

Program- B.Sc PCM/ZBC

Class- 2nd sem

Sub - Organic Chemistry

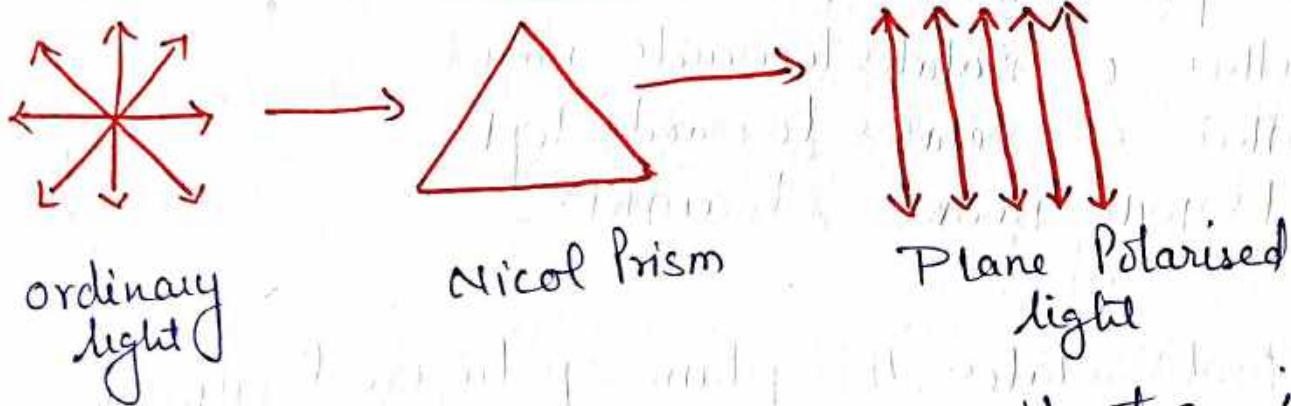
Topic- Stereochemistry

Sub-topic- Optical Isomerism.

OPTICAL ISOMERISM

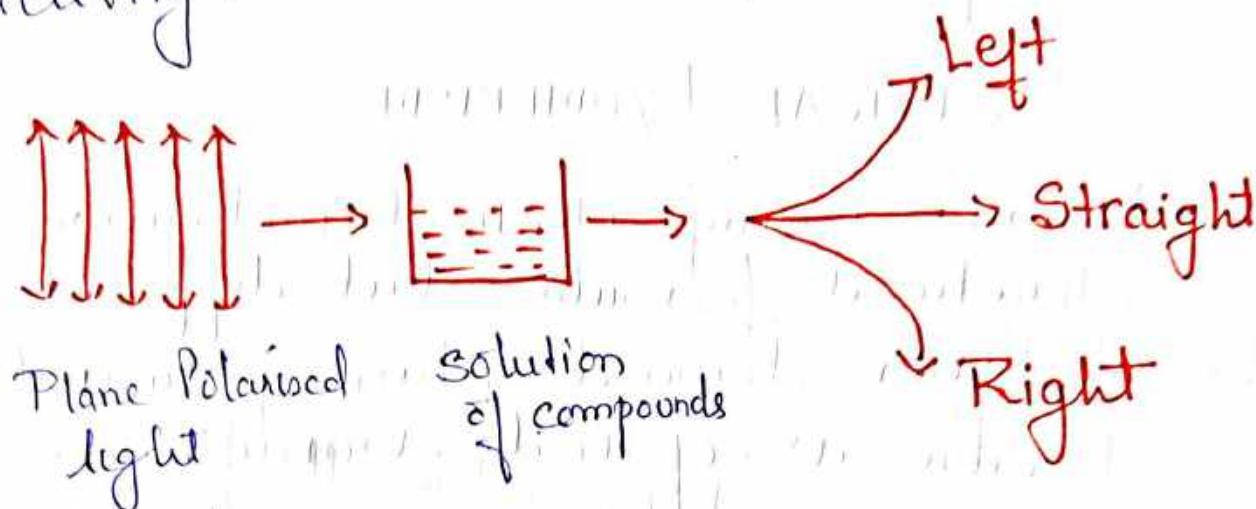
Def- Substance having identical molecular and structural formula but different in the behavior towards plane polarised light is known as optical isomerism and the phenomenon is known as optical isomerism.

OPTICAL ACTIVITY



In ordinary light, the wave vibrates in all directions and when passes through nicol prism it get converted into plane polarised light i.e. light wave vibrate along one direction only.

This plane polarised light passes through optically active substance, it rotate the plane polarised light either towards left or towards right, this is known as optical activity.



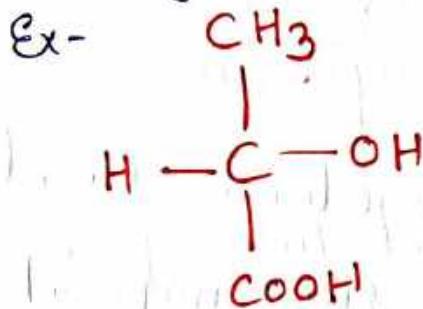
When plane polarised light passes through solution of any compound, there will be three possibilities :-

- i) either it rotates towards right
- ii) either it rotates towards left
- iii) it will move straight.

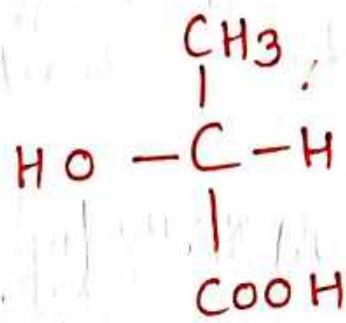
⇒ If it rotates the plane polarised light towards right, the substance is known as dextrorotatory. It is denoted by d or (+)

⇒ If it rotates the plane polarised light towards left, the substance is known as levorotatory. It is denoted by l or (-).

→ If the plane polarised light move straight then the substance in the solution is optically inactive. It is denoted by dl or (\pm)



(+) or d-lactic acid

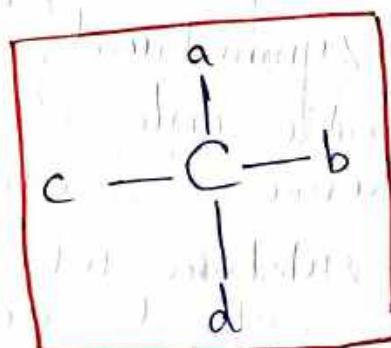


(-) or l-lactic acid

Condition for Optical Activity :-

- ① Chirality
- ② Non-superimposable mirror image
- ③ Asymmetry.

Chirality:- optical activity is caused by the presence of chiral carbon ie the four valency of carbon is satisfied by four different groups.



b) Non-Superimposable mirror image:-

If we take two alphabets say - A & P



From the above fig. it is clear that the mirror image of "A" is superimposable while mirror image of "P" is non-superimposable. Any substance which has non-superimposable mirror image are optically active.

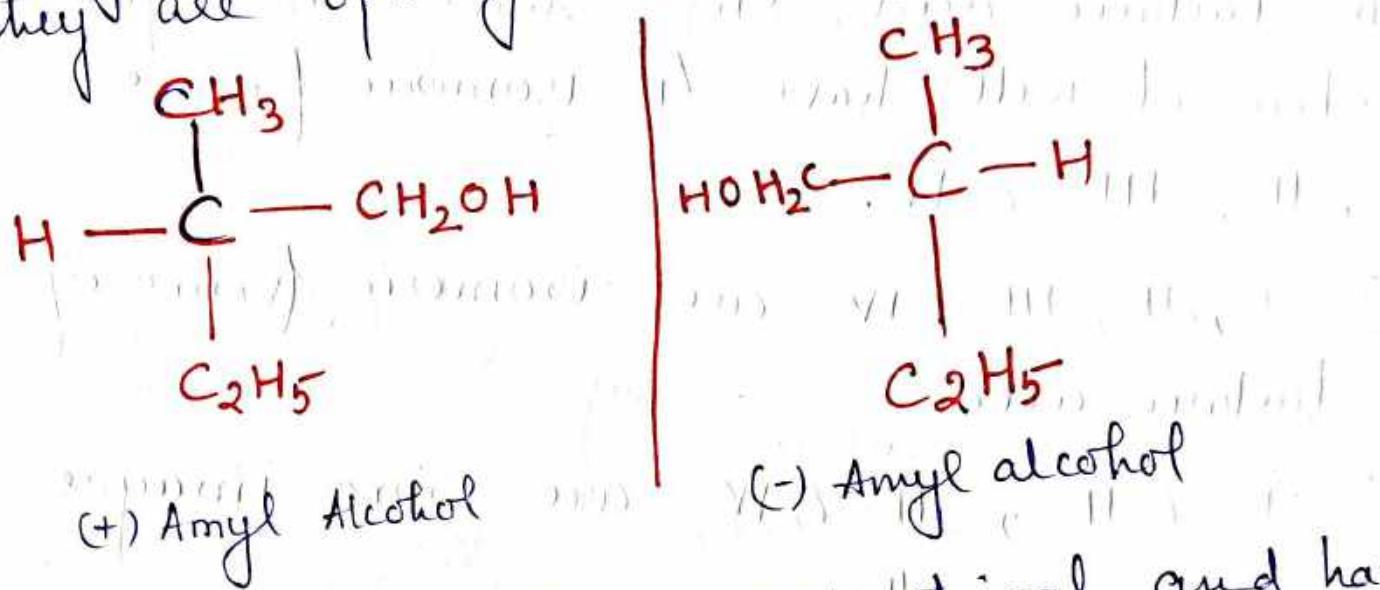
Symmetry + Asymmetry:-

Again if we take two letters, A & P

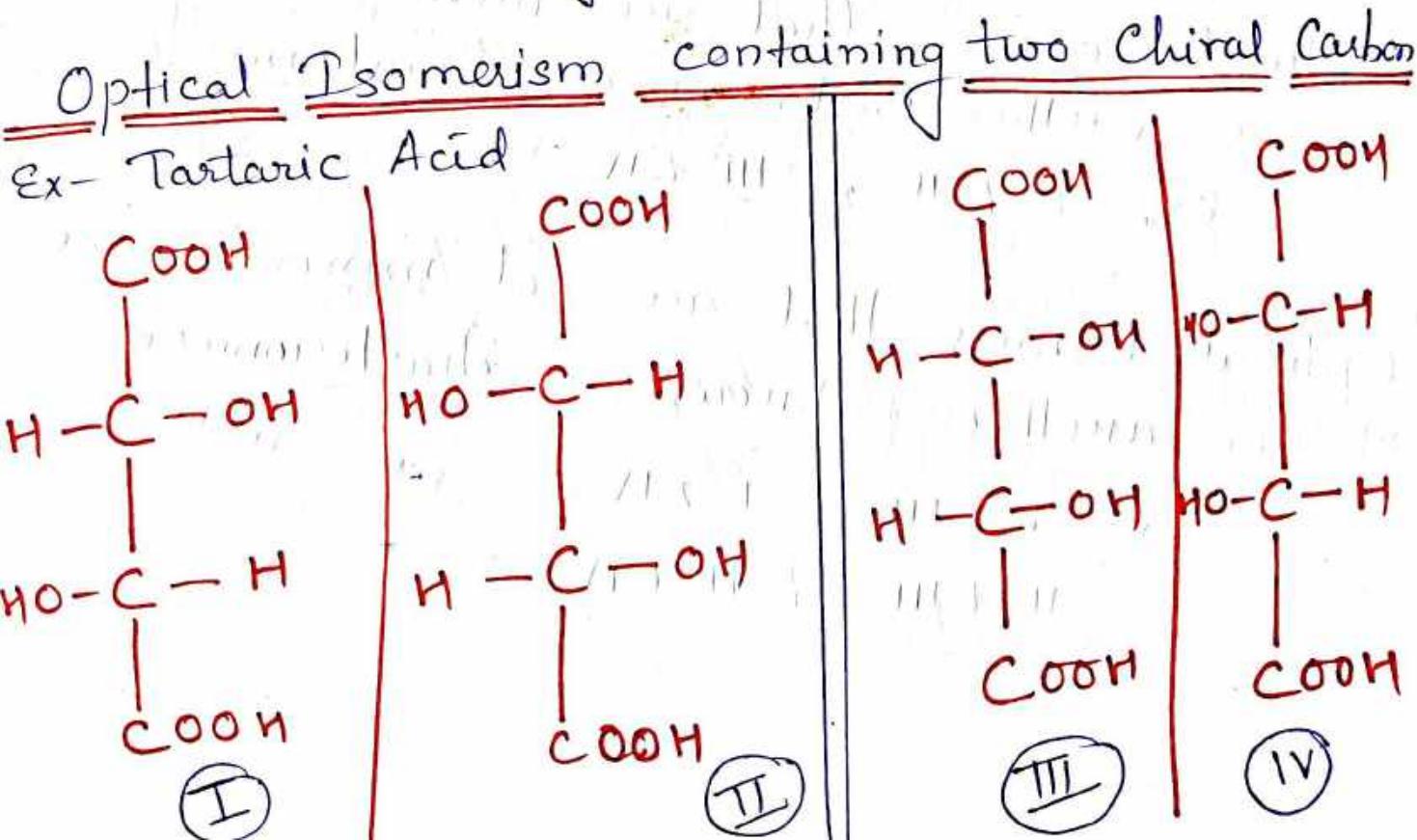


From above fig., it is clear that 'A' can divide into exactly two equal parts & thus it is considered as symmetrical, while alphabet "P" cannot be divided into exactly two equal parts and hence consider as asymmetrical. Any molecule or substance which is asymmetrical will exhibit optical activity.

So, we can say that chiral carbon are asymmetrical and due to which their mirror images are non-superimposable and therefore they are optically active.



It has chiral carbon, asymmetrical and have non-superimposable mirror image hence amyl alcohol is optically active.



No. of optically active forms is - 2^n
where $n = \text{no. of asymmetric Carbon}$

In tartaric acid, since have two asymmetric carbon, it will have 4 isomeric forms

I, II, III & IV.

\Rightarrow I, II, III & IV are isomeric forms of tartaric acid

\Rightarrow I & II, III & IV are mirror images of one another

\Rightarrow I & III, I & IV, II & III, II & IV are not mirror images of one another.

Optical isomers that are mirror images of one another is known as Enantiomer.
Ex. - I & II, III & IV

Optical isomers that are not mirror images of one another is known as Diastereomers.

Ex. - I & III, I & IV
II & III & II & IV

Enantiomer

- 1) Optical isomer that are mirror images of one another.
- 2) They have identical physical properties.
- 3) They have identical chemical properties.
- 4) They are optically active.

Diasteromer

- 1) Optical isomer that are not mirror images of one another.
- 2) They have different physical properties.
- 3) They have similar but non-identical chemical properties.
- 4) They may or may not be optically active.

Reference :-

- 1) "Concise Engg. Chemistry", A.I.T.B.S. Publishers,
by Neetu Goel & Sangay Kr.
- 2) "Organic Chemistry" by Guetu Khera.
Pragati Prakashan.

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