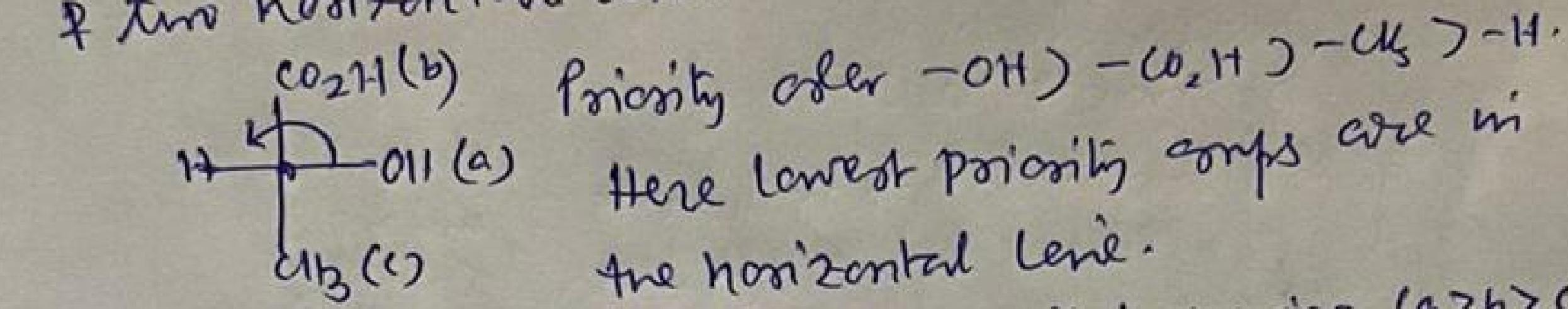


(1)

Fischer Projection:

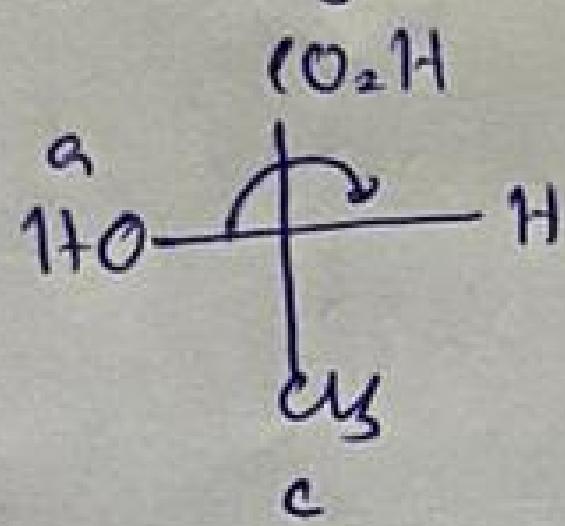
Fischer formula is a convention for displaying the three dimensional structure of molecules with chiral centre in a planar representation. Here the molecule is oriented that the each chiral carbon is in the plane & the four bonds are shown by two vertical & two horizontal lines.



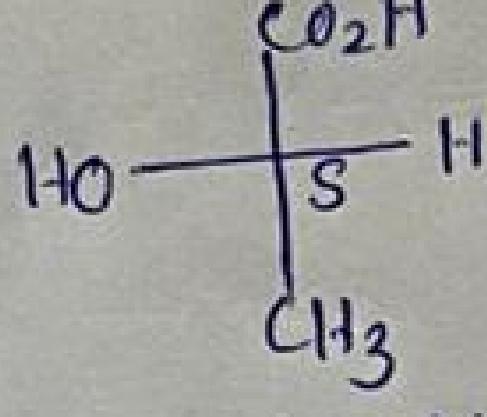
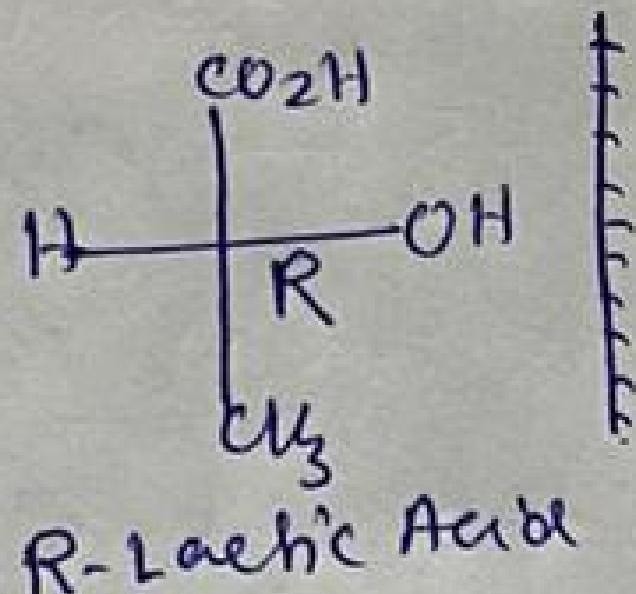
Here lowest priority groups are in the horizontal line.

a, b, c are priority of groups.

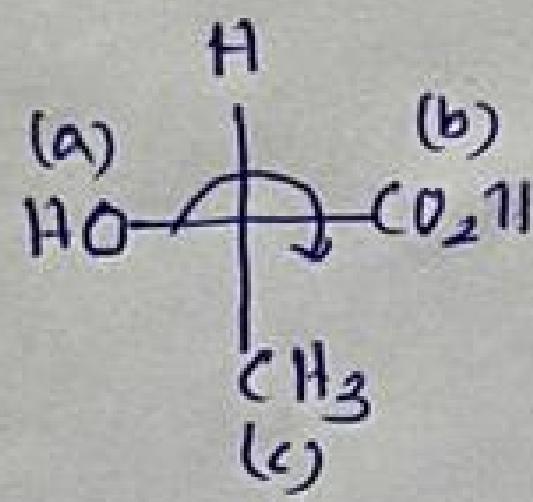
$a \rightarrow b \rightarrow c$ anticlockwise ($a > b > c$).
it is designated R.



$a \rightarrow b \rightarrow c$ clockwise.
it is designated S.

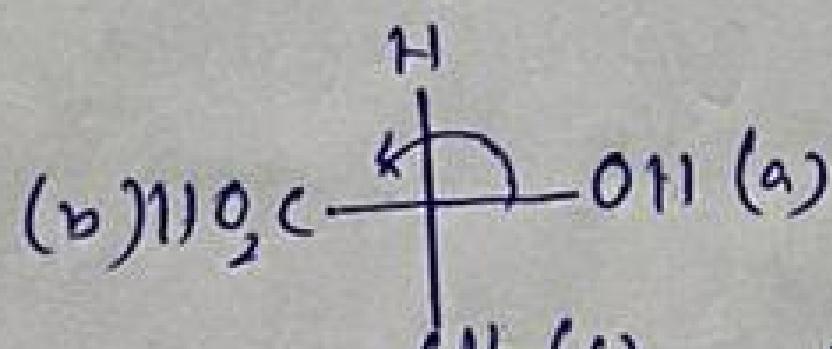


S-Lactic acid.

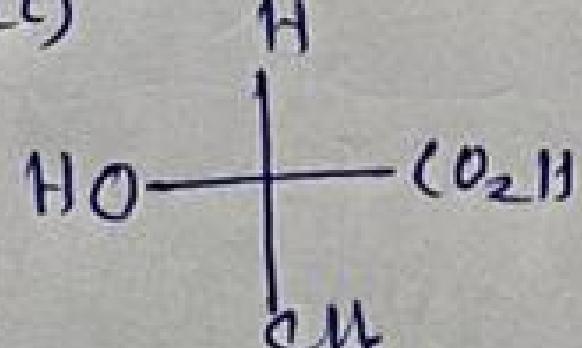


If lowest priority groups are in the vertical line.

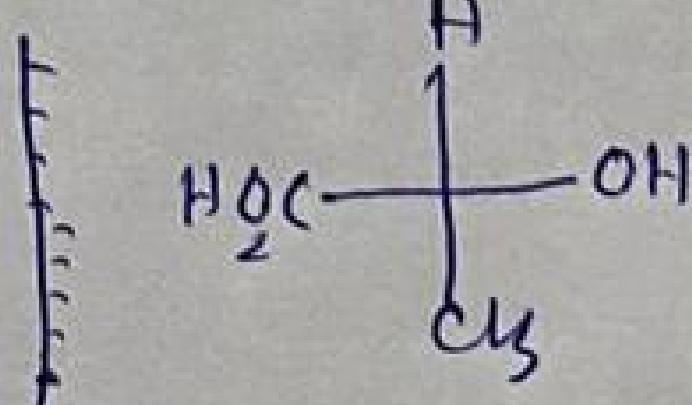
$a \rightarrow b \rightarrow c$ clockwise (R)



$a \rightarrow b \rightarrow c$ anticlockwise (S).



R-Lactic Acid

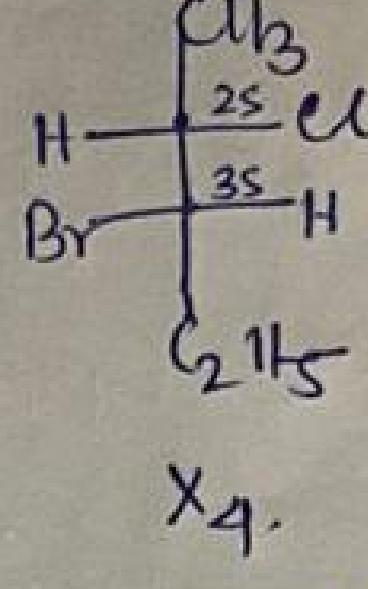
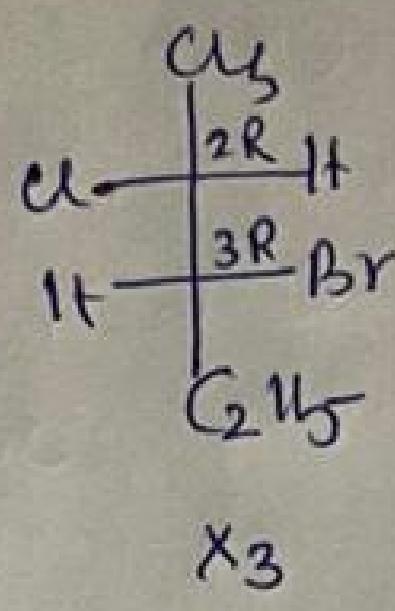
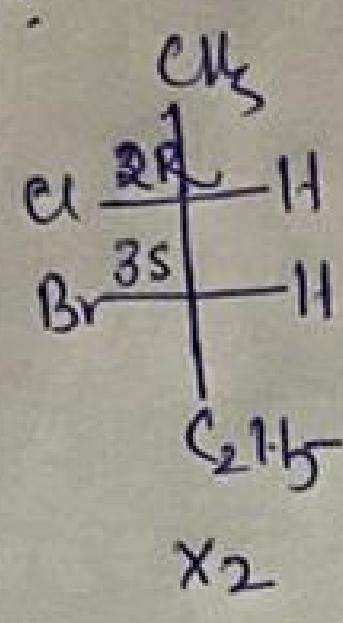
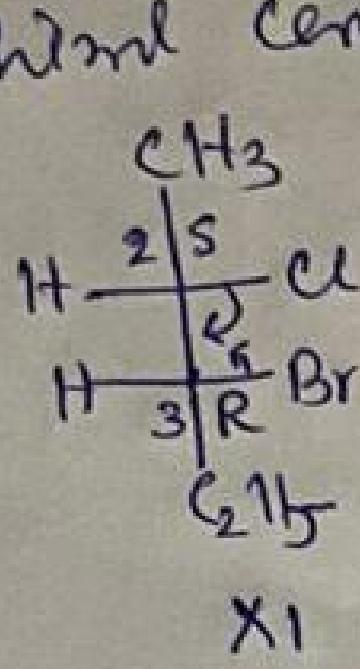


S-Lactic Acid.

②

- ⇒ for one chiral centre, 2 stereo isomers are possible
 ⇒ They are related as ENTS, they are designated as R & S.
 ⇒ Two time inter^{ter}change of any two groups result in identical molecule. One time inter change results in ENT along same chiral centre.

⇒ Fischer Projection of a cpd with more than one chiral centre:



Total 4 stereo isomers
one possible

$x_1, x_2 \Rightarrow$ enantiomers.

$x_3, x_4 \Rightarrow$ enantiomers.

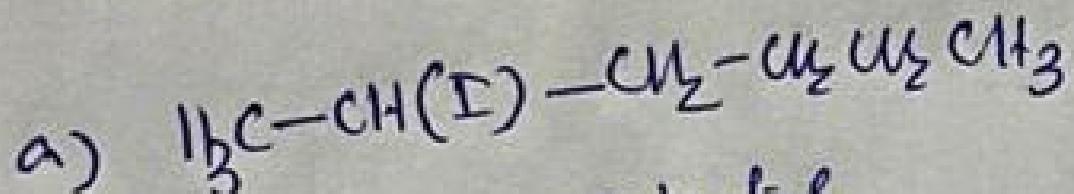
$x_1, x_3; x_1, x_4; x_2, x_3; x_2, x_4$ are diastereomers.

What are the structures of a) 2 iodo hexane - S isomer.

b) 3 heptanol - R isomer.

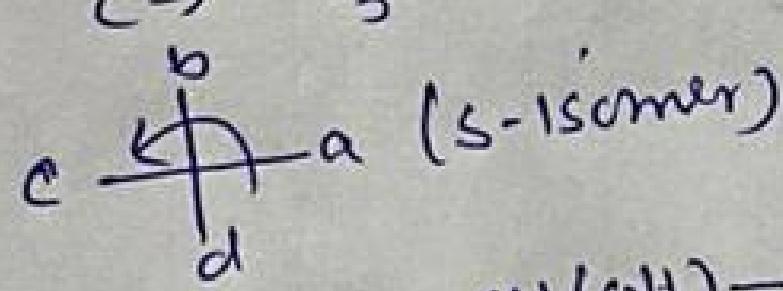
c) R-glyceraldehyde.

d) S-2-bromo- 2-chloro butane



a $\Rightarrow -\text{I}$. b \Rightarrow n butyl

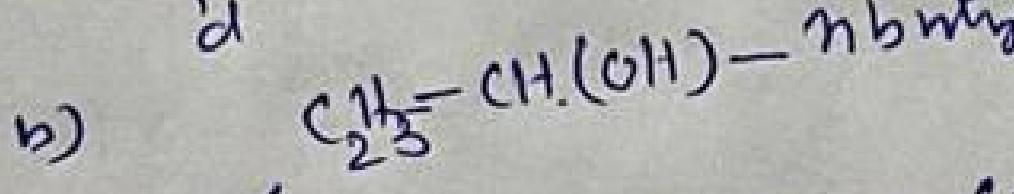
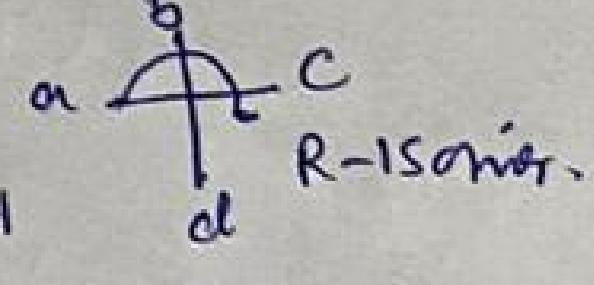
c $\Rightarrow -\text{CH}_3$ d $\Rightarrow -\text{H}$.



a $\Rightarrow -\text{OH}$.

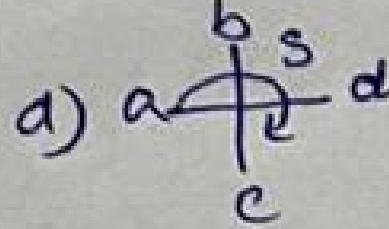
b \Rightarrow n butyl

c $\Rightarrow -\text{CH}_2\text{OH}$. d $\Rightarrow -\text{H}$.



a $\Rightarrow -\text{OII}$ c $\Rightarrow -\text{CH}_2$

b $\Rightarrow -\text{CH=O}$. d $\Rightarrow -\text{H}$.



a $\Rightarrow -\text{Br}$
b $\Rightarrow -\text{Cl}$.
c $\Rightarrow \text{Cl}$.
d $\Rightarrow -\text{CH}_3$.



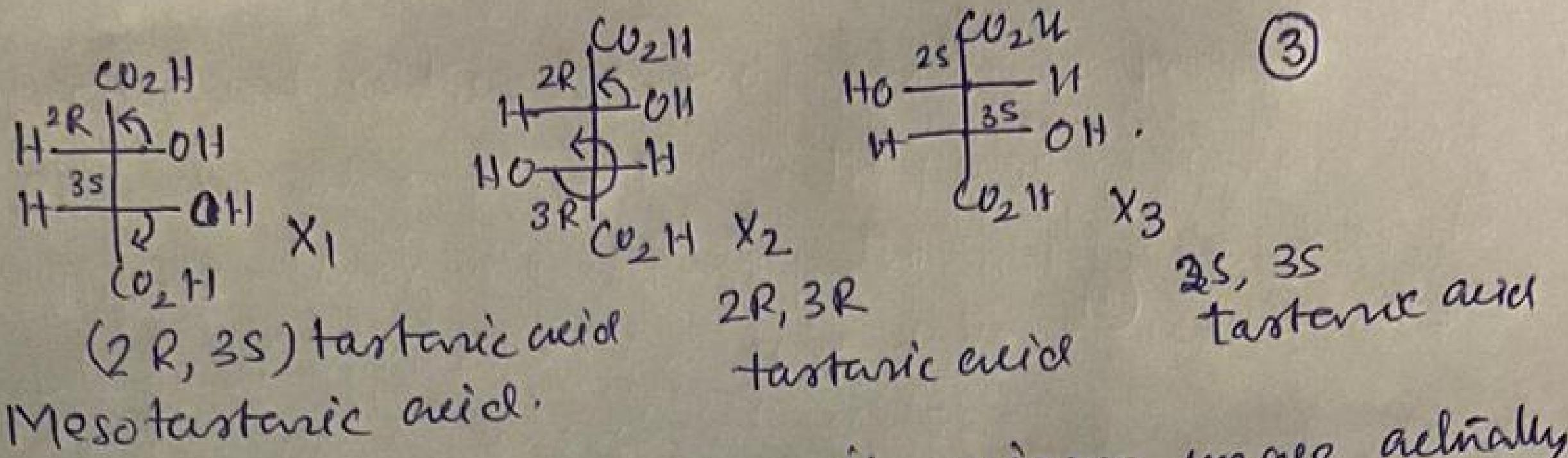
a $\Rightarrow -\text{OII}$ c $\Rightarrow -\text{CH}_2$

b $\Rightarrow -\text{CH=O}$. d $\Rightarrow -\text{H}$.

Q. If compound have 2 chiral centre

If molecule has plane of symmetry

then Fischer projection will be given as follows

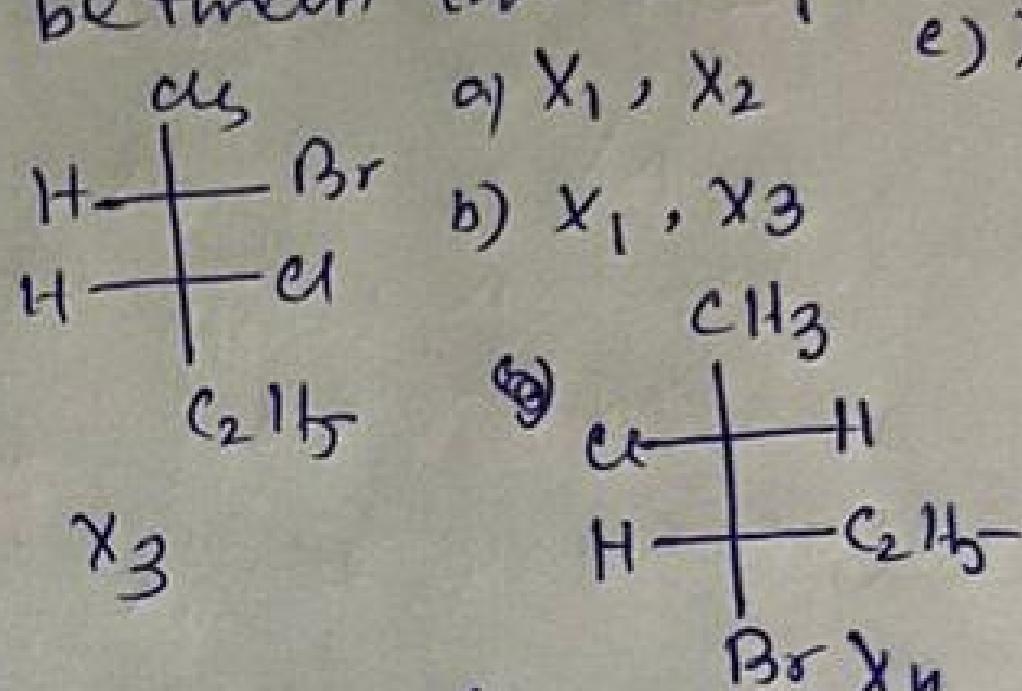
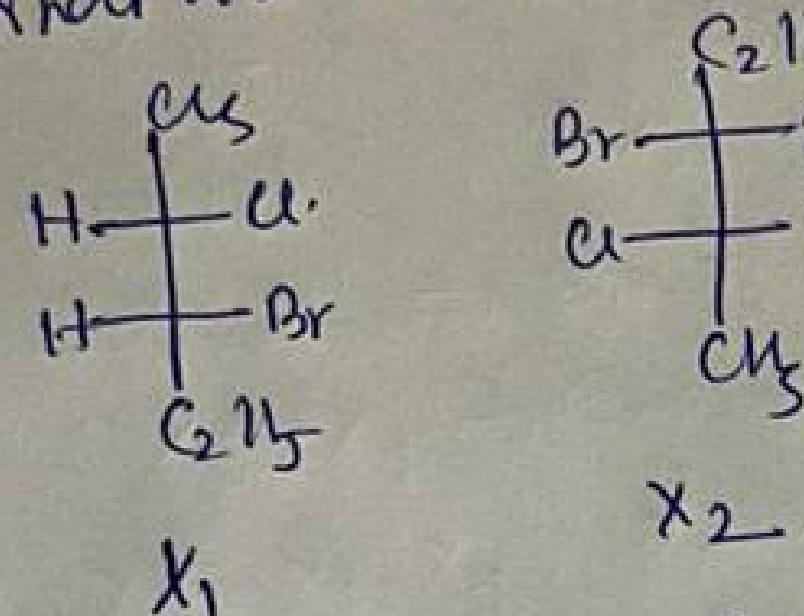


As X_1 is optically inactive so its mirror image actually identical compound.

X_2, X_3 are optically active & related as enantiomers.

X_1, X_2 ; X_1, X_3 are related as diastereomers.

What are the relationship between two compounds.

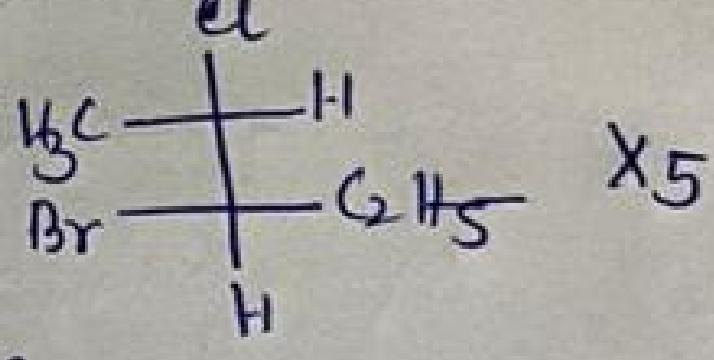


X_1 & X_2 are identical compound.

X_1 & X_3 are positional isomers.

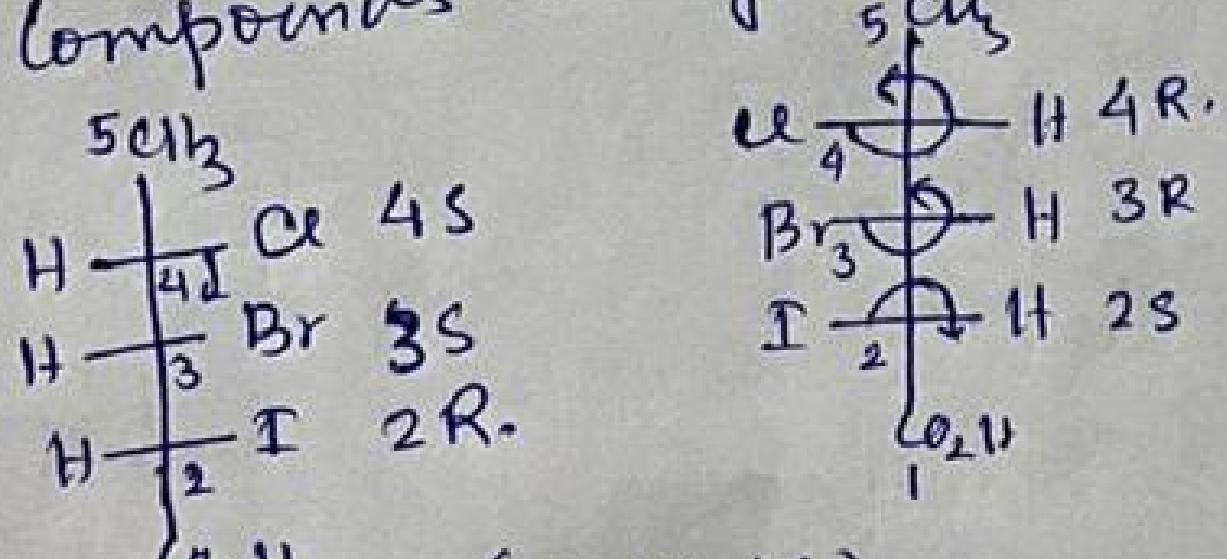
X_1 & X_4 are diastereomers.

X_1 & X_5 are identical compound.



So 3 stereoisomers are possible for compounds with two chiral centres & symmetry is present.

Compounds having 3 chiral centres:



Total no. of stereoisomers

$$= 2^3 = 8. \text{ All}$$

..... are optically active. 4 pairing enantiomers are possible.

24 pairing diastereomers are possible.

IUPAC name: ($2\text{R}, 3\text{S}, 4\text{S}$)

2iodo-3-bromo-4-chloro
2iodopentanoic acid.

Find out No. of stereoisomers for the following compound. (5)

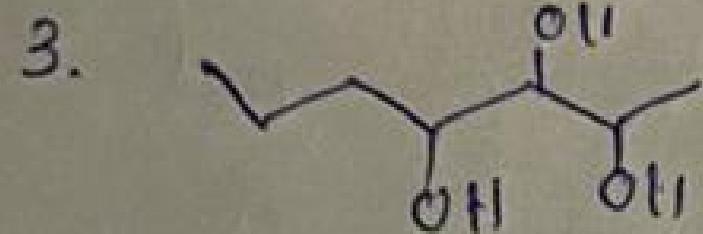
1. 2,3 dichloropentane

Total stereoisomers

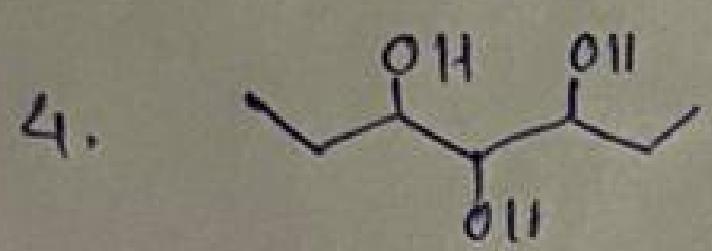
4. (All are optically active)

2. 2,3 dichlorobutane

3. (2 active + 4 inactive).



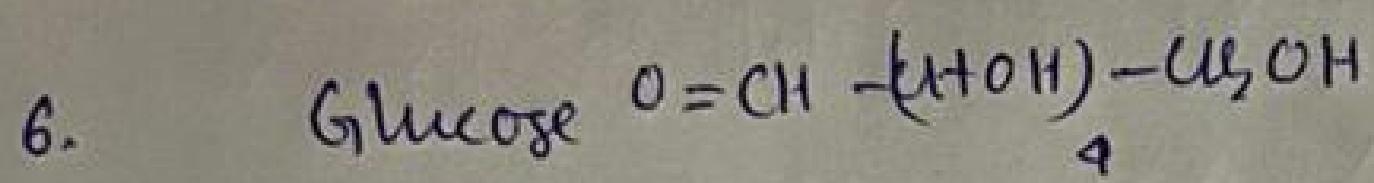
8. (All are optically active.)



4. (2 active + 2 inactive).

5. Tartaric Acid

3. (2 active + 2 inactive)



16 (All active optically)



4. (All optically inactive)

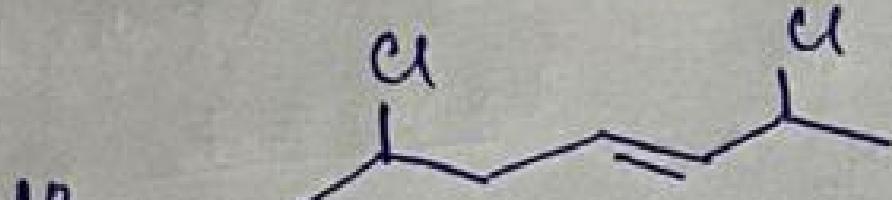


cis-R; cis-S; trans-R; trans-S.

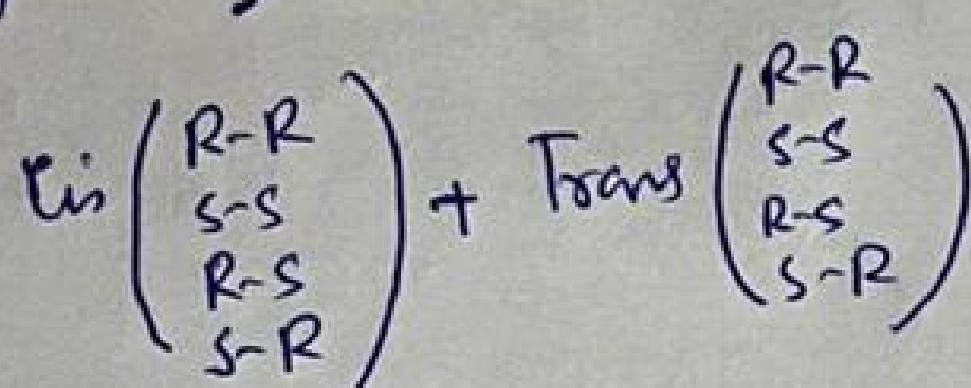


8 (All optically active.)

C-C-R	E	C-C-S.	} enantiomeric pair; 24
T-T-R	E	T-T-S.	
C-T-R	E	C-T-S.	
T-C-R	E	T-C-S	



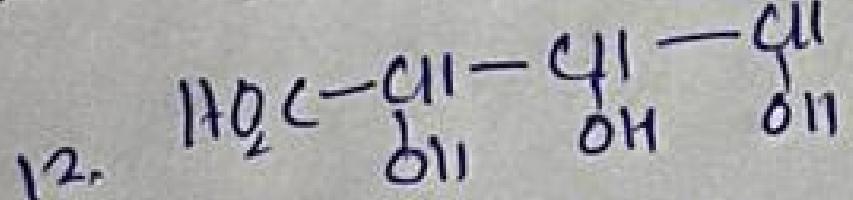
8 (All optically active.)



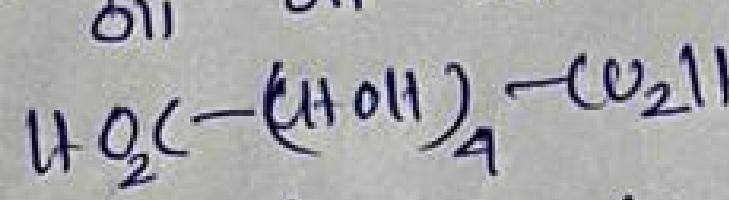
R-Cis R	E	S-Cis S.	} enantiomeric pair; 24
R-Cis S	E	S-Cis R.	
R-Trans-R	E	S-Trans S	
R-Trans-S	E	S-Trans-R	

11. 2,3,4 trichloropentane

2 op active = 4 total.
+ 2 op. inactive

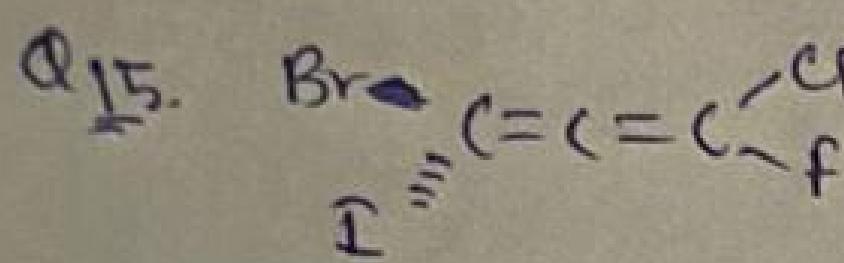
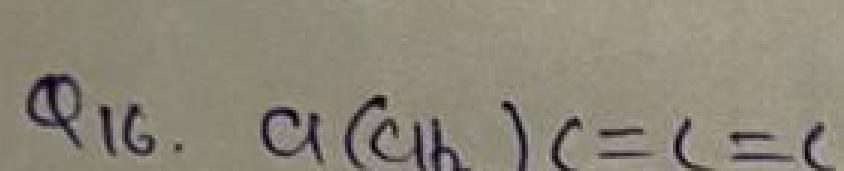
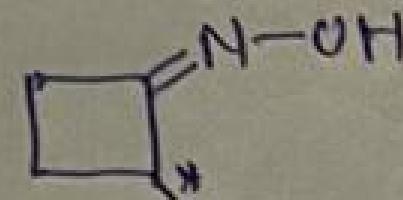
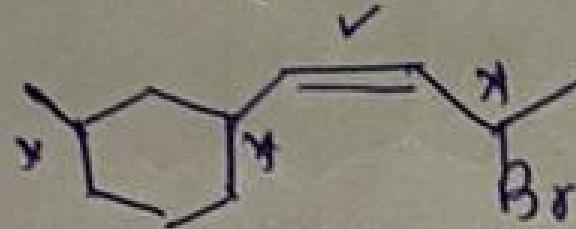
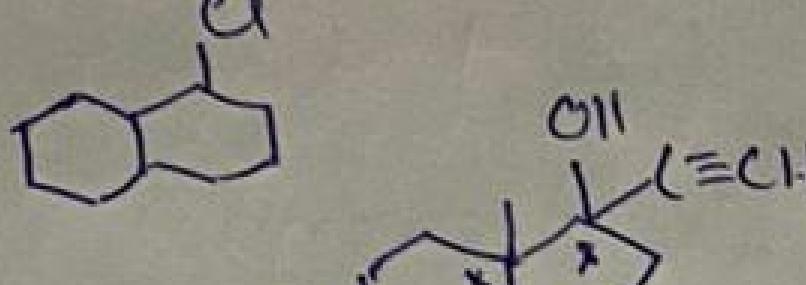
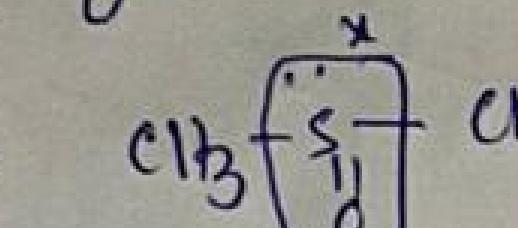
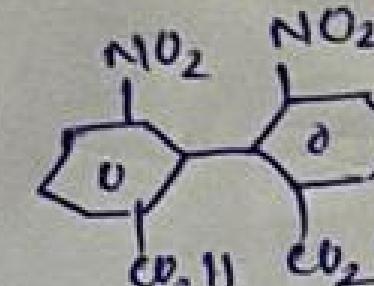
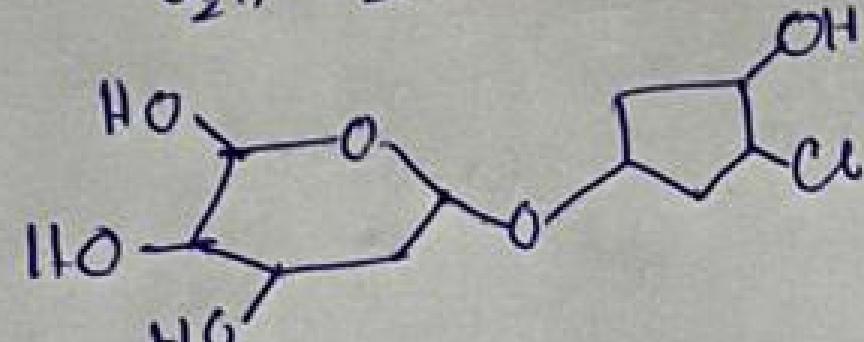
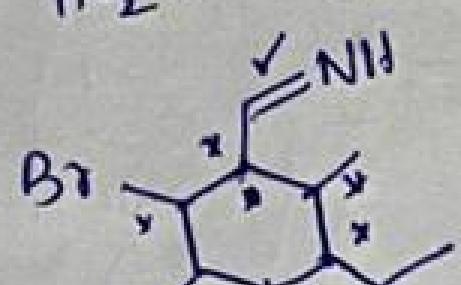
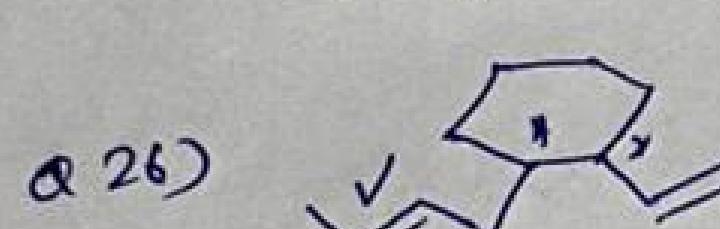
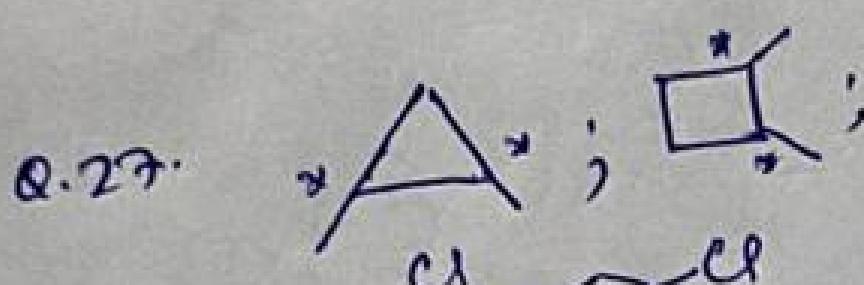


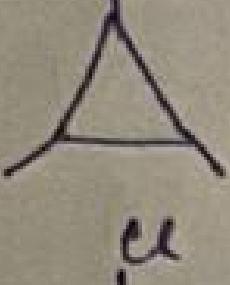
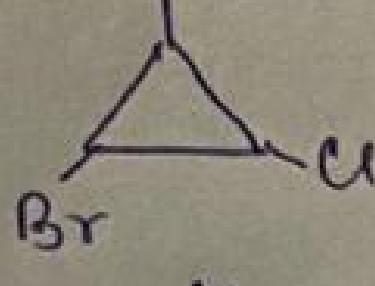
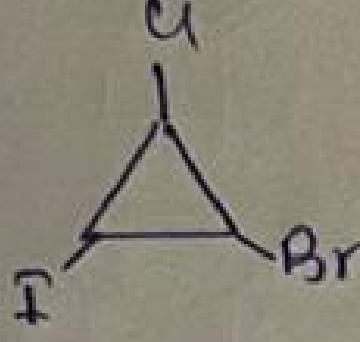
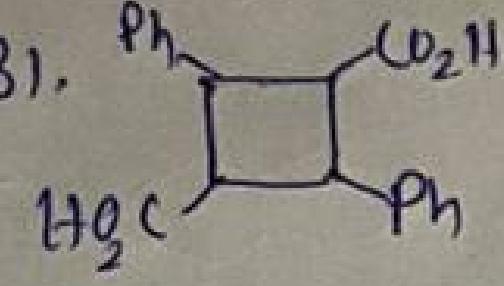
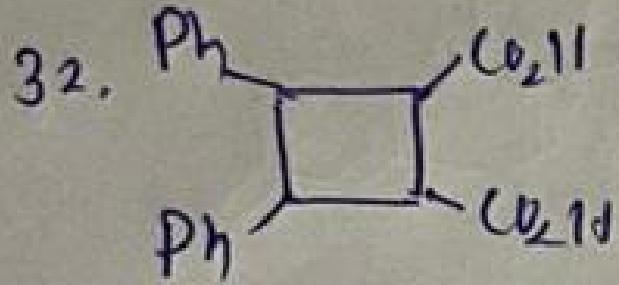
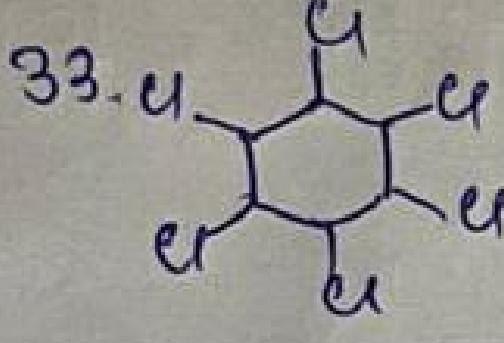
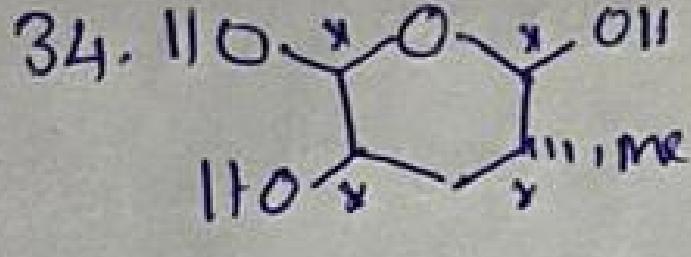
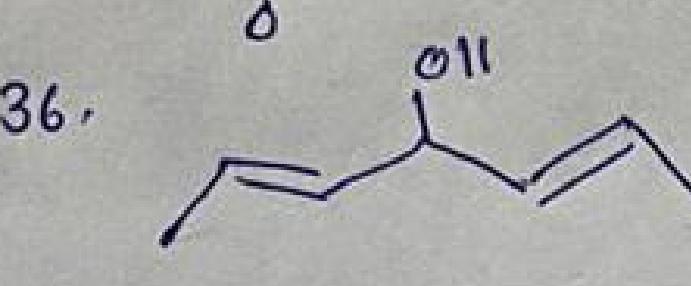
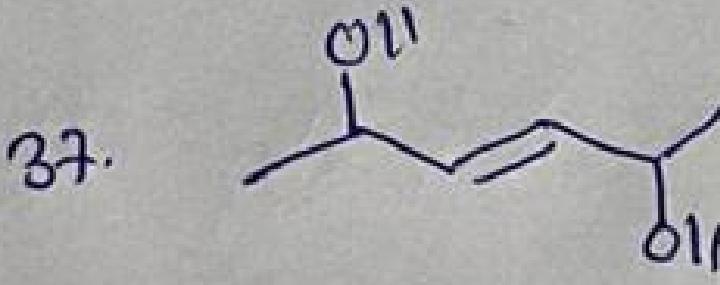
+ 2 op. inactive



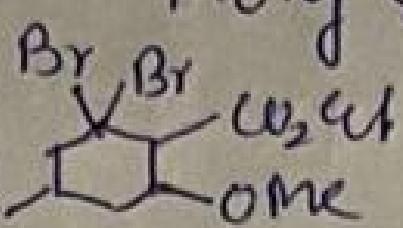
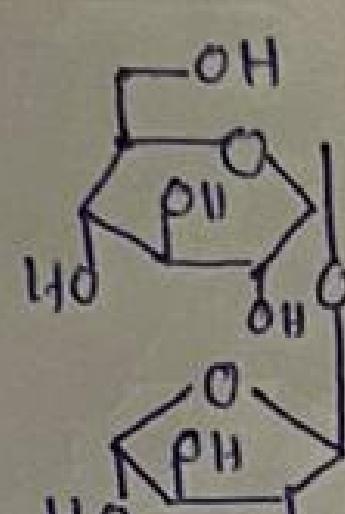
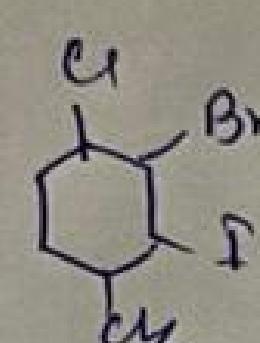
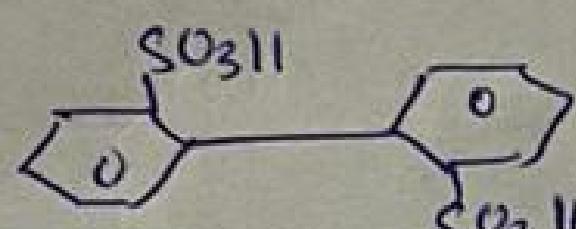
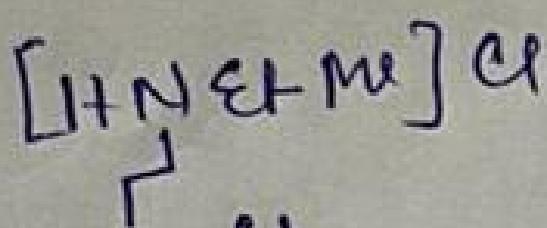
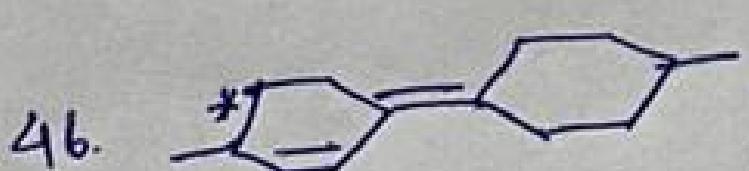
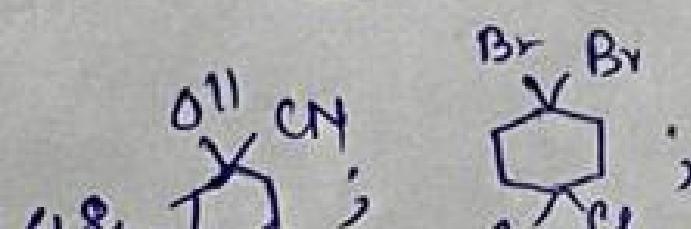
8 op active = Total 10 stereo-isomers.
+ 2 op. inactive

14.

- Q15.  No. of stereoisomers (6)
 2 (Both are optically active / E/N/T)
- Q16.  2 (Both are optically inactive).
- Q17.  4. [All are optically active].
- Q18.  16. [All are optically active].
- Q19.  8 [All are optically active].
 $2^5 = 32$ [All are optically active].
- Q20. 
- Q21.  $2^3 = 8$ All are optically active
- Q22.  2 [Both are optically active / E/N/T]
- Q23.  $2^7 = 128$ [All are optically active]
- Q24.  $2^7 = 128$ [All are optically active].
- Q25.  $2^3 = 8$ [All are optically active]
- Q26. 
- Q27.  3 [In all cases 3 stereoisomers possible; 2 are optically active; one is optically inactive]

28.  No. of stereoisomers. 7
 2 (both are optically inactive)
29.  4. [2 are optically inactive]
 2 are optically active.
30.  8 (all are optically active)
 [4.G.I possible].
31.  5 (all are optically inactive) [4 has POS & one has COS].
32.  10 [2 are optically inactive &
 8 are optically active].
33.  9. [7 are optically inactive &
 2 are optically active].
34.  $2^4 = 16$ [All are optically active]
35.  $2^3 = 8$ [all are optically active]
36. 
 4. {
 OROR CxC } 2 are diastereomers
 PBPB TXT. } optically inactive
 CRT. } 2 are enantiomers
 CST } optically active.
37. 
 6 {
 RCR }
 SCS } All are related as
 RCS } enantiomer pair
 R Trans R } 4 optically active
 S Trans S }
 R cis S } 2 optically inactive
 R Trans S } related as diast.

(8)

	Molecule / Compnd.	No. of stereoisomers	
38.	Ethyl 2,2 dibromo 4-ethoxy cyclohexane carboxylate.	 ; $2^2 = 4$. (All active)	
39.		sucrose.	$2^9 = [$ All are optically active.]
40.			$2^4 = 16$ [All are optically active]
41.			2 [Both are optically active & related as enantiomers].
42.			2 [Both are optically active & related as ENT].
43.			2. [Both are optically inactive & related as diastereomers].
44.			1 [All are optically active]
45.			2 [Both are optically inactive & related as diastereomers].
46.			2 [Both are optically active & related as enantiomers].
47.			2 [Both are optically inactive & related as diastereomers]
48.			1. [A.I/O.F not possible].
49.		; $\text{EtC}(=\text{O})(\text{CO}_2\text{H})\text{CO}_2\text{Me}$	2 [Both are optically active & related as RNT].

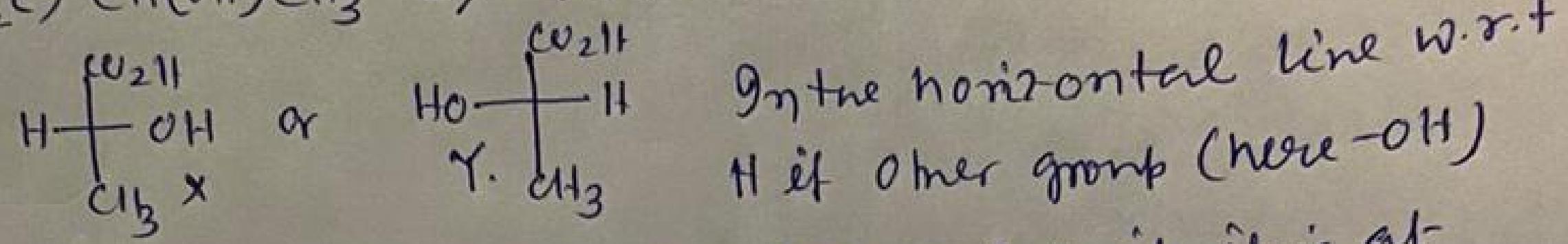
'D-L nomenclature': [single chiral centre] (9)

\Rightarrow (Correct Fischer Projection must be written)

\Rightarrow Vertical line should have maximum no. of carbon atoms.

\Rightarrow Oxidised group should be placed at the top of vertical line.

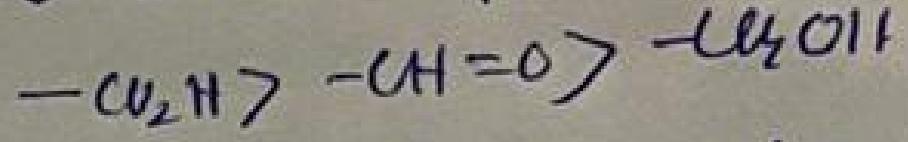
$(\text{HCO}_2\text{C})\text{CH}(\text{OH})\text{CH}_3 \Rightarrow$ The correct Fischer Projection.



is at the right then it is D (Dexter) & if it is at
the left then it is L. (Laevus).

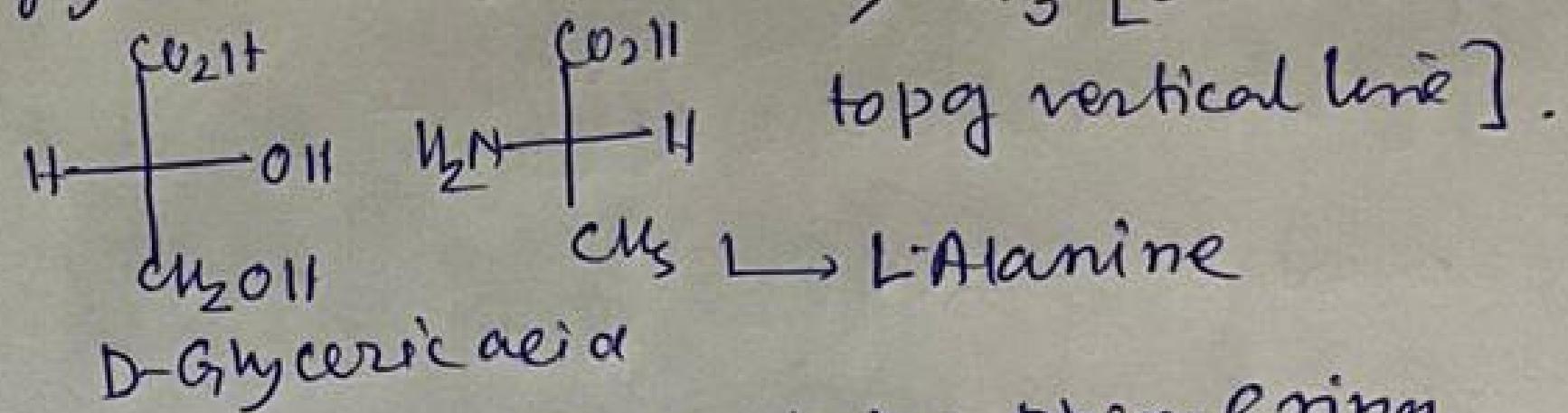
So X is D-glyceraldehyde

: oxidised grp:

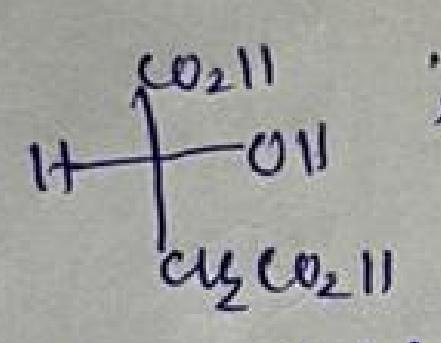


Y is L-glyceraldehyde.

$> \text{CH}_3$ [order to be



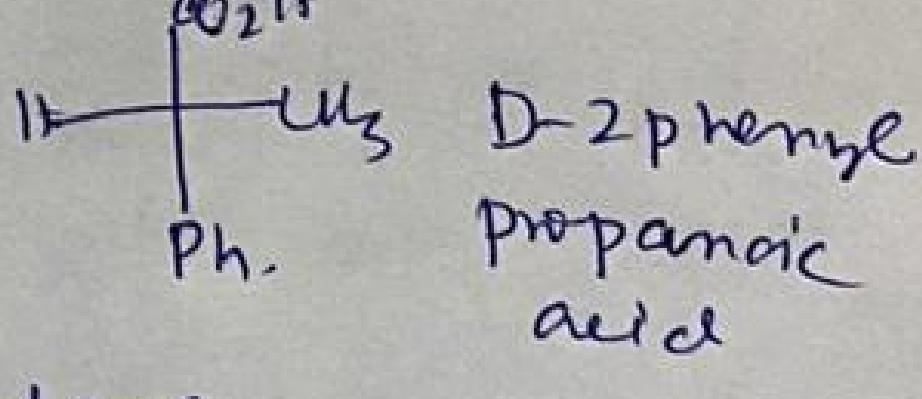
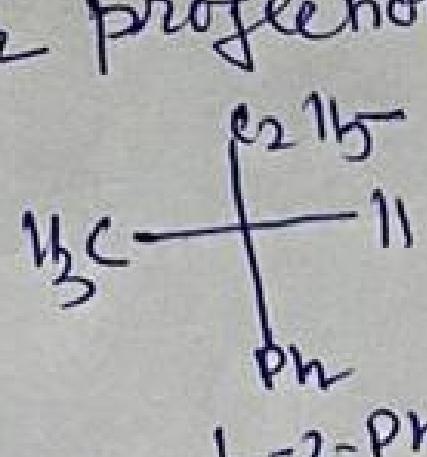
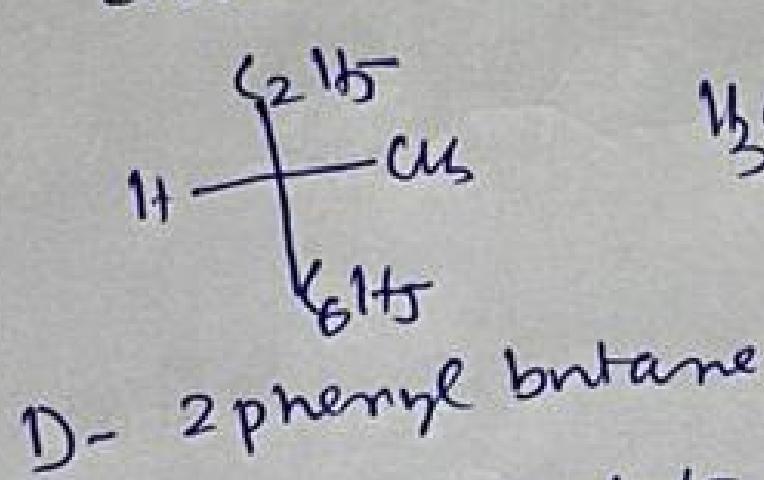
L-Cysteine.



D-Malic Acid.

; When chiral centre contains phenyl ring.
then total numbers of carbon atoms
including the ring are taken into
consideration to right down the main

chain in Fischer projection.



\Rightarrow D-L nomenclature does not have any correlation with
sign of optical rotation. D-isomer can have +ve or -ve
rotation; L-isomer also can have +ve or -ve rotation.
D & L isomers always have +ve & -ve rotation respectively.

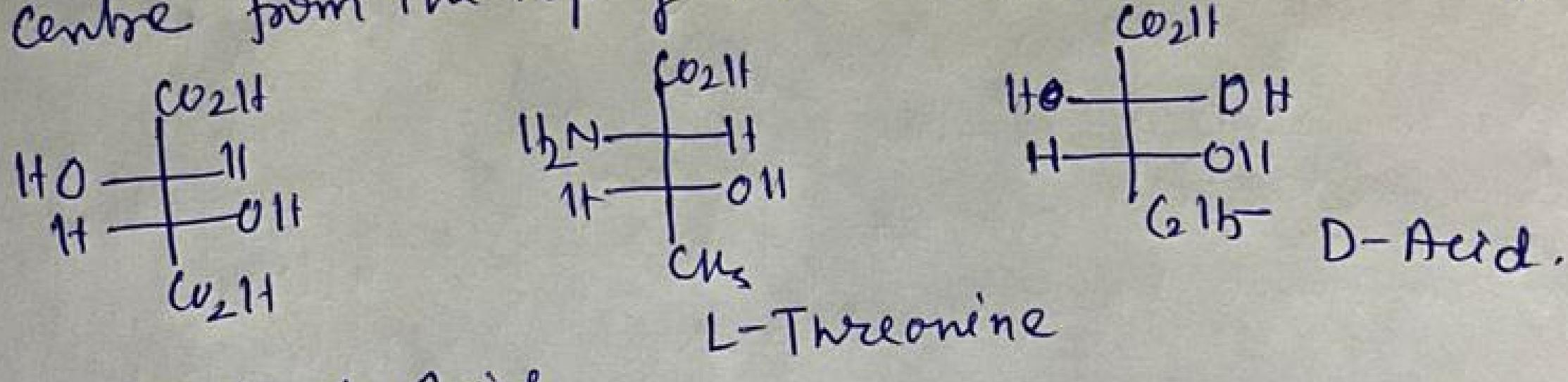
⇒ When the chiral centre does not contain H atom as one of the ligands. P is replaced by an alkyl group, then D-L nomenclature depends on the orientation of more electronegative group. In the following example when the alkyl group is on the left then it is D & when on the right, it is L-isomer.

i) $\begin{array}{c} \text{C}_2\text{H}_5 \\ | \\ \text{H}_3\text{C}-\text{CH}-\text{Cl} \\ | \\ \text{C}_2\text{H}_5 \end{array}$ ii) $\begin{array}{c} \text{C}_2\text{H}_5 \\ | \\ \text{Br}-\text{CH}-\text{CH}_3 \\ | \\ \text{C}_2\text{H}_5 \end{array}$ iii) $\begin{array}{c} \text{H}_3\text{C} \\ | \\ \text{C}_2\text{H}_5-\text{CH}-\text{OH} \\ | \\ \text{C}_2\text{H}_5 \end{array}$ iv) $\begin{array}{c} \text{C}_2\text{H}_5 \\ | \\ \text{C}_2\text{H}_5-\text{CH}-\text{CO}_2\text{H} \\ | \\ \text{C}_2\text{H}_5 \end{array}$

D-2-chloro-2-phenylbutane L-2-bromo-2-phenylbutane D-2-phenylbutane [-2-chloro-2-phenylpropanoic acid].

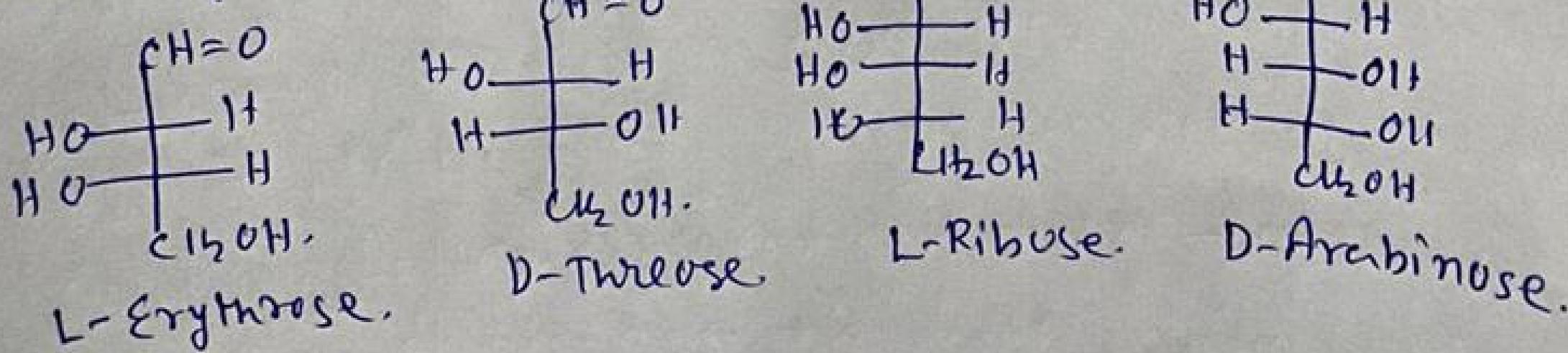
D-L nomenclature for cpds with more than one chiral centre:

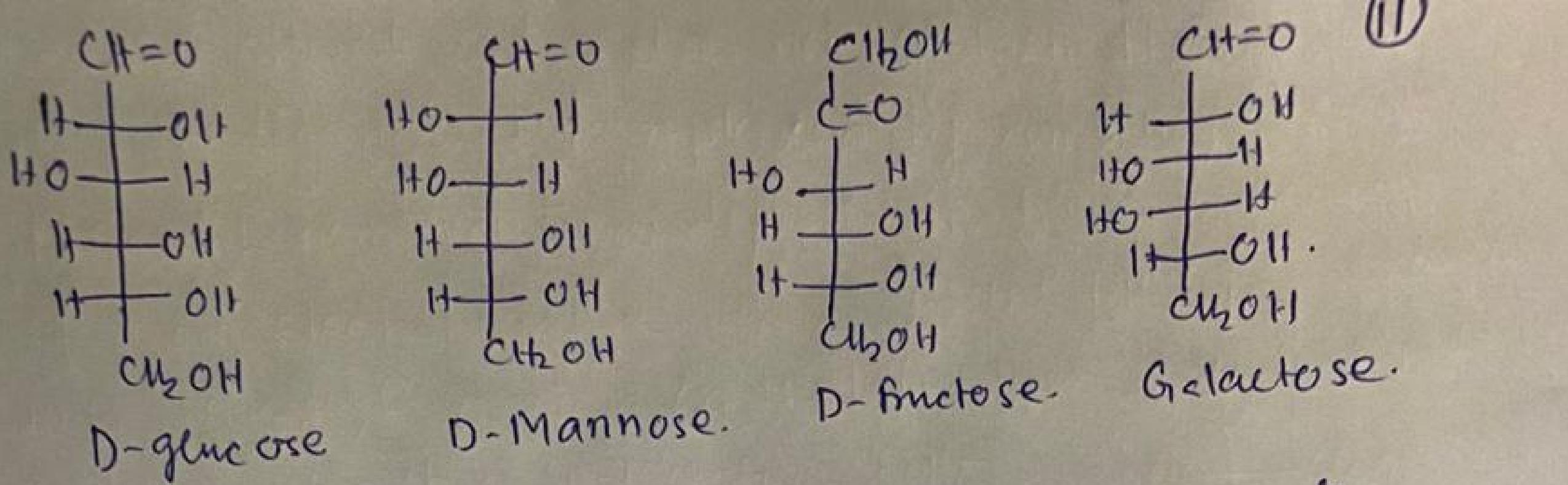
⇒ for D-amino acid & D-hydroxy acid, the convention is D-L notation is used taking the first chiral centre from the top of fischer projection as the key.



L-Tartaric Acid.

Bnt in carbohydrate chemistry (Aldose & ketose), D-L nomenclature is assigned on the basis of configuration of last chiral centre of the chain counting from the top in a fischer Projection.





If correct Fischer is not written for single chiral centre then D-L nomenclature can be assigned by indirectly.

