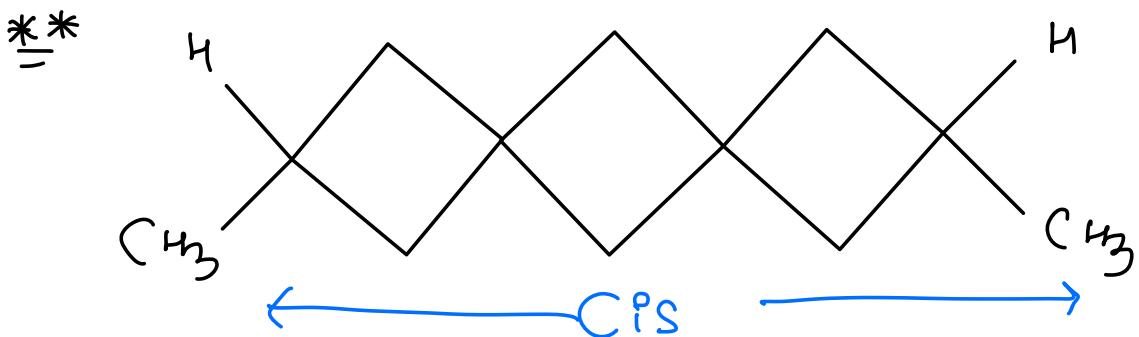




- * If $\rho_1 = \rho_2 \Rightarrow$ No Gr. I
- * If $\rho_2 > \rho_1 \Rightarrow$ will show Gr. I.



* No G.I. * No O.I.



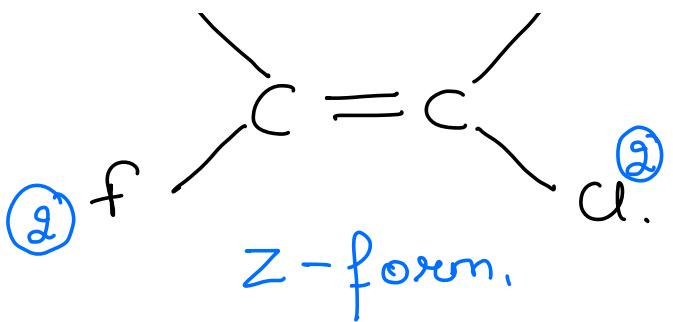
* Cⁱs - form

* Optical isomerism.

E S Z form o-

(1) H.

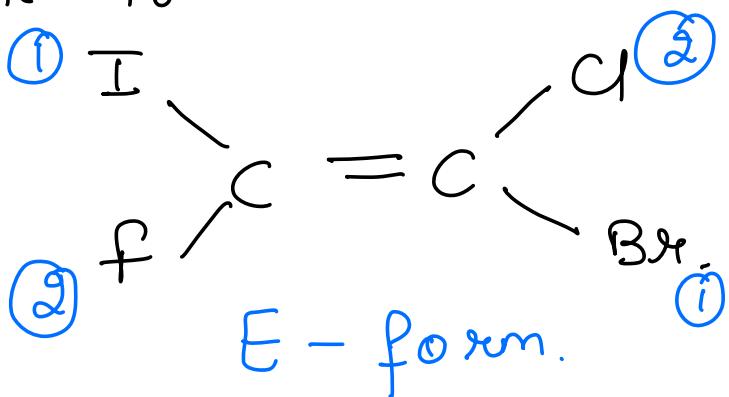
(1) Br



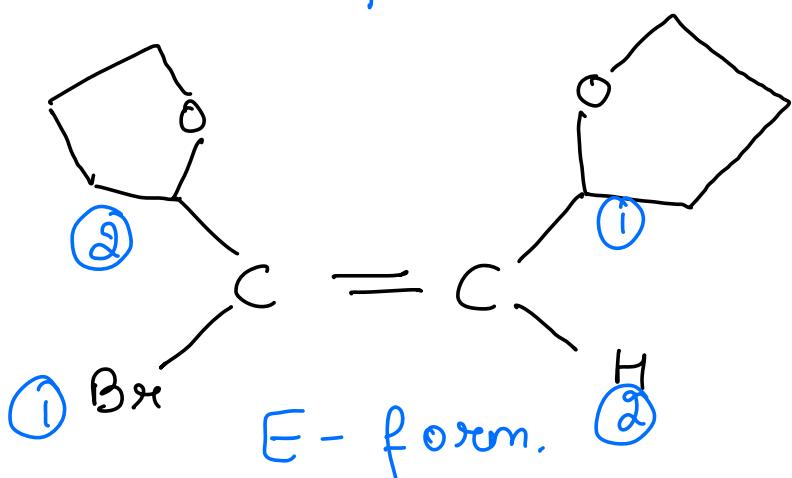
* Assign priority to the groups attached with double bounded corner carbons on the basis of C.I.P rule.

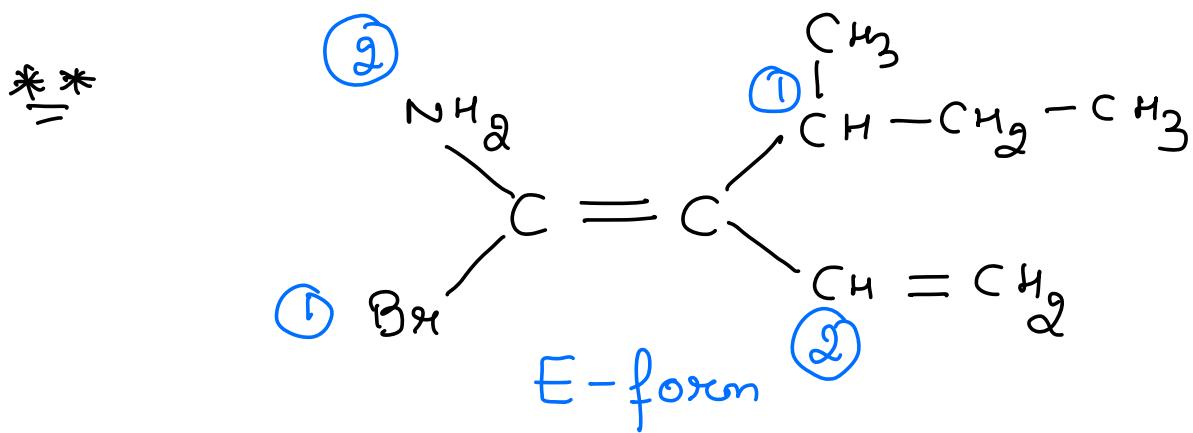
* If same priority groups are present on the same side then it will be 'Z-form'.

* If groups on atoms are present opposite to each other then 'E-form'



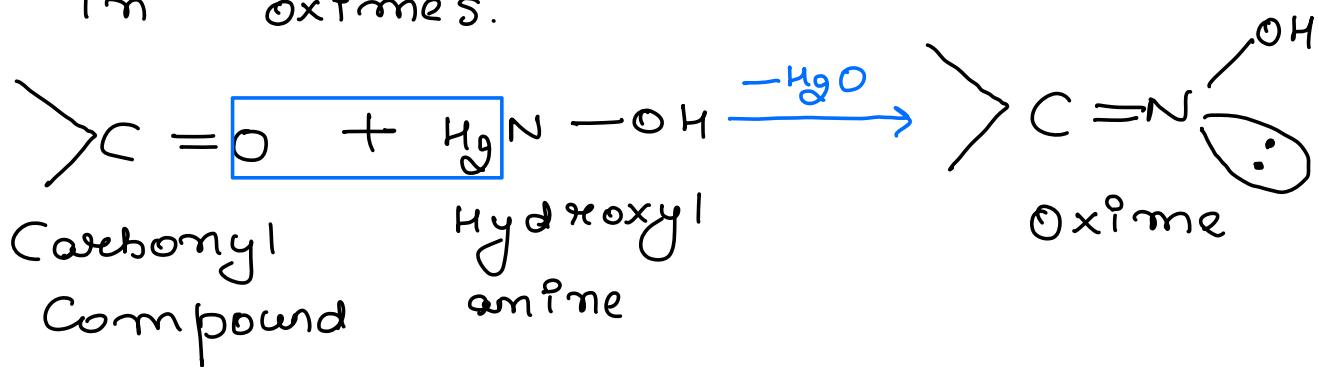
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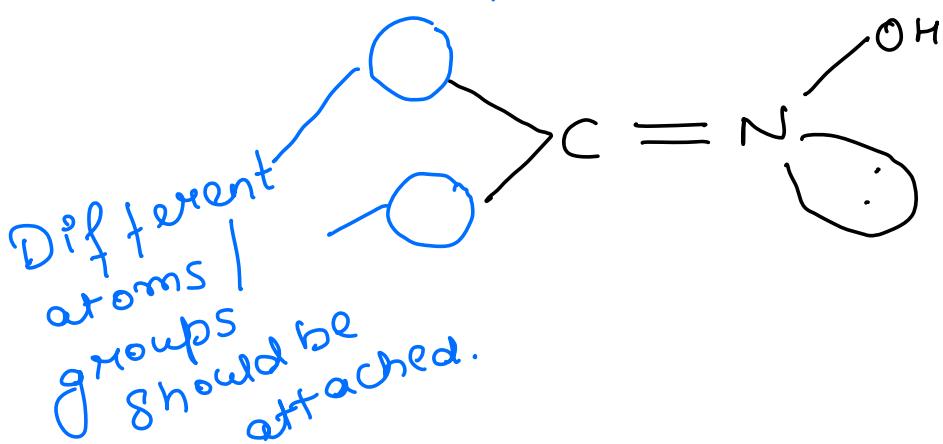


Sym and Anti form :-

* Sym & anti form is mainly found in oximes.

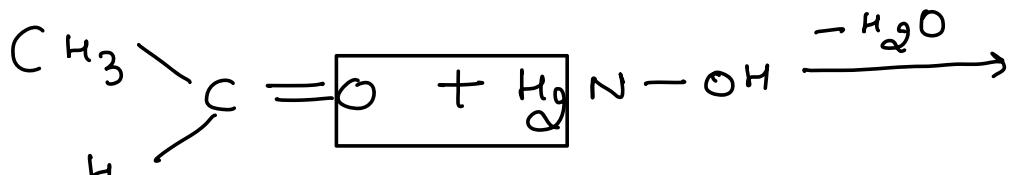


** Condition for G.I. :-

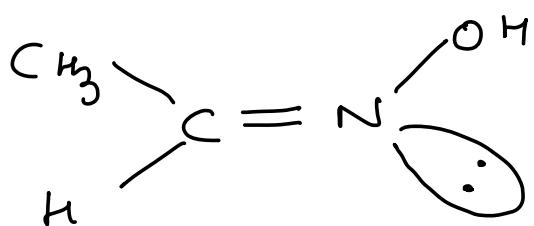


Ques :- $\text{CH}_3-\text{CH}=\text{N}\text{OH}$ will show G.I. or not ?

Soln o-

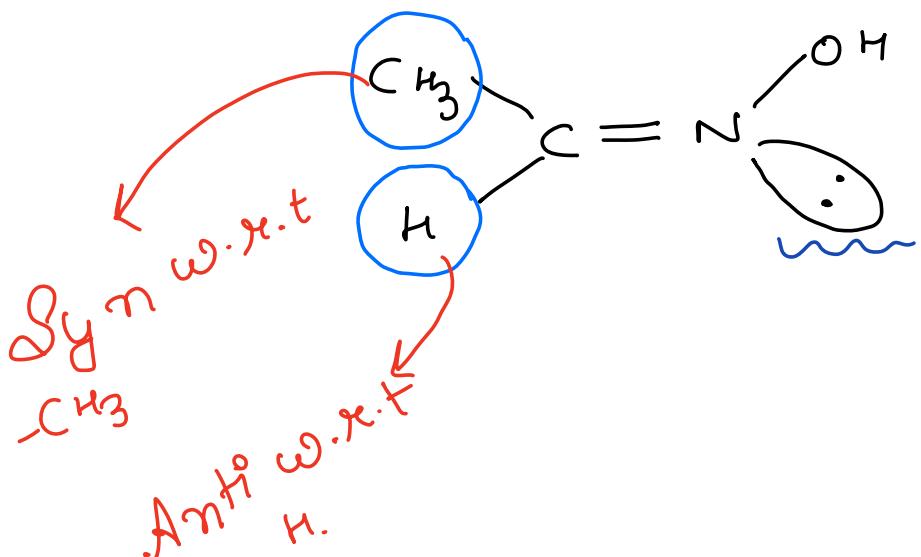


Acetaldehyde

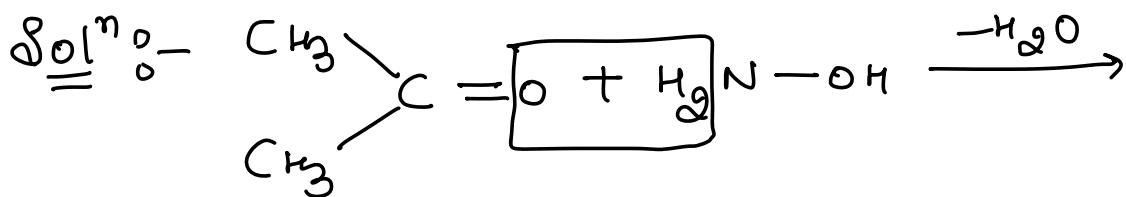


Acetaldehyde oxime

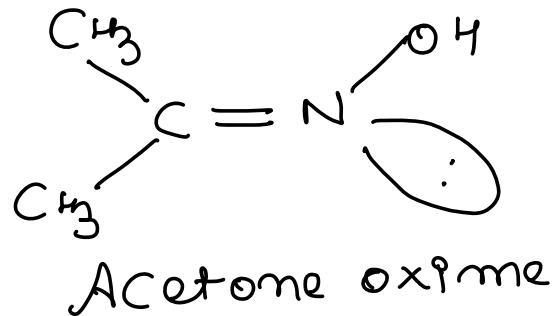
{ Show G.I? }



Ques o- $\text{CH}_3 - \text{C}(\text{CH}_3) = \text{NOH}$ will show G.I?



Acetone

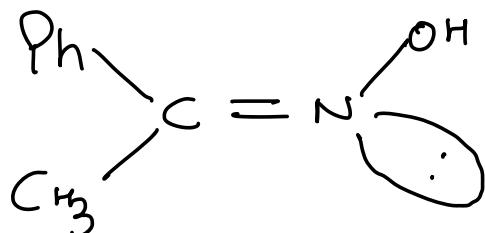


* * Acetophenone oxime

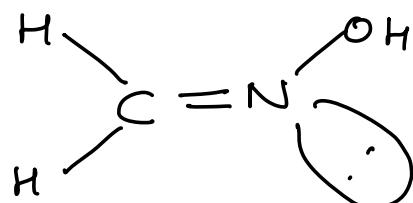
* * Formaldehyde oxime

* * Benzophenone oxime.

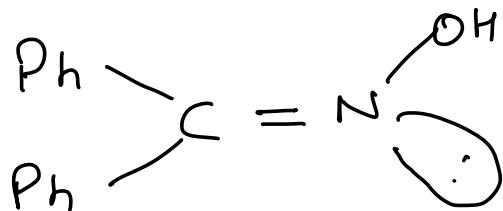
*



*



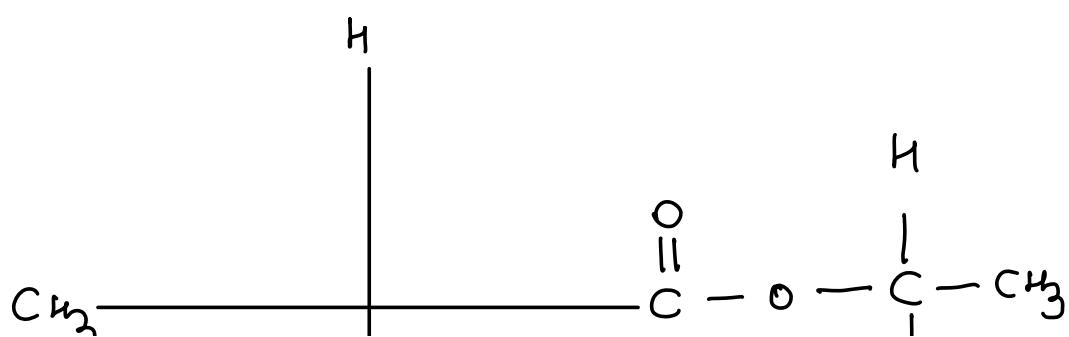
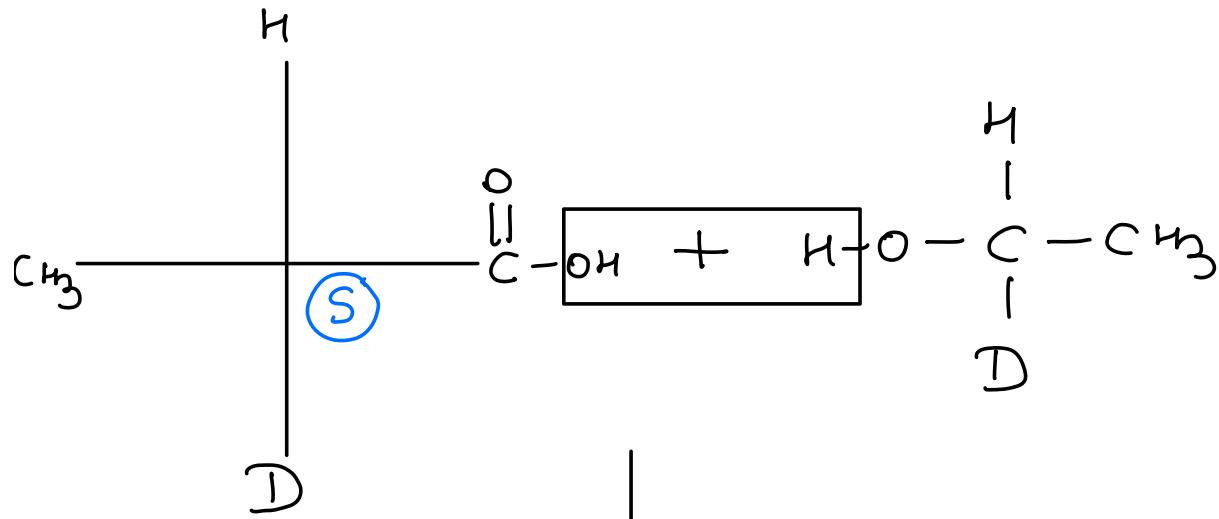
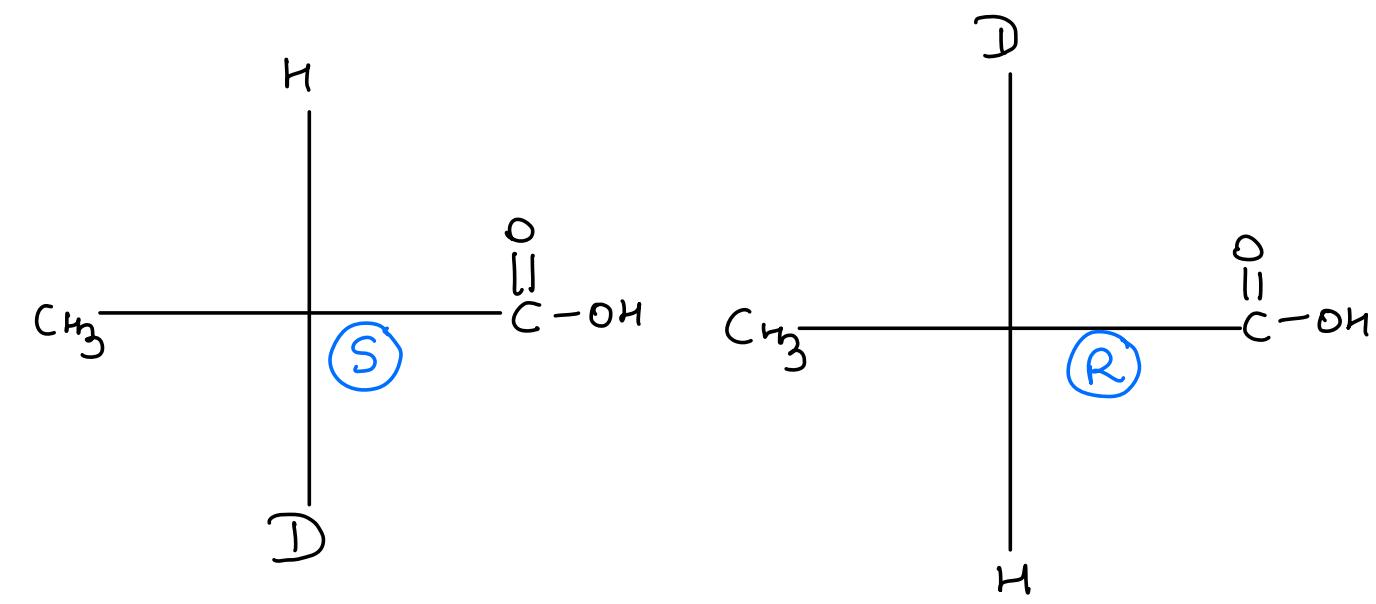
*

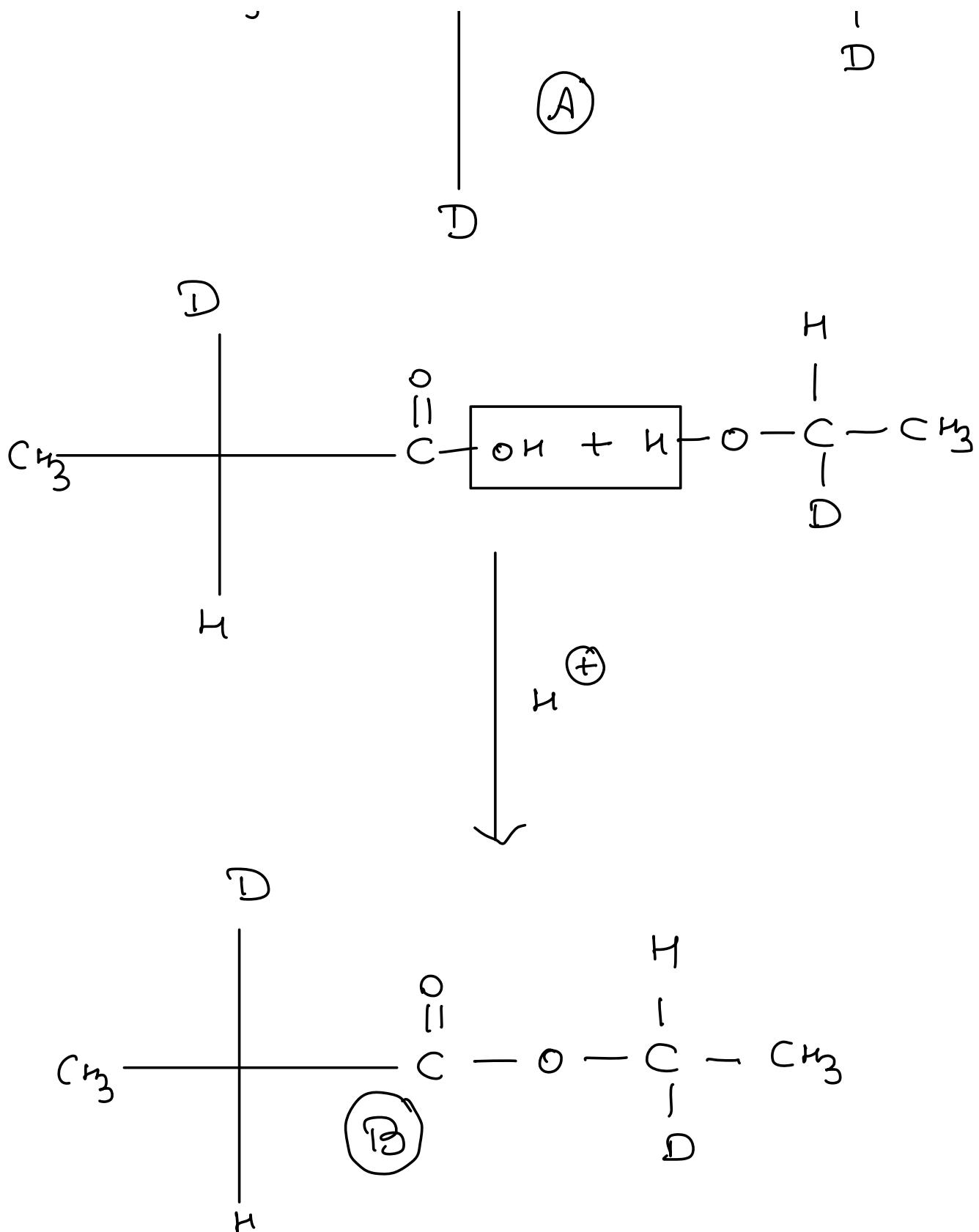


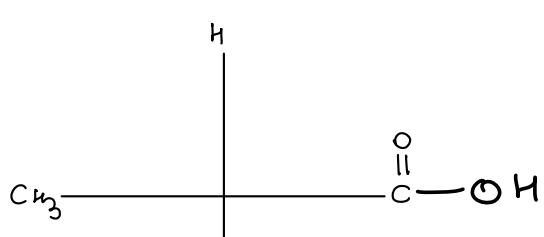
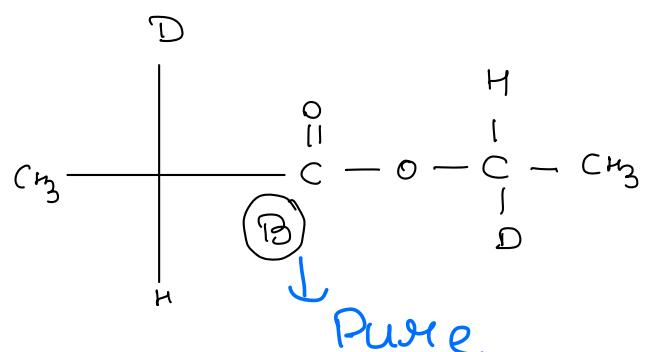
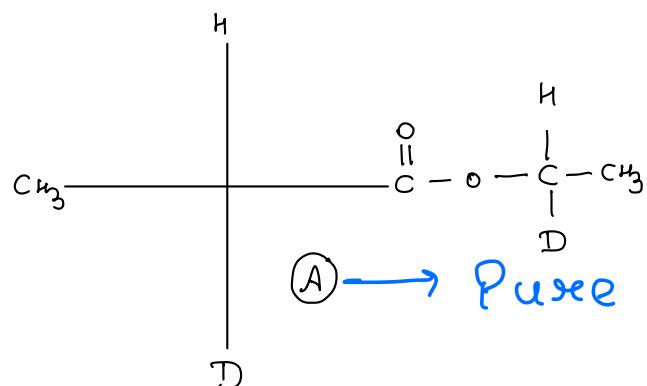
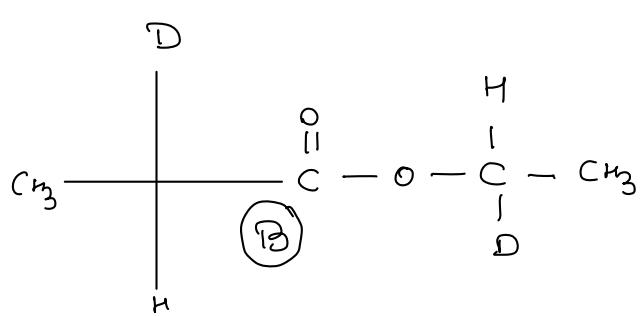
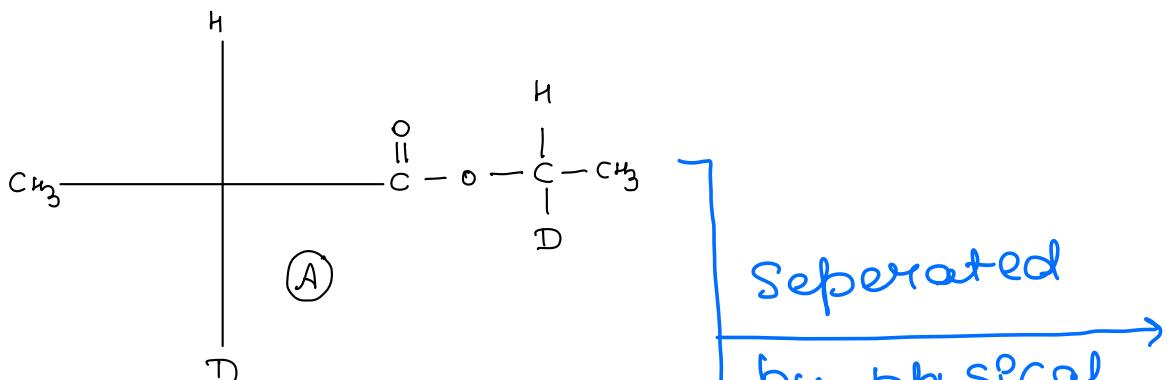
Re Resolution :-

Resolution is a method by which racemic mix. can be separated into pure form or pure enantiomers.

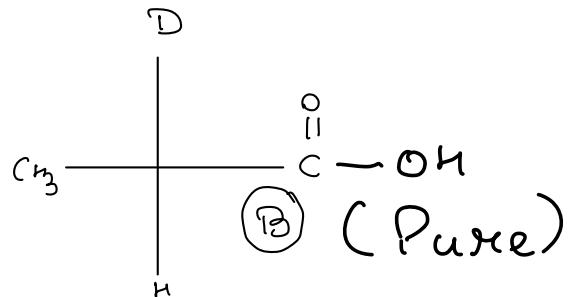
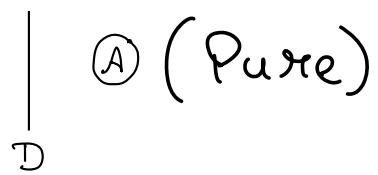
⇒ Chemical methods of resolution :-







H_3O^+



Observed rotation \neq specific rotation θ

$\theta_{\text{observed}} \propto$ Conc. of optically active substance (gm/ml) — ①

$\theta_{\text{observed}} \propto l$ [length of test tube (dm)] — ②

$\theta_{\text{observed}} \propto C.L.$

$$\theta_{\text{observed}} = |\theta| \frac{C.L.}{T}$$

$$|\theta| \frac{\lambda}{l} \rightarrow \text{specific rotation.}$$

If $C = 1 \text{ gm/ml}$ $l = 1 \text{ dm}$

$$\theta_{\text{observed}} = \theta_{\text{specific}}$$

Ques - A and B are enantiomers to each other the specific rotation of A is $10^\circ \delta$ the rotation of mix of A & B is 2.5° . Then find the % age of A & B in the mix. and also calculate the % age of racemic mix. & % age of enantiomer excess.

Solⁿ: Let moles of mix = 1

1 mole

x moles of A
(1-x) moles of B

$$2.5 = x (10^\circ) + (1-x) (-10)$$

$$x = 0.625.$$

$$\% \text{ age of } A = 62.5\%$$

$$\% \text{ " " } B = 37.5\%$$

Enantiomers \rightarrow ?

Equimolar mix. of A & B.

$$\% \text{ age of Enantiomeric mix} = 37.5 \times 2 \\ = 75\%$$

* Enantiomeric excess = 25 %

**

Enantiomer excess = optical purity