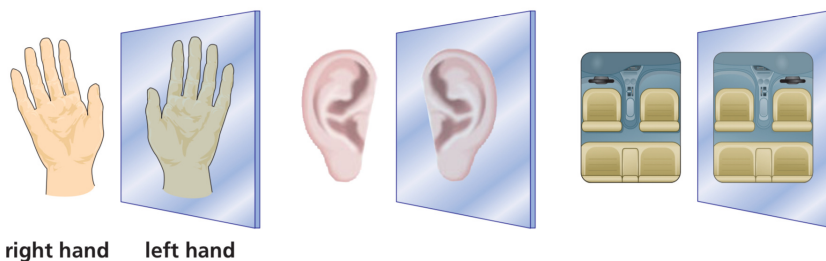


OPTICAL ISOMERISM

CBJ

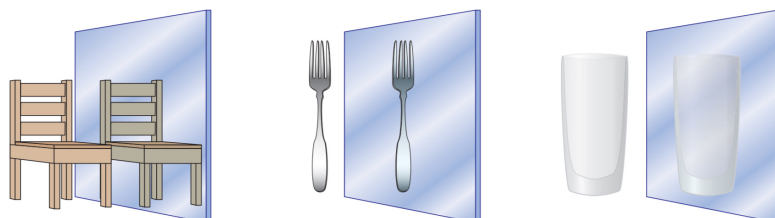
Chiral :- molecule having non superimposable mirror image is known as chiral molecule and this phenomenon is known as chirality.

chiral objects



CBJ

achiral objects



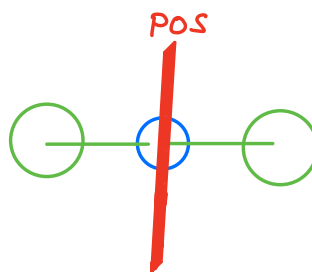
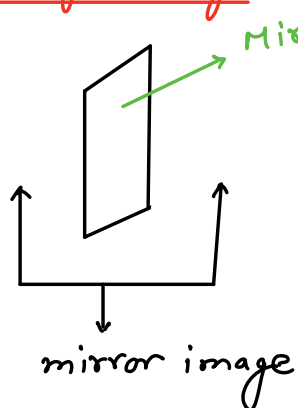
Chiral molecules are dissymmetric.

	POS	COS	AAOS	AOS
Asymmetry	X	X	X	X
Dissymmetry	X	X	X	✓/X

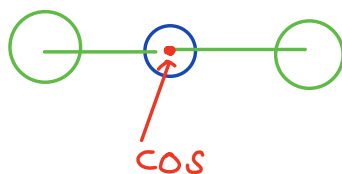
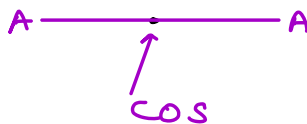
Que which symmetry element is not related with chirality?

- (a) POS (b) COS (c) AAOS (d) AOS

Plane of Symmetry :- imaginary plane

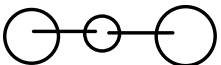
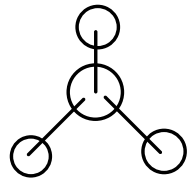
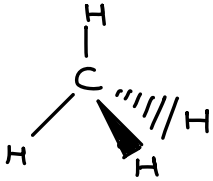
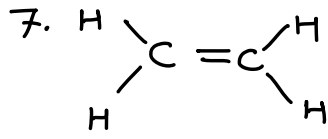
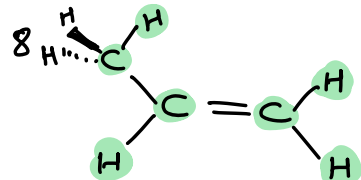


Center of Symmetry (COS) :- imaginary point

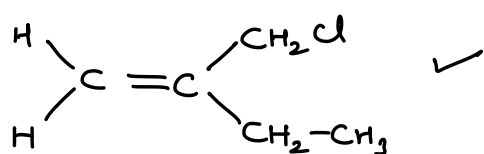


* COS in a molecule can never be greater than one.

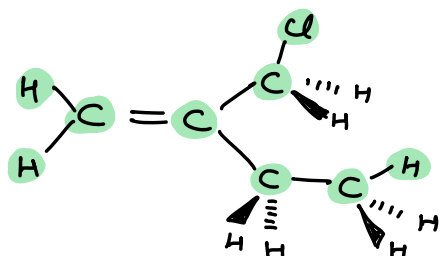
	POS	COS
Chiral	X	X
Achiral	✓	X
	X	✓
	✓	✓

Molecule	P.O.S	C.O.S.	chiral/ ~~Achiral~~ ^{CBJ}
1. BeCl_2 	✓	✓	~~Achiral~~
2. BF_3 	✓	✗	~~Achiral~~
3. CH_4 	✓ (6)	✗	~~Achiral~~
4. CH_3Cl	✓ (3)	✗	~~Achiral~~
5. CH_2ClF	✓(1)	✗	~~Achiral~~
6. CHBrClF	✗	✗	chiral
7. $\text{H}_2\text{C}=\text{CH}_2$ 	✓	✓	~~Achiral~~
8. 	✓ (Mol. plane)	✗	~~Achiral~~

9.



X

Achiral

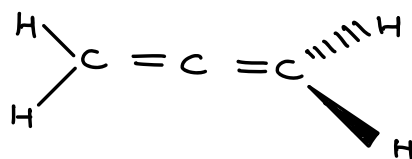
10.



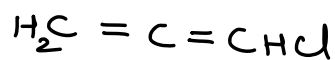
$$\checkmark$$

(2)

X

Achiral

11.



$$\checkmark$$

(1)

X

Achiral

12.

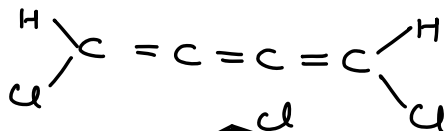


X

X

chiral

13.

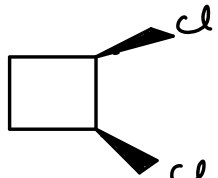


✓

X

Achiral

14.

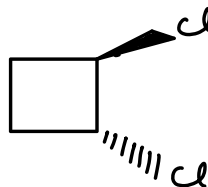


✓

X

Achiral

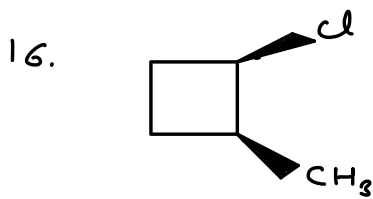
15.



X

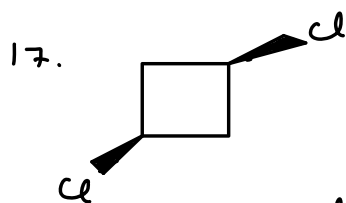
X

chiral



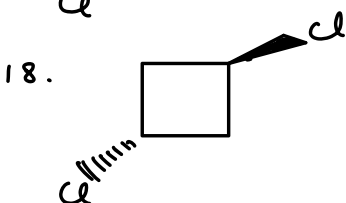
X

X

chiral

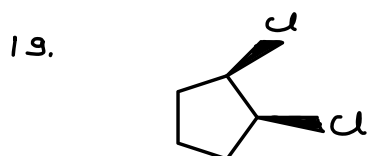
✓

X

achiral

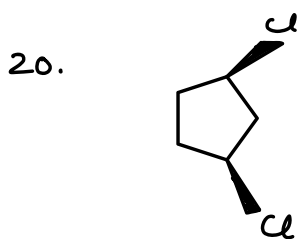
✓

✓

achiral

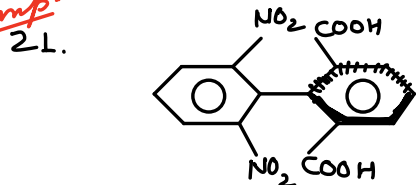
✓

X

achiral

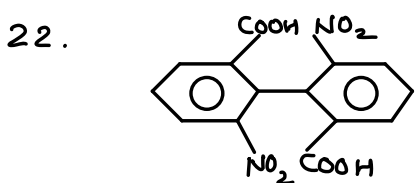
✓

X

*achiral**Imp:*

✓

X

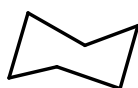
achiral

X

X

chiral

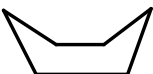
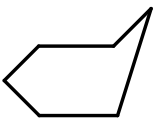
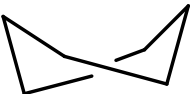
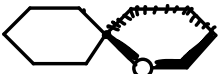
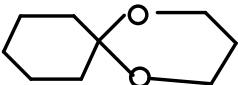
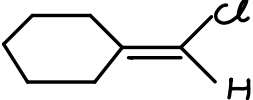
23.



✓

✓

*achiral**chair form*

24.  ✓ ✗ *Achiral*
Boat form
25.  ✓ ✗ *Achiral*
Half chair
26.  ✗ ✗ *Chiral*
Twist Boat
27.  ✓ ✗ *Achiral*
28.  ✗ ✗ *Chiral*
29.  ✓ ✗ *Achiral*
30.  ✓ ✗ *Achiral*

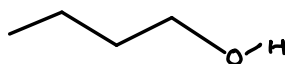
Chiral center and chiral carbon :-

CBJ

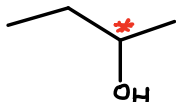
* sp^3 hybridised atom having four different groups is known as chiral center and if this atom is carbon then it is known as chiral carbon.

* Presence of chiral carbon is not an essential condition for a compound to be chiral. It only helps to recognise a key part of compound.

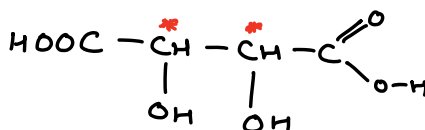
1> butan-1-ol



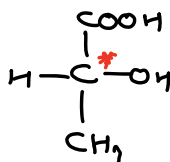
2> butan-2-ol



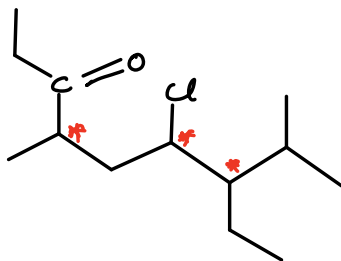
3> 2,3-dihydroxy
butan-1,4-dioic acid
(Tartaric acid)



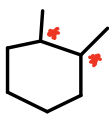
4> lactic acid



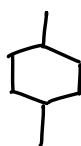
5>



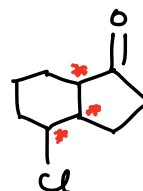
6>



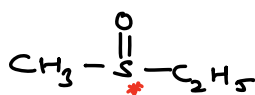
7>



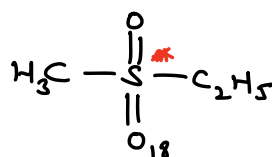
8>



9>

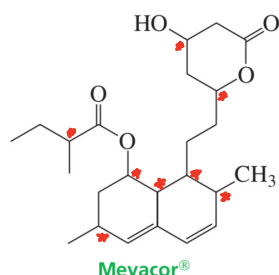


10>



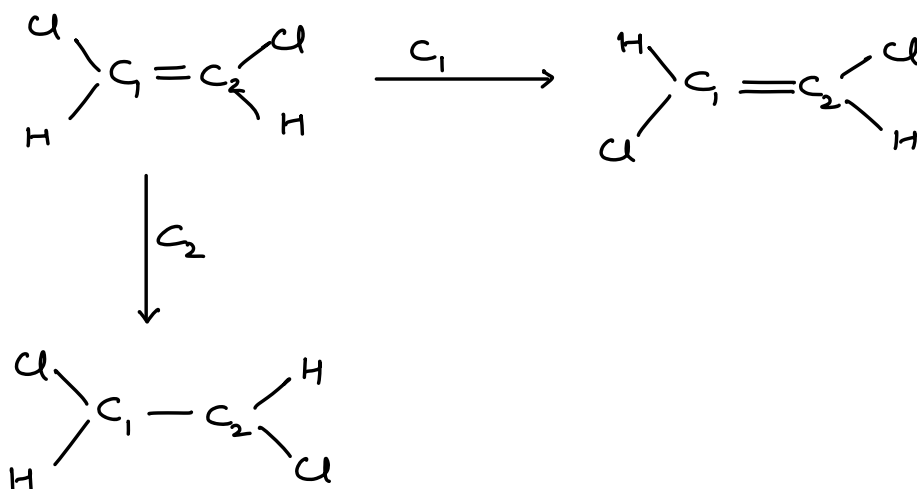
Ques

Mevacor is used clinically to lower serum cholesterol levels. How many asymmetric centers does Mevacor have?

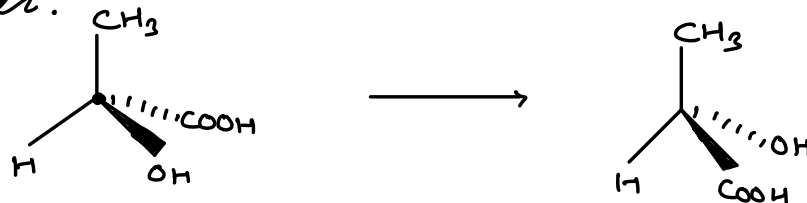


Stereo center :-

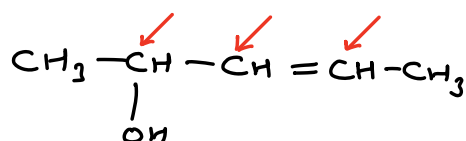
An atom about which if two groups are interchanged then a stereoisomer is formed is known as stereo center.



double bond which shows C.I. has two stereo center.



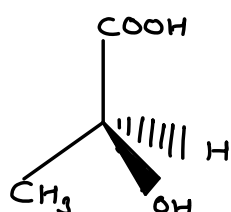
* All chiral centers are also stereo centers.



chiral center = 1
stereo center = 3

Projection formula :-

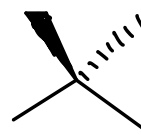
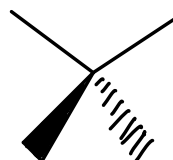
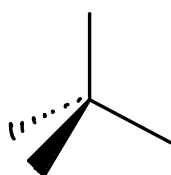
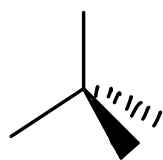
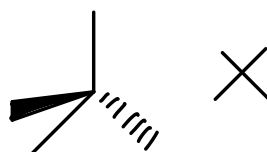
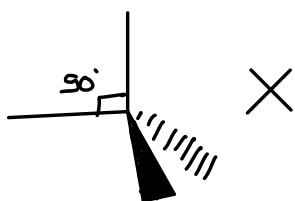
1. Wedge - dash projection formula
2. Fischer projection formula
3. Newman's " "
4. Saw-horse " "
5. Haworth " "

1. wedge - dash projection formula :-

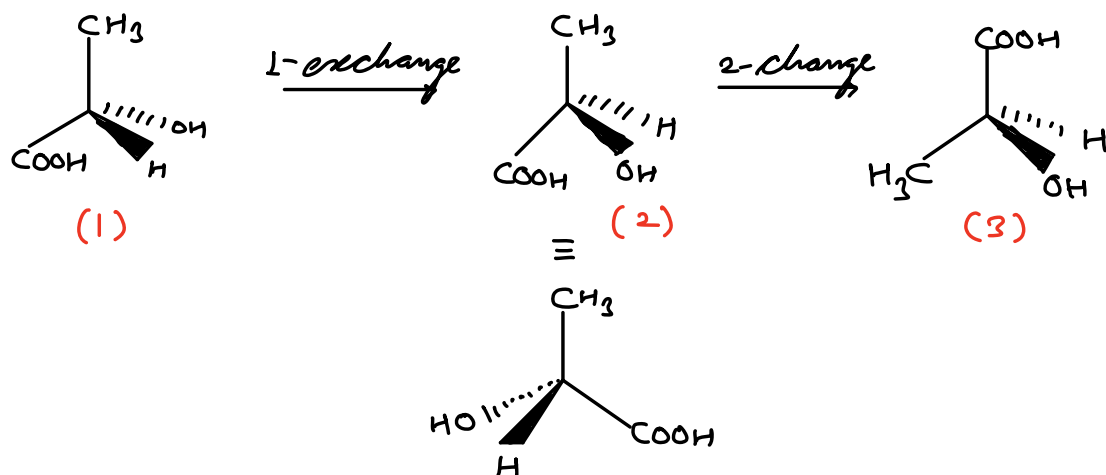
— Normal line → on the plane

▴ Solid wedge → towards the viewer

▾ dashed wedge → away from the viewer



- * If on a chiral carbon two groups are exchanged then configuration of that chiral carbon is changed.



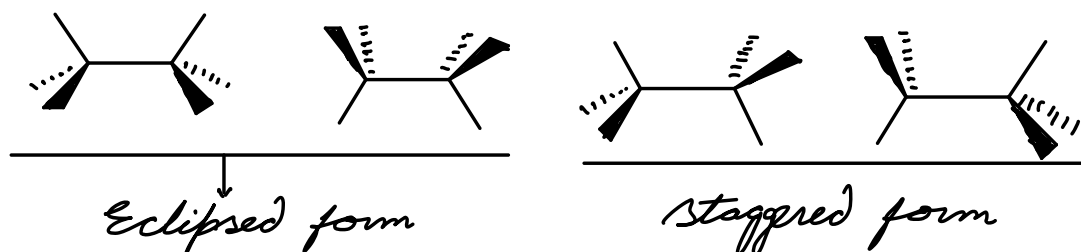
on odd changes :- configuration of chiral carbon will change

on even changes :- " " " remains same

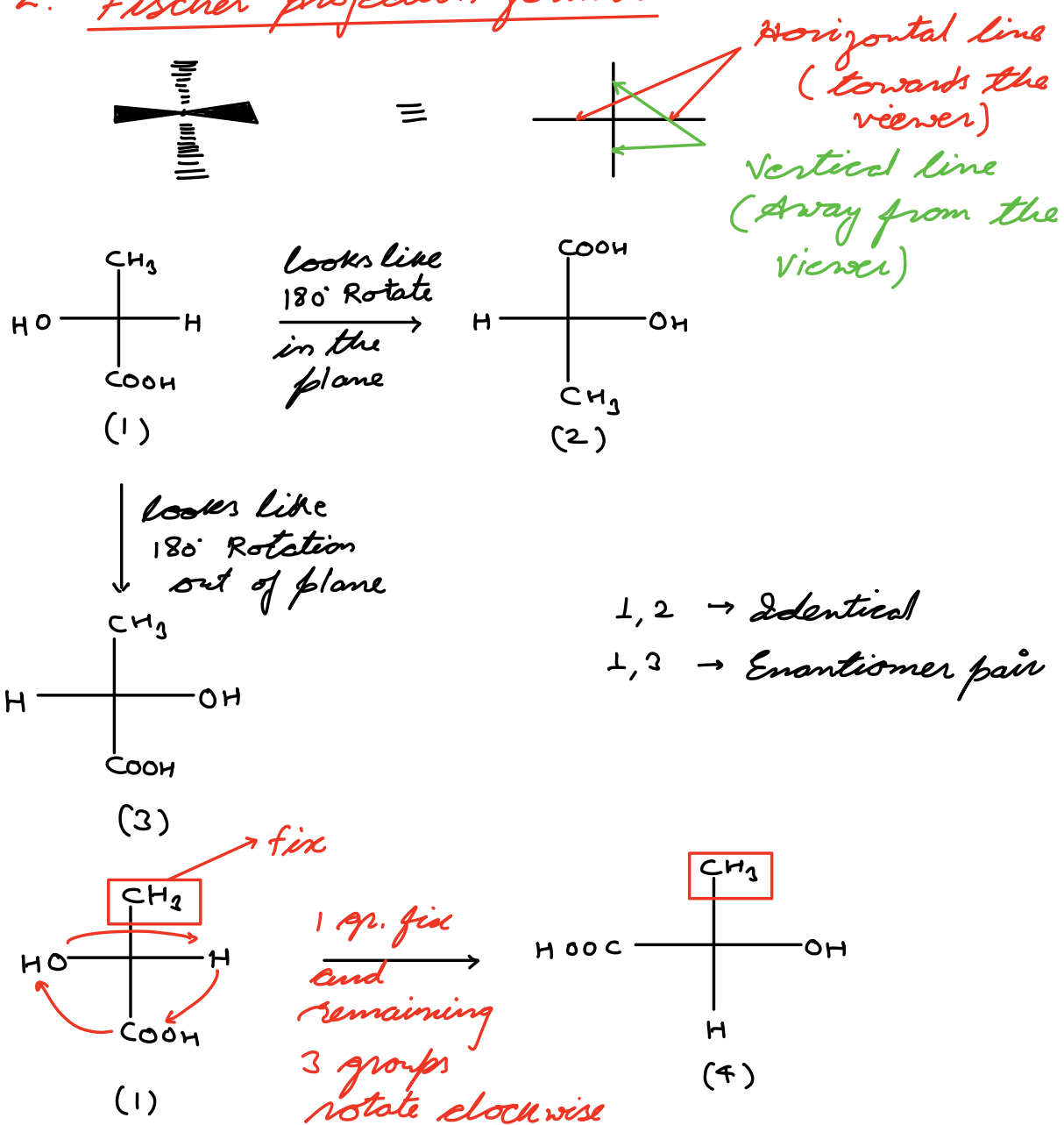
1, 2 :- Nonsuperimposable mirror images pair (Enantiomer pair)

1, 3 :- Identical (Homomers)

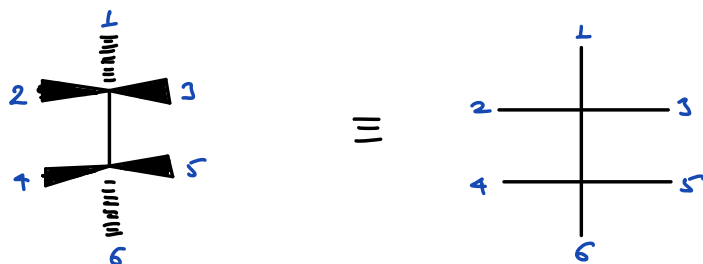
2, 3 :- Enantiomer pair



2. Fischer projection formula :-

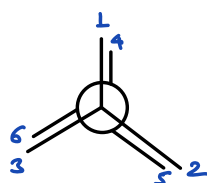


- * on rotating Fischer by 180° in the plane the configuration of chiral C does not change
- * If we fix one group and rotate other 3 groups either in clockwise or anticlockwise configuration of chiral C does not change.

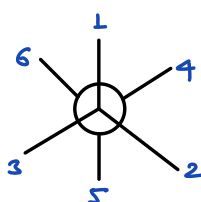


Fischer projection formula shows always Eclipse conformer never shows staggered.

3 > Newman's projection formula :- Front view

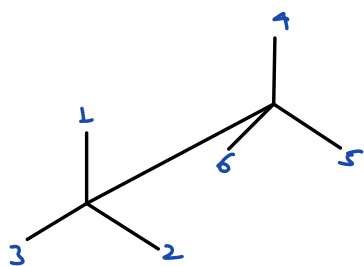


Eclipse

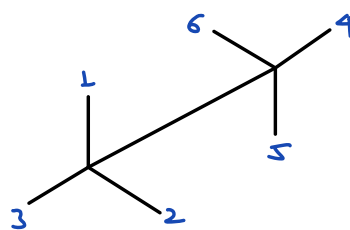


staggered

4 > Saw-horse projection formula :- Side view



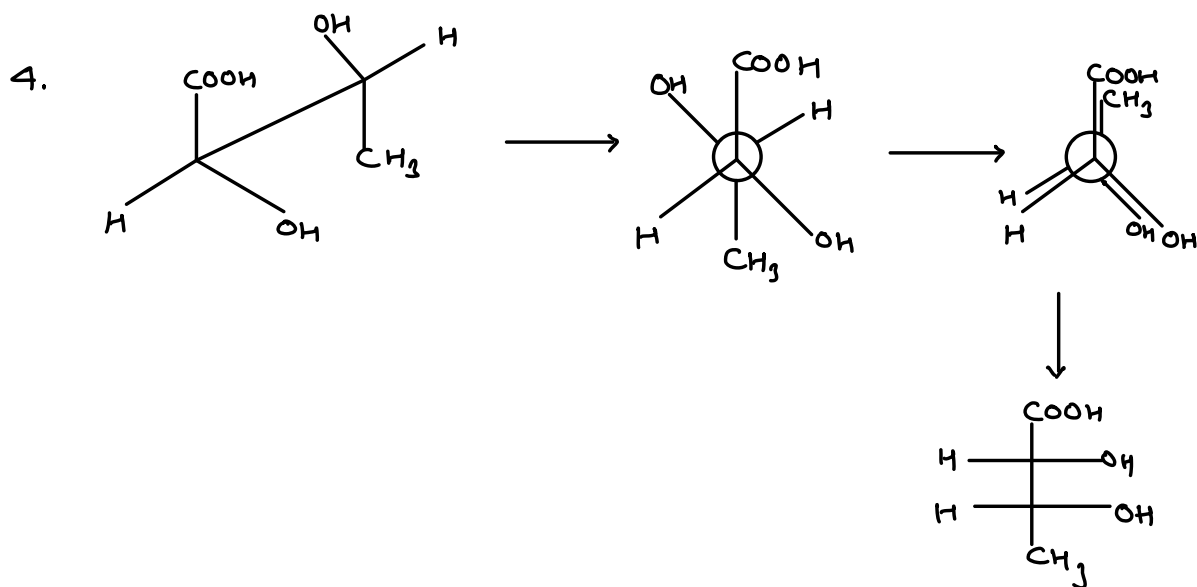
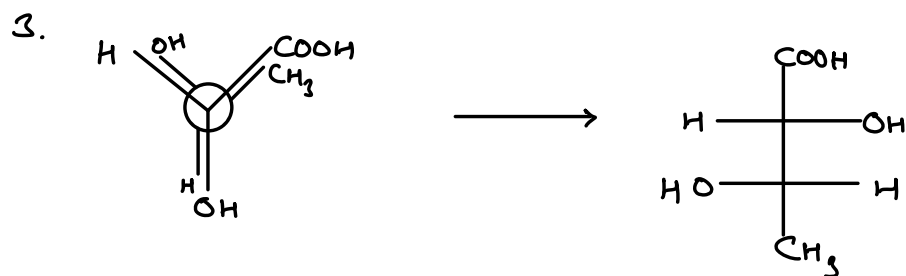
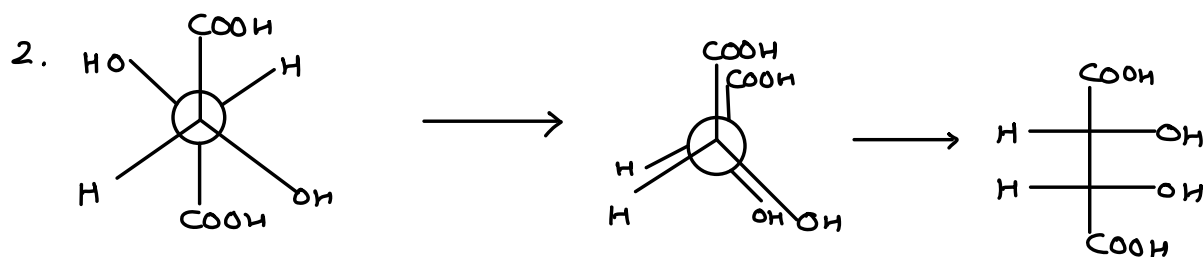
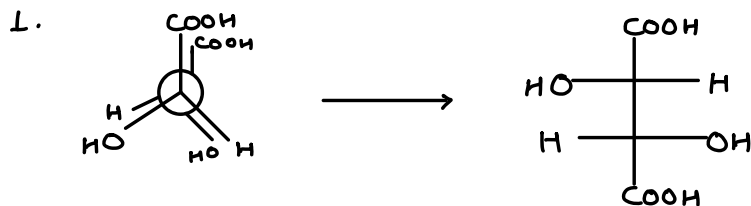
Eclipse

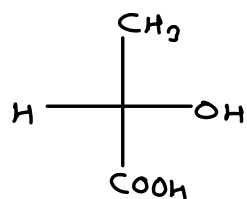
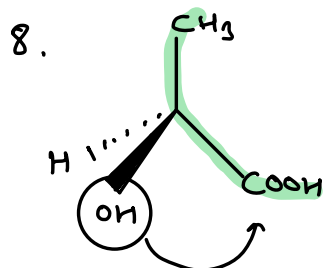
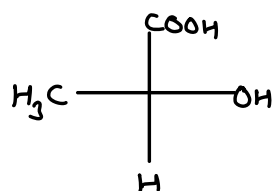
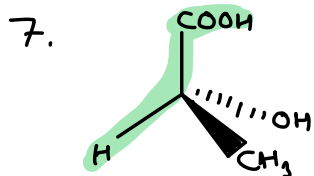
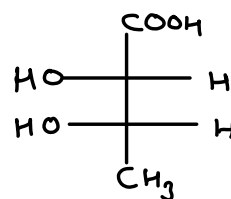
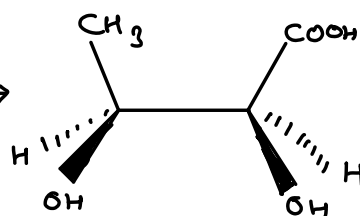
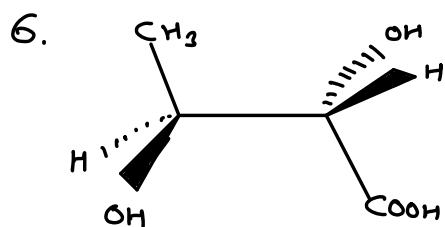
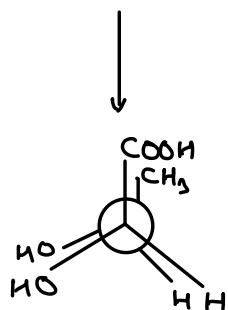
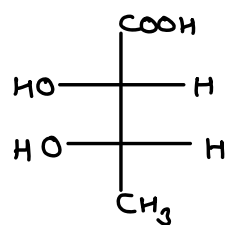
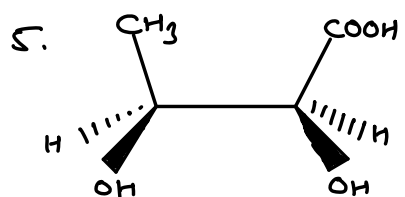


Staggered

Conversion of projection formula :-
convert all p.f. in Fischer.

CBJ





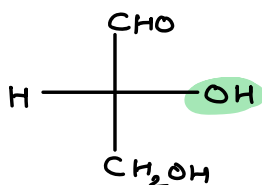
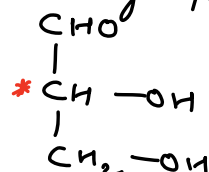
How to assign configuration of a chiral carbon:-

- 1> D-L configuration $\rightarrow$ Relative configuration
- 2> R-S configuration $\rightarrow$ Absolute configuration

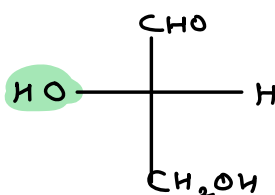
1> D-L configuration :-

carbohydrates :- poly hydroxy aldehyde / ketone

Ref. :- glyceraldehyde



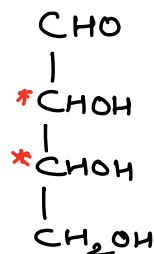
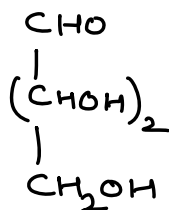
D-glyceraldehyde

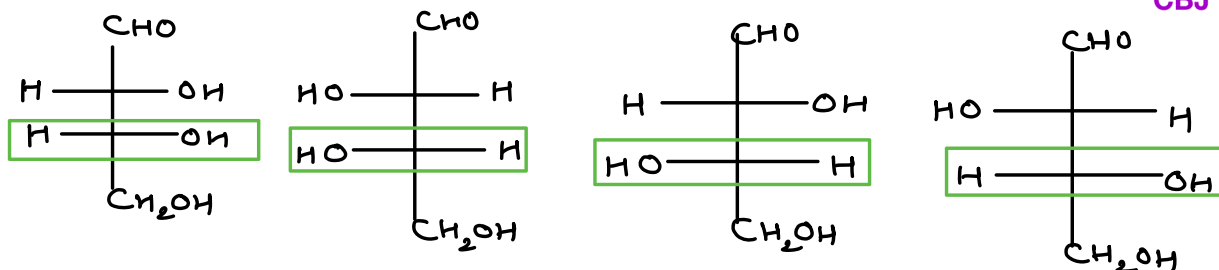


L-glyceraldehyde

* IUPAC Numbering $\rightarrow$ up to down

* If there is more than one chiral carbon then in this system, configuration of last chiral carbon will be decided.

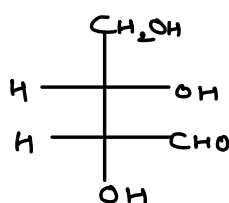




D-Erythrose L-Erythrose L-Threose D-Threose

D $\neq$ L

que



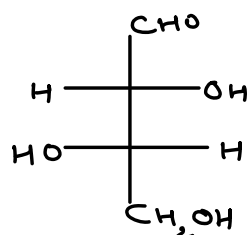
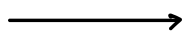
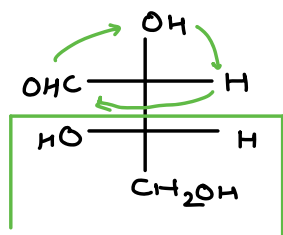
compound will be ?

(a) D-Erythrose

(b) L-Erythrose

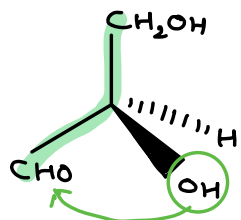
(c) D-Threose

(d) L-Threose

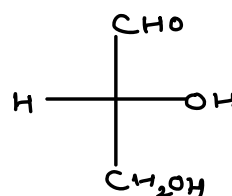
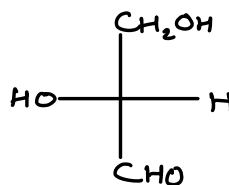


L-Threose

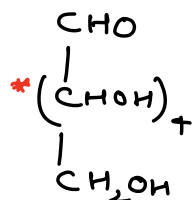
que



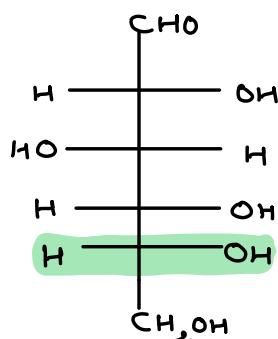
✓ (a) D-glyceraldehyde



(b) L-glyceraldehyde

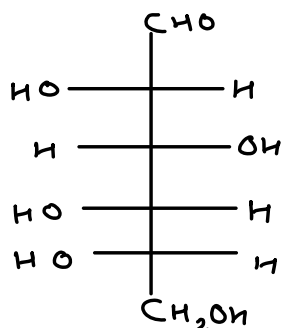


JEE-ADV
Free



this is the structure of D-glucose what will be the structure of L-glucose?

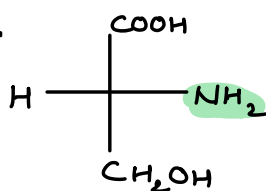
Sol:-



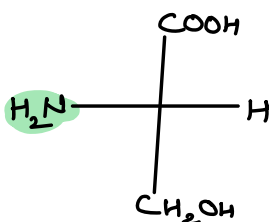
L-glucose

Amino Acids:-

Ref.

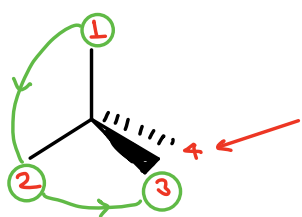


D-Serine

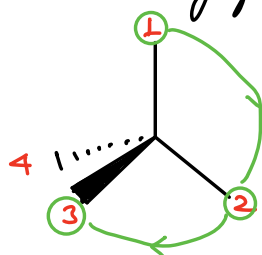


L-Serine

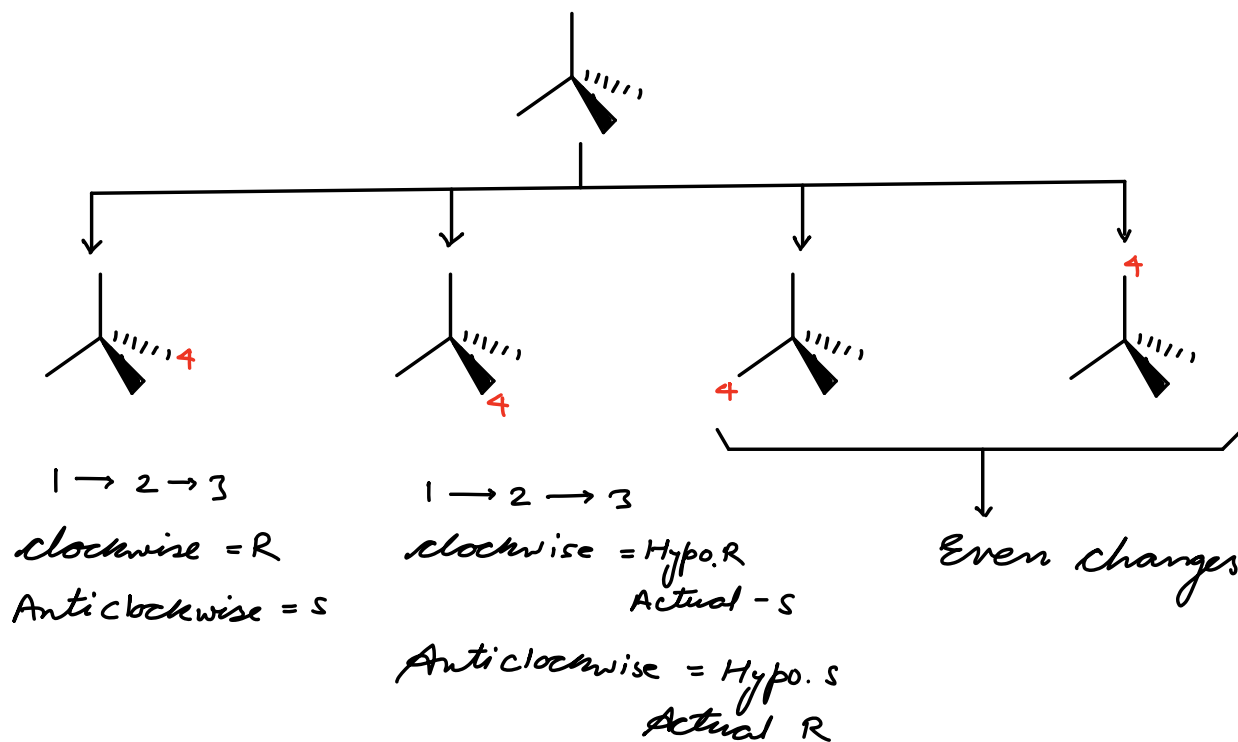
* All natural occurring amino acid have L-configuration.

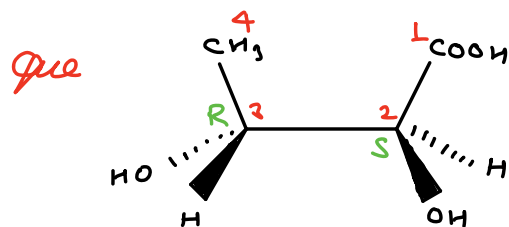
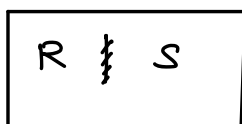
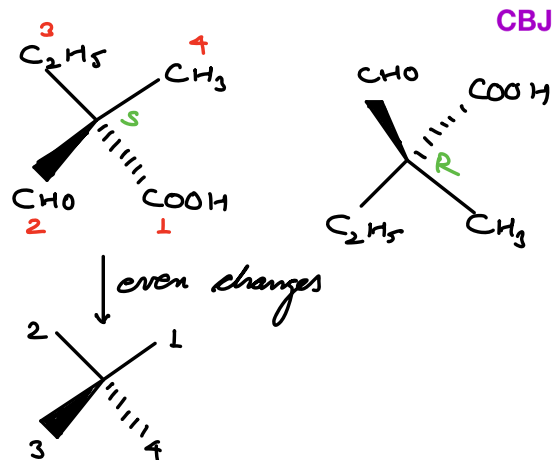
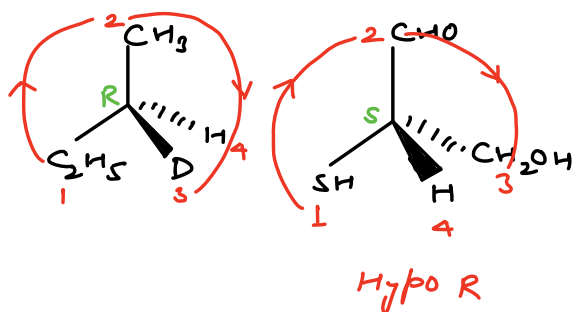
R-S configuration :-R = Rectus $\rightarrow$ clockwiseS = Sinister $\rightarrow$ AnticlockwiseRule -1 Priority rule $\rightarrow$ CIP Rule / sequence ruleRule -2 Chirality rule $\rightarrow$ lowest priority
away from the viewer

Anticlockwise = S



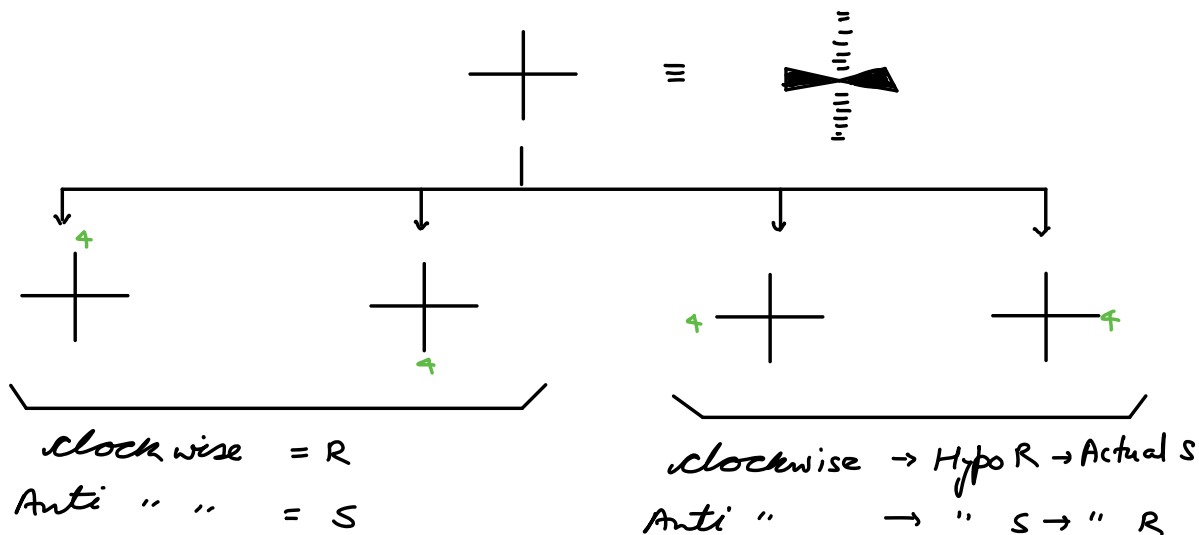
clockwise = R

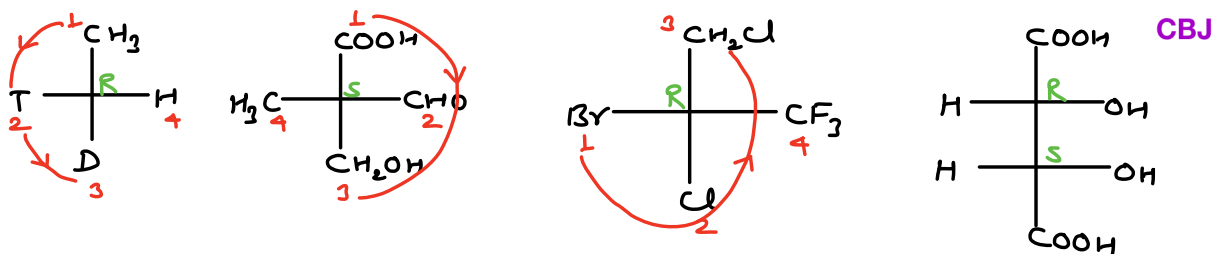




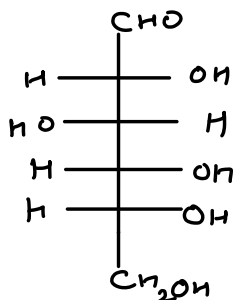
write the IUPAC name of the compound with its configuration?

Sol:- (2S,3R) 2,3-dihydroxybutanoic acid

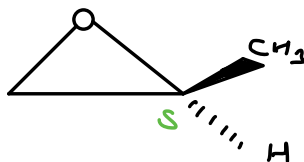
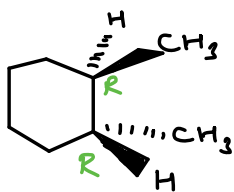




Que write the IUPAC name of D-glucose?

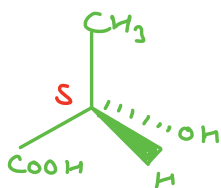


(2R, 3S, 4R, 5R) - 2, 3, 4, 5, 6 - pentahydroxy hexanal

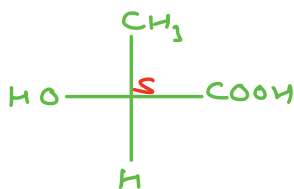


Enantiomers :- pair of Non superimposable mirror images is known as enantiomer pair.

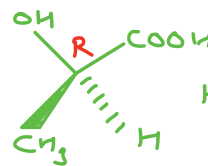
Que what is the relationship in b/w following



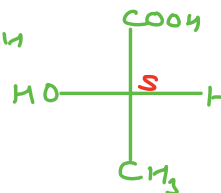
(1)



(2)



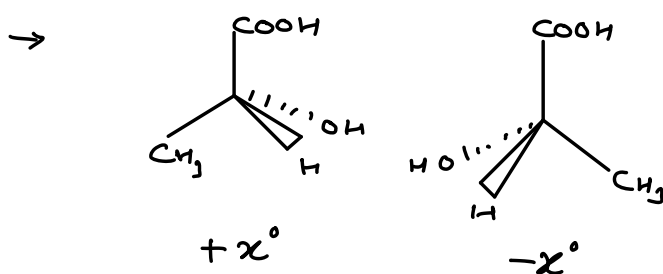
(3)



(4)

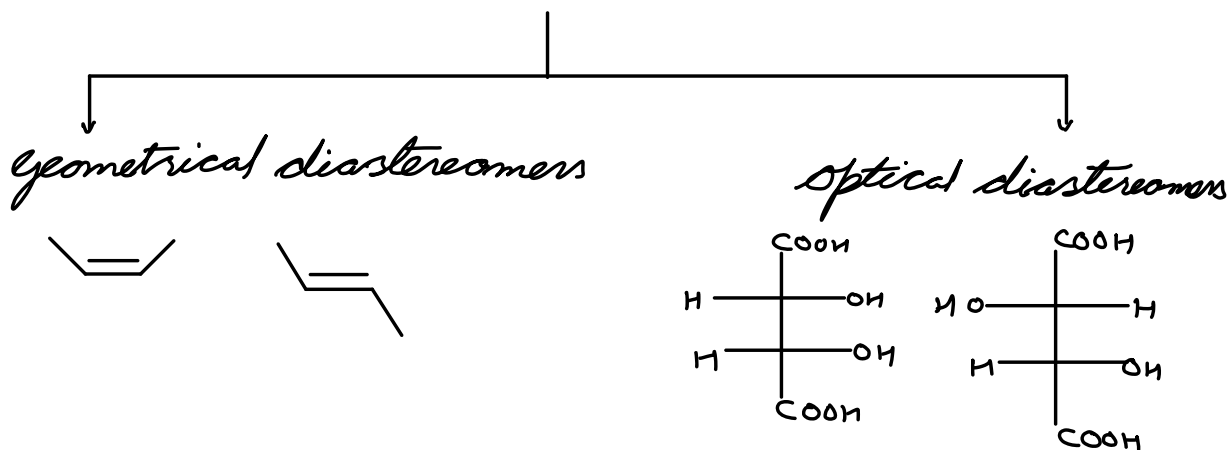
1, 2 :- *identical* 2, 3 :- *Em.* 3, 4 :- *Enantiomers*
 1, 3 :- *Enantiomers* 2, 4 :- *identical*
 1, 4 :- *identical*

→ Enantiomers have same physical properties that's why these can't be separated by a physical method like crystallisation or distillation.



Enantiomers has same magnitude of angle of rotation but the direction is opposite.

Diastereomers :- non mirror image stereo isomers

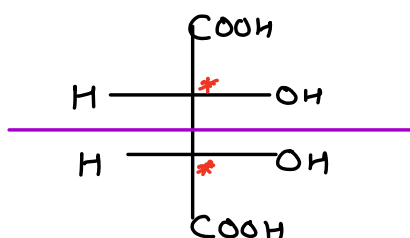


→ Diastereomers has different physical properties so these can be separated by a common physical method.

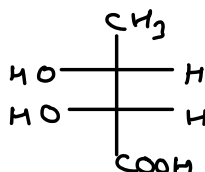
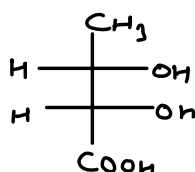
Meso Compound :-

→ two or more two chiral carbon but also has POS or COS or both will present.

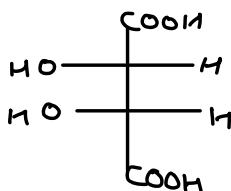
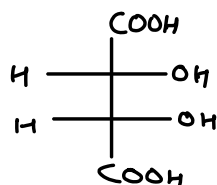
→ Achiral



Que



Set-1



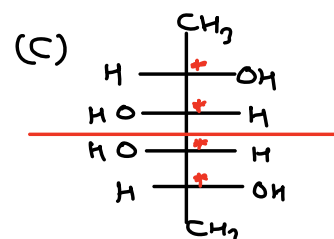
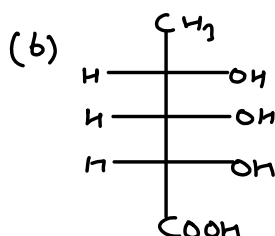
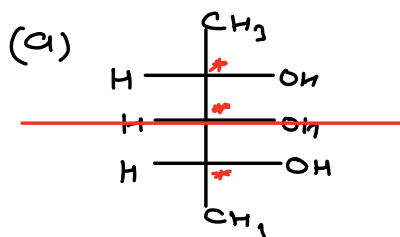
Set-2

What will be the relationship in b/w compounds in both sets?

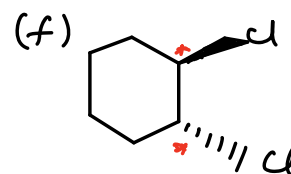
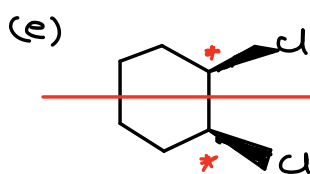
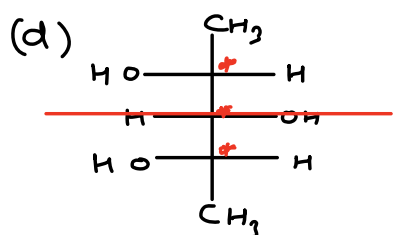
Sol. :- Set-1 :- Enantiomer

Set-2 :- Identical

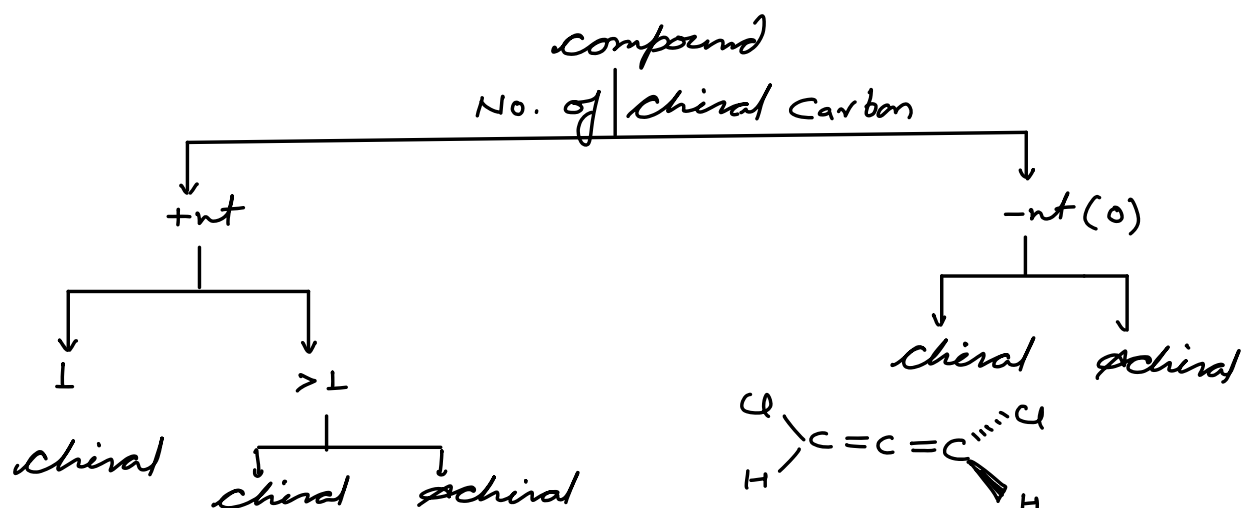
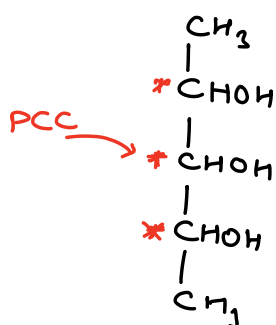
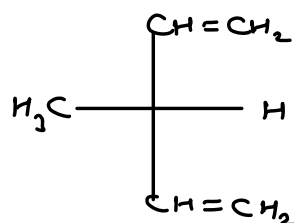
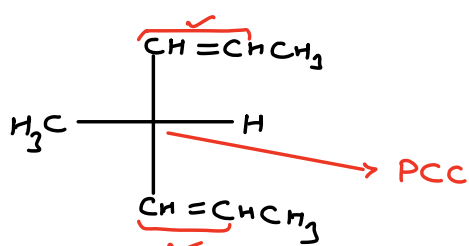
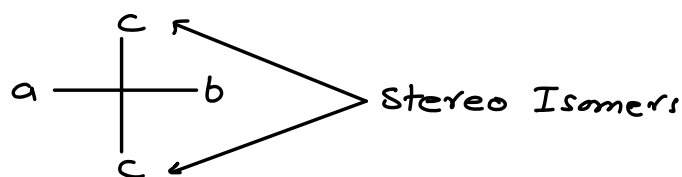
Que find the meso :-



CBJ



Pseudo chiral carbon :- conditional chiral carbon



No. of Stereo Isomers :-

CBJ

1. Butan-1-ol

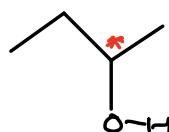


G.I. X

O.I. X

Does not show Stereo Isomerism

2. Butan-2-ol

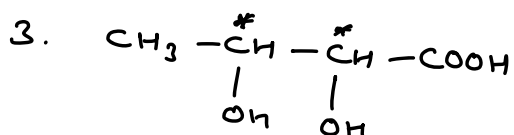
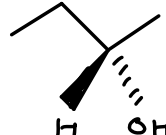
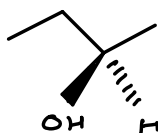


G.I. X

O.I. ✓

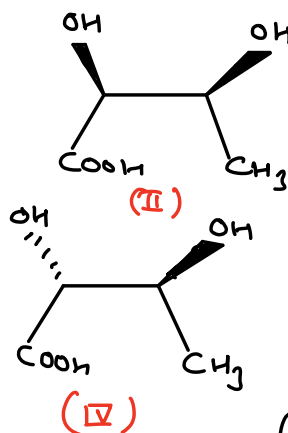
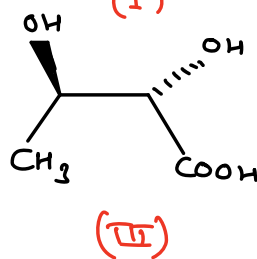
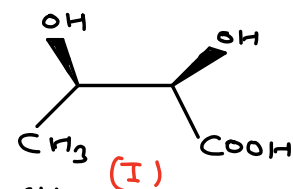
S.I. = 2

Enantiomer pair = 1
Optical Isomers = 2



RR $\nparallel$ SS

RS $\nparallel$ SR



G.I. X

O.I. ✓

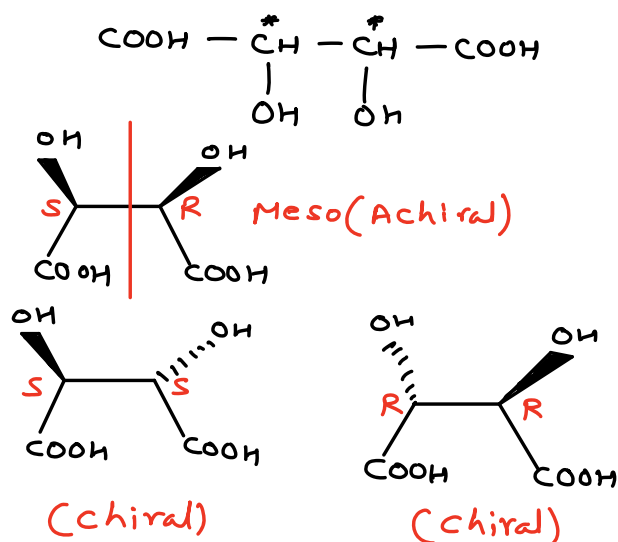
Stereo Isomers = 4

Enantiomer pair = 2
(I, II; III, IV)

Diastereomer pair = 4

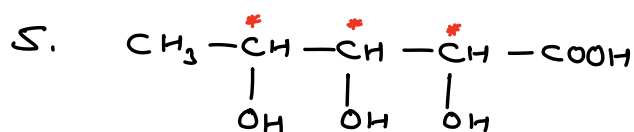
(I, III; I, IV; II, III; II, IV)

All are Chiral
Optically Active

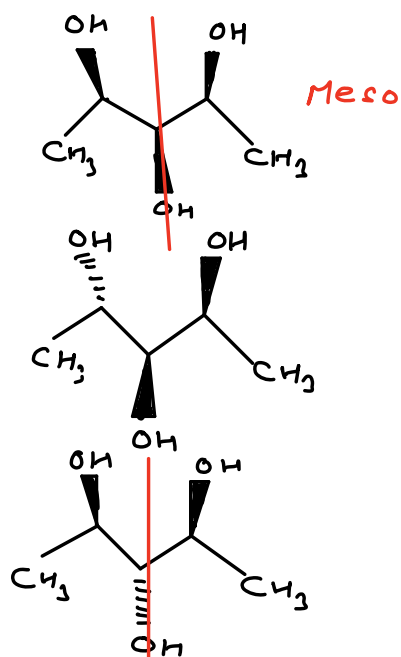
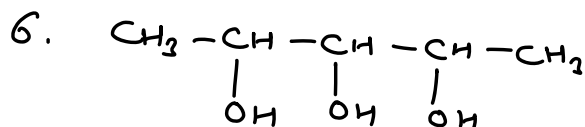
4. Tartaric Acid :-

Stereo Isomers = 3
 Chiral (optical active) = 2
 Achiral (inactive) = 1
 Optical isomers = 3

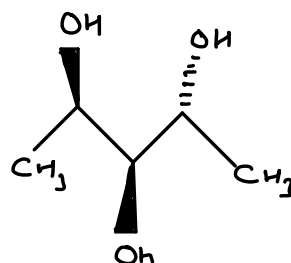
RR, SS, RS/SR



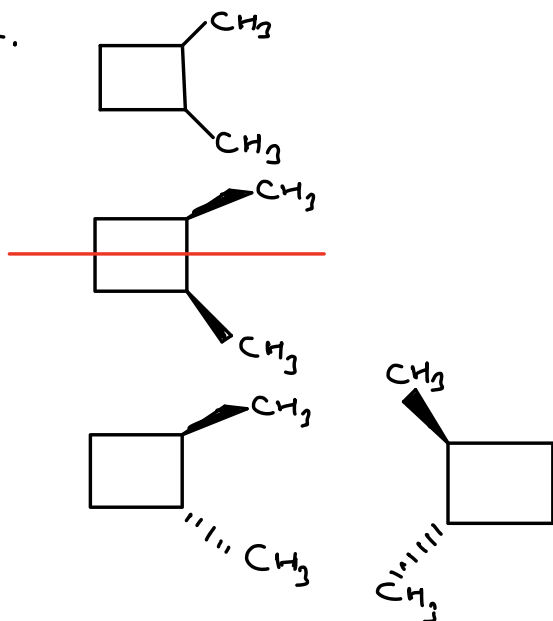
S.I. = 8
 Enantiomer pair = 4
 All are chiral



Stereo Isomers = 4
 Meso = 2
 Enantiomer = 1



7.

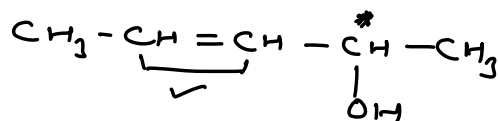


Stereo Isomers = 3

G.I. ✓ = (2)

O.I. ✓ = (3)

8.

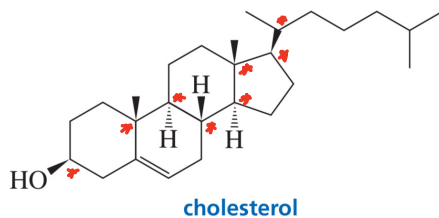


G.I. ✓

O.I. ✓

S.I. = 4

The stereoisomer of cholesterol found in nature is shown here.



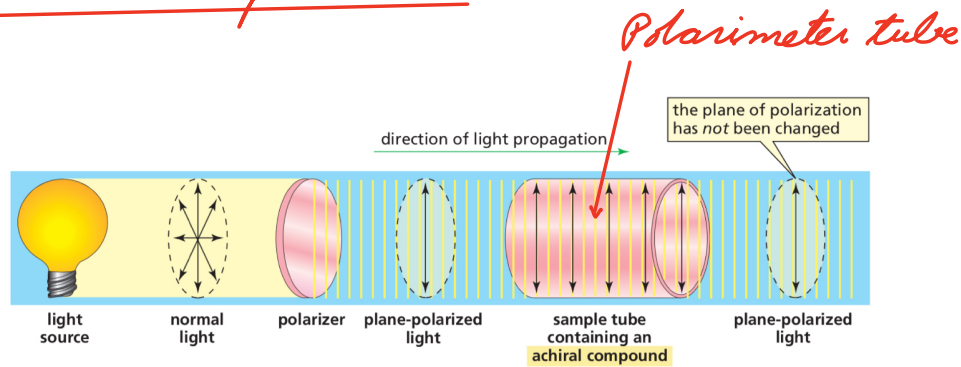
- How many asymmetric centers does cholesterol have?
- What is the maximum number of stereoisomers that cholesterol can have?

Sol:- (a) 8

(b) Asym. $(2)^8 = 256$

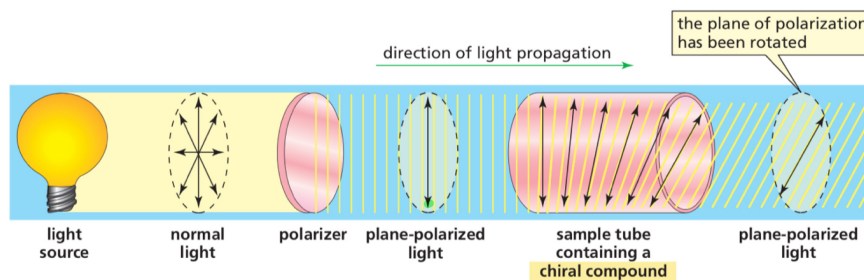
Polarimeter Experiment :-

CBJ



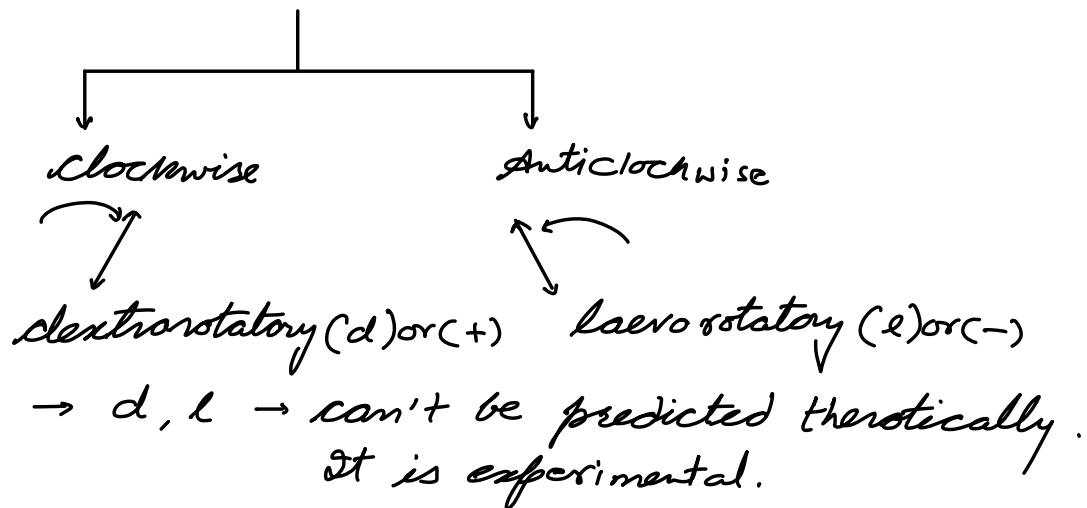
An achiral compound does not rotate the plane of polarization of plane-polarized light.

optically inactive $\rightarrow$ which does not change plane of PPL.
(Achiral)



A chiral compound rotates the plane of polarization of plane-polarized light.

optically active $\rightarrow$ which change plane of PPL.
(Chiral)



Angle of rotation (θ) :-

depends upon following factors :-

1. concentration of solution
2. length of polarimeter tube
3. Nature of compound
4. Temp
5. Nature of light

$$\theta \propto c l$$

$$\theta = [\alpha]_{D\text{-Line}}^{25^\circ\text{C}} c l$$

$$c \rightarrow \text{g/mL}$$

$$l \rightarrow \text{dm}$$

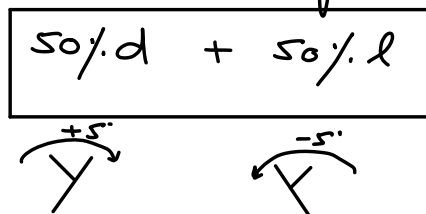
$$[\alpha]_{D\text{Line}}^{25^\circ\text{C}} = \frac{\theta}{c \cdot l}$$

↓
specific rotation

$[\alpha]$ does not depend upon conc. and length.

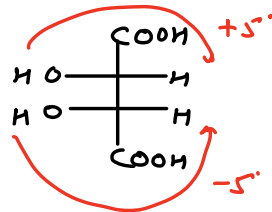
Racemic mixture (Racemate) :-

equimolar mixture of enantiomers



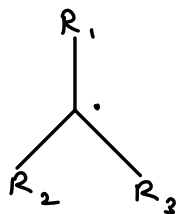
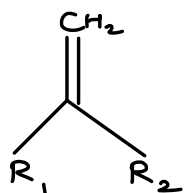
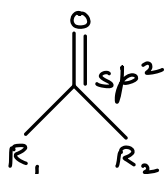
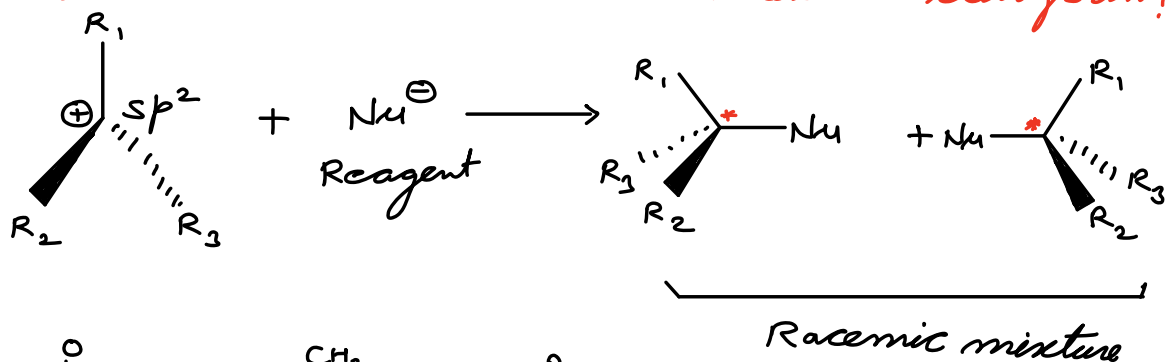
→ Racemic mixture is optically inactive due to external compensation.

→ Meso compound is optically inactive due to internal compensation

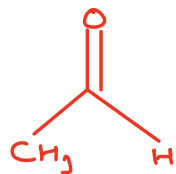


Representation of Racemic mixture $\rightarrow (dl)/(\pm)$

Imp. In which reactions racemic mixture can form?

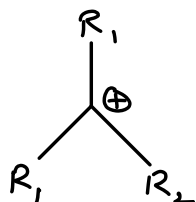


Que



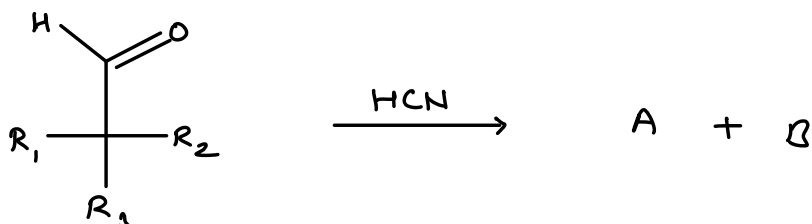
Nature of product = ?

- ✓ (i) Racemic mixture
- (ii) Mixture of diastereomers
- (iii) Identical



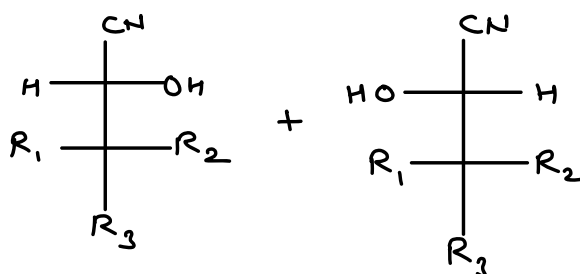
NO Racemic mixture will form.

Ques



what is the relationship in b/w A and B?

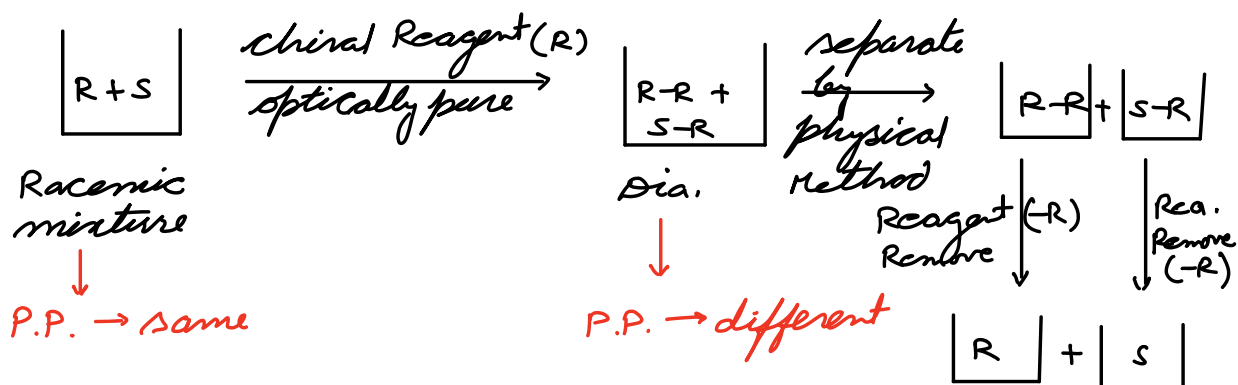
Sol:-



pair of Diastereomer

Note :- 0 chiral Carbon $\longrightarrow$ Pro.
 1 chiral Carbon $\longrightarrow$ 1 chiral C $\rightarrow$ R.M.
 2 chiral Carbon $\longrightarrow$ 2 chiral C $\rightarrow$ Dia.

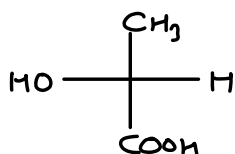
How to Resolve Racemic Mixture :-



* Resolution

Ques WOTF reagent can be used for resolution of Racemic mixture of lactic acid?

- (a) butan-1-ol
 (b) (+) butan-2-ol
 (c) (-) butan-2-ol
 ✓ (d) both b and c

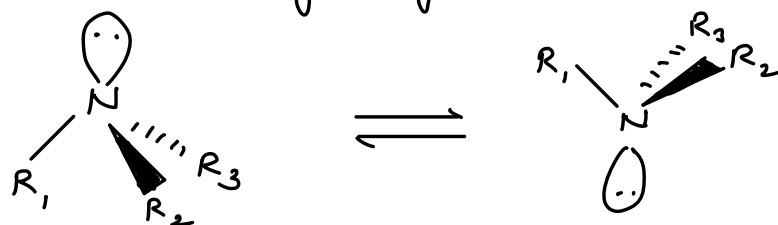
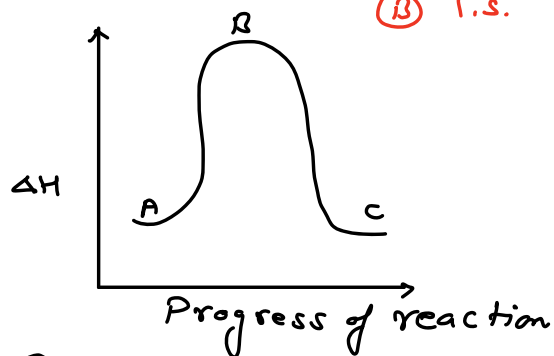
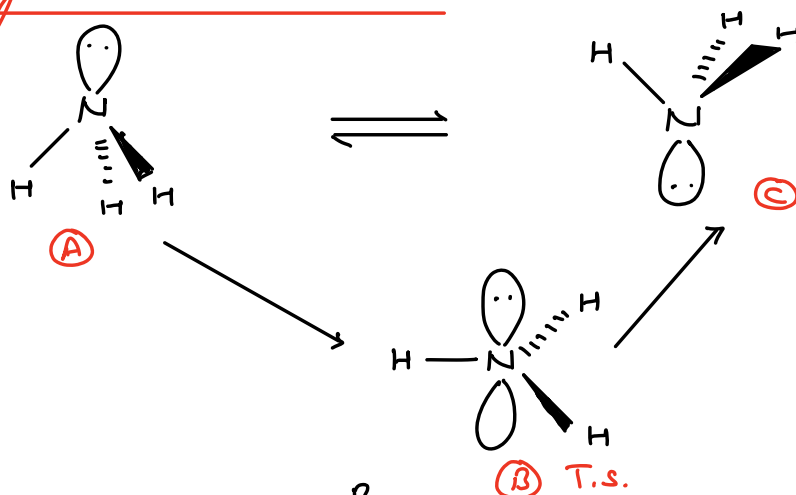


	%d	%l	%e.e./o.p.	% Racemisation	$[\alpha]_{\text{mix}}$
<i>pure</i> 1.	100%	0%	100%	0%	$+x^\circ$
2.	80%	20%	60%	40%	$+0.6x^\circ$
3.	50%	50%	0%	100%	0°
4.	40%	60%	20%	80%	$-0.2x^\circ$
<i>pure</i> 5.	0%	100%	100%	0%	$-x^\circ$

$$\% \text{ e.e.} = \frac{[\alpha]_{\text{obs}}}{[\alpha]_{\text{pure}}} \times 100$$

$$\% \text{ e.e.} = |\%d - \%l|$$

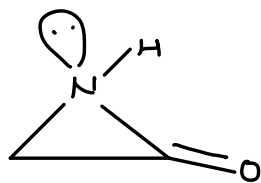
Pyramidal Inversion :-



→ chiral but optically inactive due to pyramidal inversion.

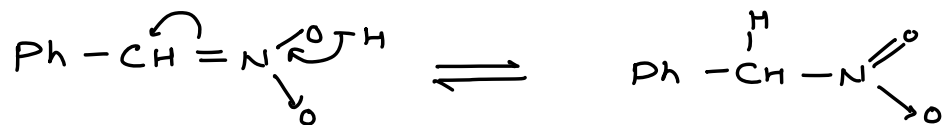
optically active = chiral + Resolvable

* All optically active are chiral but all chiral are not optically active.



pyramidal inversion → absent
chiral
optically active

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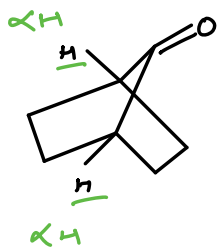


Acinitro form

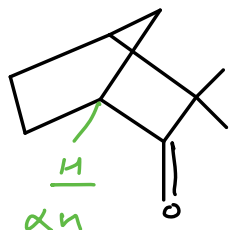
nitro form

Ans is (b)

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but Kaam ka nahi hai.
violates Bredt's rule.

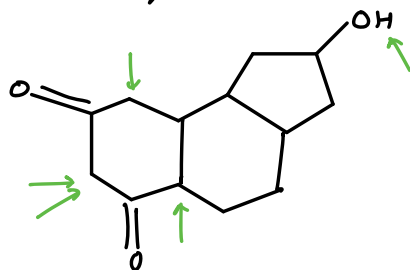


,,
,,

Ans is (d)

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concept :- the site at which base can abstract a proton D-exchange can be possible.



Ans is (b)