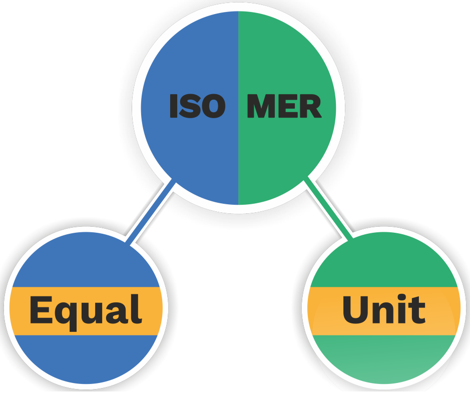
Isomerism

Isomerism



- Isomers have same molecular formula but different physical and chemical properties.
- Compounds having same molecular formula, but different connectivity, different bonding pattern (structural isomerism) or different 3-D relative arrangement (stereoisomerism) is known as isomers and this phenomenon is known as isomerism.
- Isomers are those which can be separated at room temperature.
- Isomers always have same Degree of Unsaturation (DU)
- Isomers are formed to satellite a system.
- Connectivity change (bonding pattern) structural isomerism.

Definition

Isomers have same molecular formula but different structures or configurations of compounds.

Concept Ladder

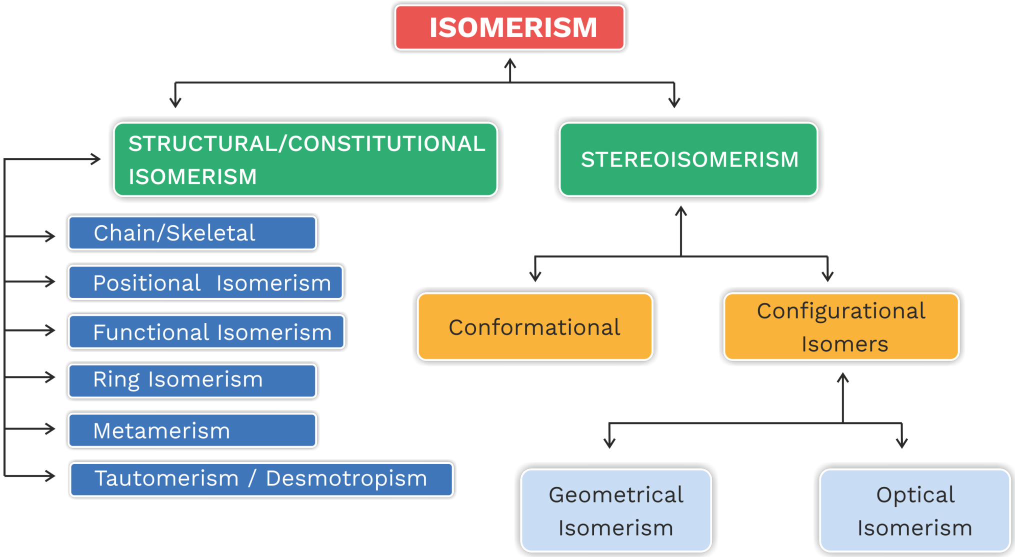
Isomerism is resultant factor of thermodynamic system "entropy".

Previous Year's Questions

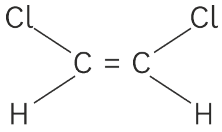
Isomers of a substance must have the same

[NEET-1991]

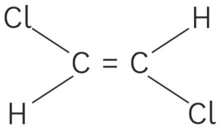
(1) structural formula
(2) physical properties
(3) chemical properties
(4) molecular formula



- C_2H_6O (DU = 0)
  (1) Alcohol $CH_3-CH_2-\overset{-\delta}{O}-\overset{+\delta}{H}$
  (2) Ether CH_3-O-CH_3
- Both compounds have different connectivity so both are structural isomers.
- **Que**



(1)



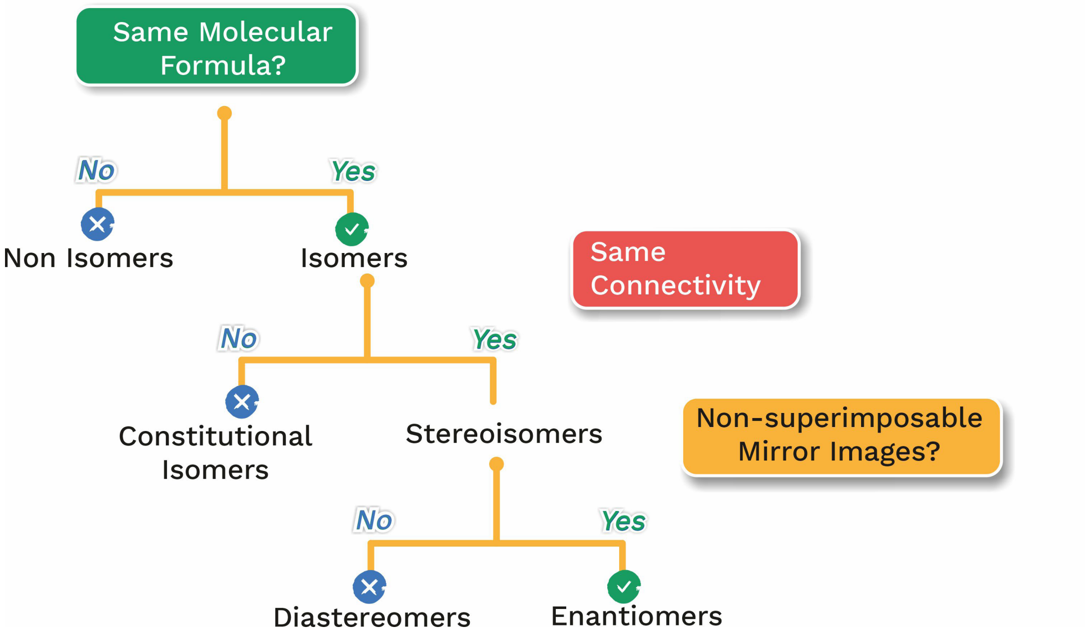
(2)

Both are stereo isomers.

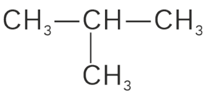
Rack your Brain

How molecular structures affect the value of its entropy?

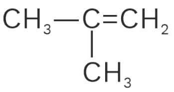
Possible Relationships Between Two Molecules



STRUCTURAL ISOMERISM

Ex. $CH_3—CH_2—CH_2—CH_3$,

$CH_3—\underset{|}{\overset{}{CH}}—CH_3$ with CH_3 below

I. Chain Isomerism

(1)

$CH_3—\underset{\overset{|}{CH_3}}{C}{=}CH_2$

I

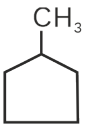
$CH_3—CH_2—CH=CH_2$

II

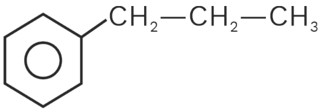
I & II are chain isomers

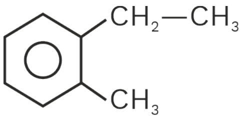
(2)

I

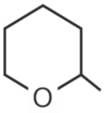

II

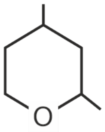
I & II are chain isomer

(3)

I

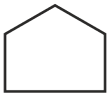

II

I & II are chain isomers

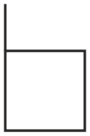
(4)

I


II

I & II are not chain isomers

(5)

I

and


II

I & II are chain isomer.

Definition

Same molecular fomula but different connectivity of atoms is known as structural isomers.

Concept Ladder

Degree of Unsaturation (DU) also known as Double Bond Equivalent (DBE).

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

Definition

Compounds having same MF and same functional group but different P.C.C. or side chain is called chain isomers.

Rack your Brain

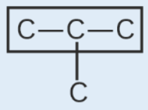
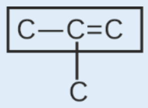
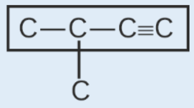
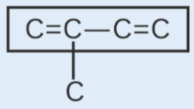
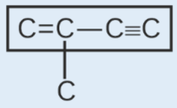
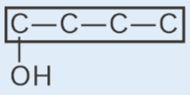
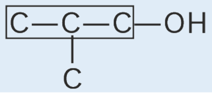
How many minimum C-atoms are required to give chain isomers for Alcohol?

Previous Year's Questions

The isomer of ethyl alcohol is : **[AIPMT]**

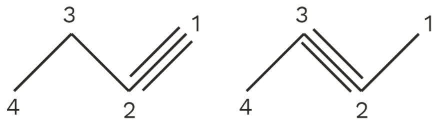
(1) diethyl ether
(2) dimethyl ether
(3) acetaldehyde
(4) acetone

NOTE : Minimum carbon atoms required to give C.I. for :

S.NO.	HYDROCARBON	NO. OF CARBON ATOMS	ISOMER 1	ISOMER 2
1.	Alkane	4	$\boxed{C-C-C-C}$	 $\boxed{C-\underset{\underset{C}{\mid}}{C}-C}$
2.	Alkene	4	$\boxed{C-C-C=C}$	 $\boxed{C-\underset{\underset{C}{\mid}}{C}=C}$
3.	Alkyne	5	$\boxed{C-C-C-C\equiv C}$	 $\boxed{C-\underset{\underset{C}{\mid}}{C}-C\equiv C}$
4.	Alkediene	5	$\boxed{C-C=C-C=C}$	 $\boxed{C=\underset{\underset{C}{\mid}}{C}-C=C}$
5.	Alkenyne	5	$\boxed{C-C=C-C\equiv C}$	 $\boxed{C=\underset{\underset{C}{\mid}}{C}-C\equiv C}$
6.	Alcohol	4	 $\boxed{\underset{\underset{OH}{\mid}}{C}-C-C-C}$	 $\boxed{C-\underset{\underset{C}{\mid}}{C}-C}-OH$

II. Position Isomers

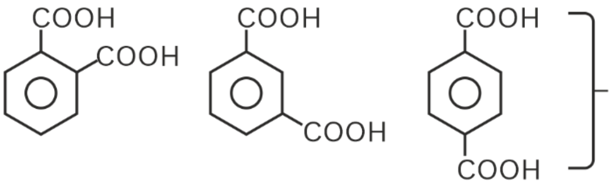
Compounds having same M.F., same figure same P.C.C. or side chain but different position of functional group, multiple bonds & substituent.

(1) 

Both are Position Isomers

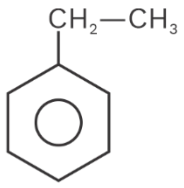
Definition

Compounds have same M.F. but difference in position of fucntion group, multiple bond and substituent.

(2) 

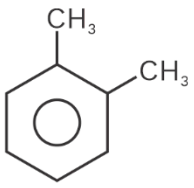
All are P.I.

(3)



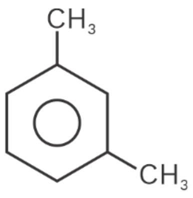
I

Ethyl benzene



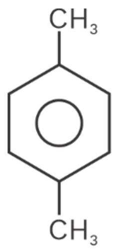
II

o-xylene



III

m-xylene



IV

p-xylene

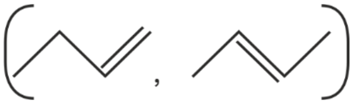
I & II → Chain

I & III → Chain

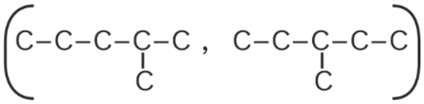
I & IV → Chain

II & III, II & IV, III & IV — Positional Isomers

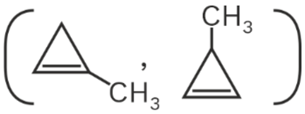
NOTE : Minimum carbon atoms react to give positional isomers for :

(A) Alkene — 4 

(B) Alkyne — 4 

(C) Alkane — 6 

$\left(C-C-C-\underset{\displaystyle C}{\underset{|}{C}}-C\ ,\ C-C-\underset{\displaystyle C}{\underset{|}{C}}-C-C \right)$

(D) Cyclopropene 

Definition

Compounds have same M.F. but difference in functional group is knwon as functional isomers.

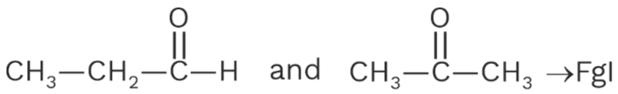
III. Functional isomerism

1. Acid and ester 

$CH_3-CH_2-\overset{\displaystyle O}{\overset{\|}{C}}-OH$ and $CH_3-\overset{\displaystyle O}{\overset{\|}{C}}-O-CH_3 \rightarrow FgI$

2. Cyanide and isocyanide $CH_3-C\equiv N$ and $CH_3-N\equiv C \rightarrow FgI$

3. Aldehyde and ketone



$CH_3-CH_2-\overset{O}{\overset{\|}{C}}-H$ and $CH_3-\overset{O}{\overset{\|}{C}}-CH_3 \rightarrow FgI$

4. Keto and enol form

$CH_3-\overset{O}{\overset{\|}{C}}-CH_3$ and $CH_3-\overset{OH}{\overset{|}{C}}=CH_2 \rightarrow FgI$

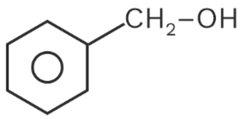
Keto form   Enol form

5. Nitro and nitrile

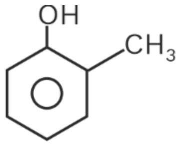
CH_3-NO_2 $CH_3-O-N=O \rightarrow FgI$

Nitro   Nitrile

6. Alcohol & phenolic compounds



Alcoholic



Phenolic

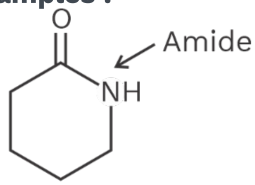
7. Alcohol & ether

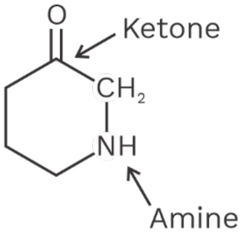
CH_3-CH_2-OH and CH_3-O-CH_3

8. 1°, 2° and 3° Amines

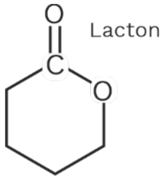
Examples :

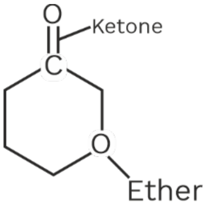
(1)





(2)





Rack your Brain

What are the Functional Isomers of monocarboxylic acids?

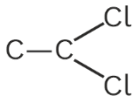
Previous Year's Questions

Functional isomerism is showsn by **[AIPMT]**

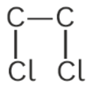
(1) o-Nitrophenol and p-nitrophenol
(2) Dimethyl ether and ethanol
(3) 2-Pentenoic acid and 3-pentenoic acid
(4) Acetaldehyde and acetone

Que. How many minimum carbon atom required to give position isomer?

Sol.



Gem dihalide



Vicinal dihalide

Definition

Compounds having same M.F. but different mode of linking.

IV. Ring-chain Isomerism

Linking

Open chain

Closed chain

$\underbrace{\text{Closed chain}}$

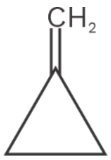
Cannot be member of same homologous series

Que. $C_4H_6 \rightarrow (DU=2)$

$C-C\equiv C-C$ I I, II → F.g

$C=C-C=C$ II I, III → F.g, RCI

III I, IV → RCI, FGI,



IV II, IV → RCI, FGI

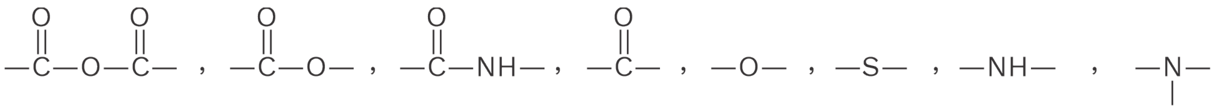
Concept Ladder

All ring chain isomers are functional group isomers but vice-versa not true.

In case of ring chain and functional group isomers, ring chain isomer will be prior.

V. Metamers

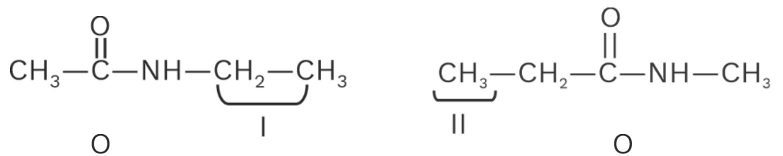
Compound having same M.F. but different alkyl group attached at polyvalent functional group.



$-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-$, $-\overset{O}{\overset{\|}{C}}-O-$, $-\overset{O}{\overset{\|}{C}}-NH-$, $-\overset{O}{\overset{\|}{C}}-$, $-O-$, $-S-$, $-NH-$, $-\underset{|}{N}-$

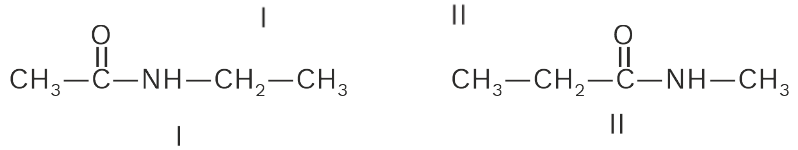
Anhydride Ester Amide Ketone Ether Thio 2° Amine 3°Amine

Bi/Polyvalent functional group

(1)


$CH_3-\overset{O}{\overset{\|}{C}}-NH-\underbrace{CH_2-CH_3}_{I}$ $\underbrace{CH_3}_{II}-CH_2-\overset{O}{\overset{\|}{C}}-NH-CH_3$

Inter-unit change
↓
Only metamers

(2)


$CH_3-\overset{O}{\overset{\|}{C}}-NH-CH_2-CH_3$ (I) $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-NH-CH_3$ (II)

Inter-unit change
↓
Only metamers

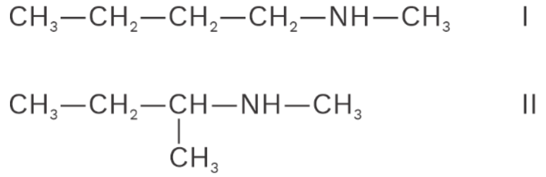
(3)


I II

Metamers-X
Identical Homomers
(Isomerism)

(4) $CH_3-CH_2-CH_2-O-CH_3$ (I) $CH_3-CH_2-O-CH_2-CH_3$ (II)

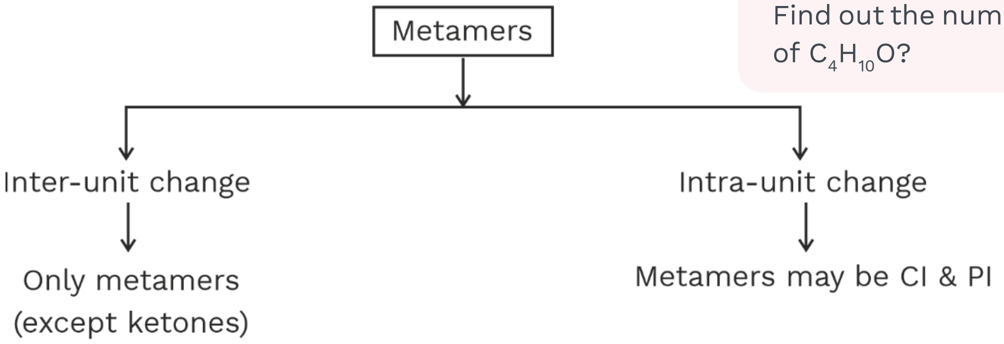
Inter-unit change
Metamers

(5)


$CH_3-CH_2-CH_2-CH_2-NH-CH_3$ (I)

$CH_3-CH_2-\underset{CH_3}{\underset{|}{CH}}-NH-CH_3$ (II)

Intra unit change
Metamers as well as CI



Rack your Brain

Find out the number of Metamers of $C_4H_{10}O$?

Previous Year's Questions

Which of the following ether show metamerism

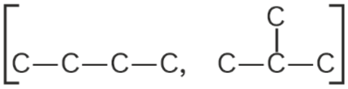
[AIPMT]

(1) $CH_3-CO-C_3H_7$
(2) $C_2H_5-O-C_2H_5$
(3) CH_3-O-CH_3
(4) $CH_3-O-C_2H_5$

Isomers formation probability

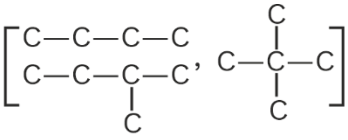
(I) Open chain hydrocarbon

1. 1C → 1 [C]
2. 2C → 1 [C—C]
3. 3C → 1 [C—C—C]
4. 4C → 2



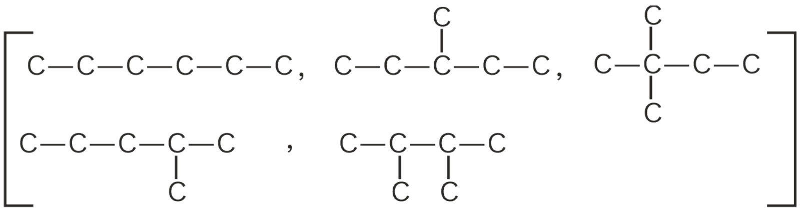
$$\left[\mathrm{C{-}C{-}C{-}C},\quad \mathrm{C{-}\overset{\displaystyle C}{\overset{|}{C}}{-}C}\right]$$

5. 5C → 3



$$\left[\begin{matrix}\mathrm{C{-}C{-}C{-}C}\\ \mathrm{C{-}C{-}\underset{\displaystyle C}{\underset{|}{C}}{-}C}\end{matrix},\quad \mathrm{C{-}\overset{\displaystyle C}{\overset{|}{\underset{\displaystyle C}{\underset{|}{C}}}}{-}C}\right]$$

6. 6C → 5



$$\left[\begin{matrix}\mathrm{C{-}C{-}C{-}C{-}C{-}C}, & \mathrm{C{-}C{-}\overset{\displaystyle C}{\overset{|}{C}}{-}C{-}C}, & \mathrm{C{-}\overset{\displaystyle C}{\overset{|}{\underset{\displaystyle C}{\underset{|}{C}}}}{-}C{-}C}\\ \mathrm{C{-}C{-}C{-}\underset{\displaystyle C}{\underset{|}{C}}{-}C}, & \mathrm{C{-}\underset{\displaystyle C}{\underset{|}{C}}{-}\underset{\displaystyle C}{\underset{|}{C}}{-}C} & \end{matrix}\right]$$

7. 7C → 9

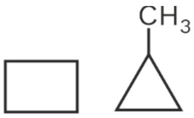
(II) Closed chain hydrocarbon

1C → ×

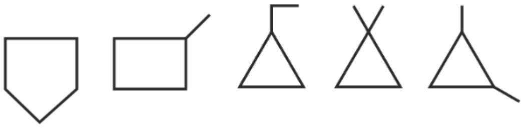
2C → ×

3C → 1 →

4C → 2 →



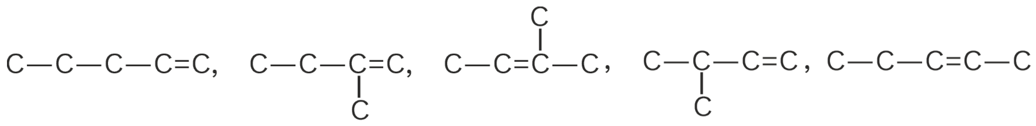
5C → 5 →



Ex. How many structural isomers are possible with following molecular formula ?

(1) C_5H_{10}

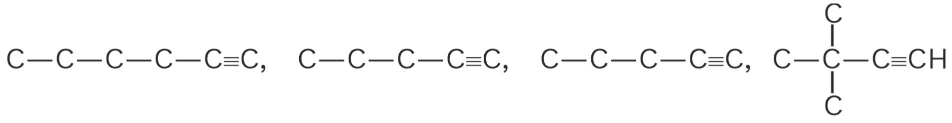
Sol. DU–1, Open–5, Closed–5



$$\mathrm{C{-}C{-}C{-}C{=}C},\quad \mathrm{C{-}C{-}\underset{\displaystyle C}{\underset{|}{C}}{=}C},\quad \mathrm{C{-}C{=}\overset{\displaystyle C}{\overset{|}{C}}{-}C},\quad \mathrm{C{-}\underset{\displaystyle C}{\underset{|}{C}}{-}C{=}C},\quad \mathrm{C{-}C{-}C{=}C{-}C}$$

(2) C_6H_{10} (No. of terminal alkynes)

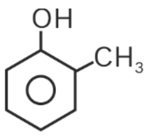
Sol. DU–2, Open–4



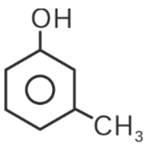
$$\mathrm{C{-}C{-}C{-}C{-}C{\equiv}C},\quad \mathrm{C{-}C{-}C{-}C{\equiv}C},\quad \mathrm{C{-}C{-}C{-}C{\equiv}C},\quad \mathrm{C{-}\overset{\displaystyle C}{\overset{|}{\underset{\displaystyle C}{\underset{|}{C}}}}{-}C{\equiv}CH}$$

(3) C_7H_8O (No. of benzoid isomer)

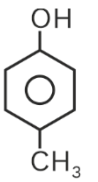
Sol. DU–4



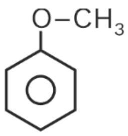
o-Cresol

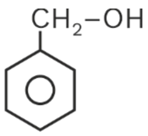


m-Cresol



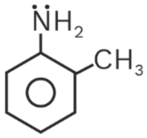
p-Cresol

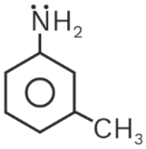


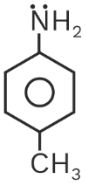


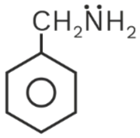
(4) C_7H_9N (No. of benzoid isomer)

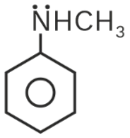
Sol. DU–4





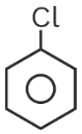






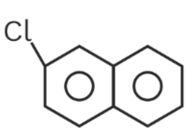
(5) C_6H_6 (No. of monochloro product)

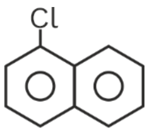
Sol.



(6) Napthlene (No. of monochloro product)

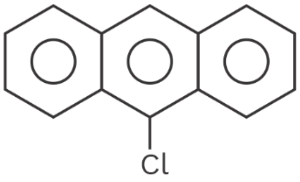
Sol.

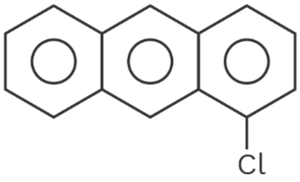


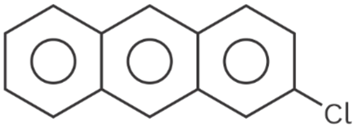


(7) No. of monochloro product in anthracene

Sol.







(8) C_3H_8O, $C_4H_{10}O$, $C_5H_{12}O$ } DU=0

No. of alcohol(–OH)

Previous Year's Questions

The number of isomers in $C_4H_{10}O$ will be

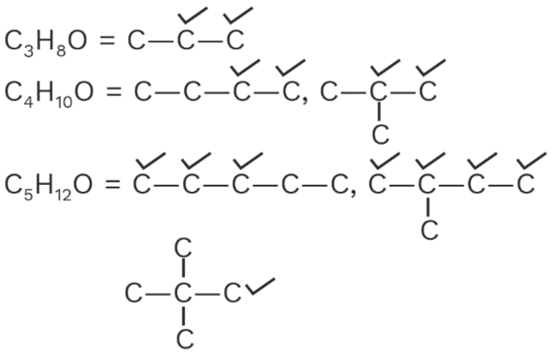
[NEET-1996]

(1) 7 (2) 8 (3) 5 (4) 6

Rack your Brain

Find out the number of Stuctural isomers of $C_2H_2FClBrI$?

Sol.



$C_3H_8O = C-\overset{\checkmark}{C}-\overset{\checkmark}{C}$

$C_4H_{10}O = C-C-\overset{\checkmark}{C}-\overset{\checkmark}{C},\ C-\underset{\overset{|}{C}}{\overset{\checkmark}{C}}-\overset{\checkmark}{C}$

$C_5H_{12}O = \overset{\checkmark}{C}-\overset{\checkmark}{C}-\overset{\checkmark}{C}-C-C,\ \overset{\checkmark}{C}-\underset{\overset{|}{C}}{\overset{\checkmark}{C}}-\overset{\checkmark}{C}-\overset{\checkmark}{C}$

$C-\underset{\overset{|}{C}}{\overset{C}{\overset{|}{C}}}-C\checkmark$

Previous Year's Questions

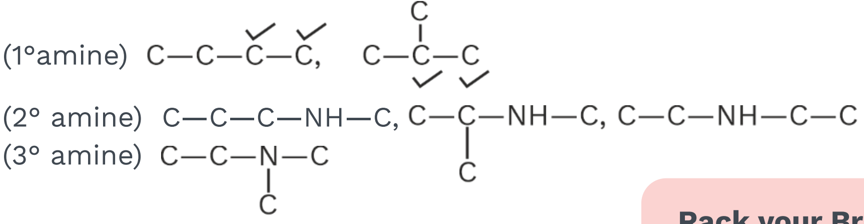
Number of isomers of C_5H_6

[AIIMS-2012]

(1) 2 (2) 3 (3) 4 (4) 5

(9) $C_4H_{11}N$ → No. of 1°, 2° and 3° amine.

Sol.



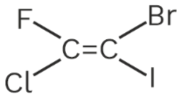
(1°amine) $C-C-\overset{\checkmark}{C}-\overset{\checkmark}{C},\quad C-\underset{\checkmark}{\overset{C}{\overset{|}{C}}}-\underset{\checkmark}{C}$

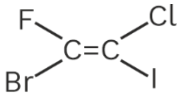
(2° amine) $C-C-C-NH-C,\ C-\underset{\overset{|}{C}}{C}-NH-C,\ C-C-NH-C-C$

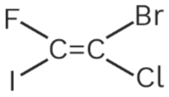
(3° amine) $C-C-\underset{\overset{|}{C}}{N}-C$

(10) $C_2FClBrI$ (No. of structural isomerism)

Sol. DU = 1,







Rack your Brain

Find out the number of Stuctural isomers (Acid and Ester) of $C_4H_8O_2$?

(11) C_3H_9N (No. of 1°, 2°, 3° amine)

Sol. (1° amine) C—C—C—N

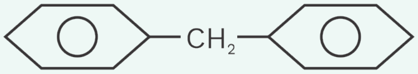
(2° amine) C—C—NH—C

(3º amine) 

$C-\underset{\overset{|}{C}}{N}-C$

Previous Year's Questions

The molecular formula of diphenylmethane,



is $C_{13}H_{12}$.

How many structural isomers are possible when one of the hydrogen is replaced by a chlorine atom?

[NEET-2004]

(1) 6 (2) 4 (3) 8 (4) 7

Important Point

$CH_3—$	$C_2H_5—$	$C_3H_7—$	$C_4H_9—$	$C_5H_{11}—$
1	1	2	4	8

Free valency

—X (F, Cl, Br, I), $—NH_2$, —OH etc.

Ex. $C_5H_{11}Cl \rightarrow 8$

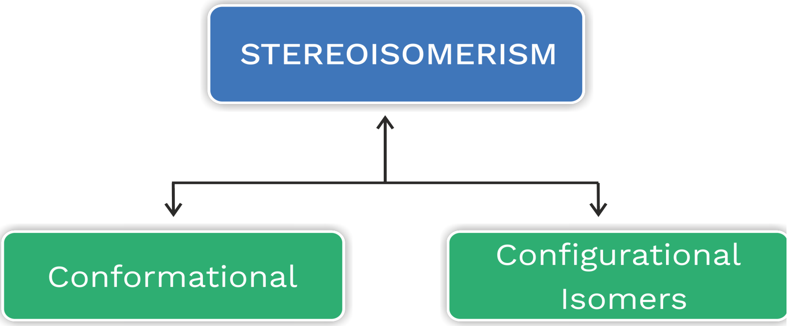
$C_5H_{13}N \rightarrow 8$ (1° Amine)

$C_4H_9Cl \rightarrow 4$

Rack your Brain

Find out the number of Stuctural isomers of $C_6H_{13}Cl$?

Stereo Isomerism



1. Conformational Isomerism

- Conformers also known as rotamers, and this isomerism is known as rotational isomerism.
- Study of conformers based on P.E. is known as conformational analysis at room temperature that's why conformations interconvertible to each other at room temperature and not separated and called as pseudo isomers.

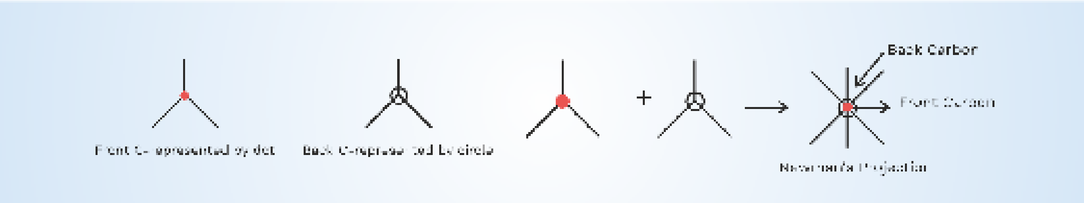
Definition

A number of stereoisomers which are formed due to free rotation around a single bond is known as conformations and this isomerism is known as conformational isomerism.

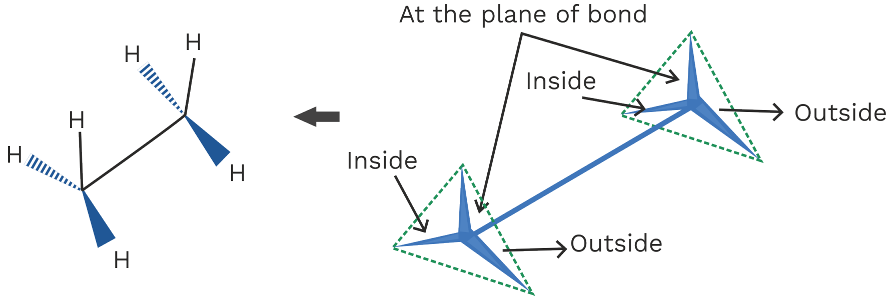
Representation of 3-D molecules

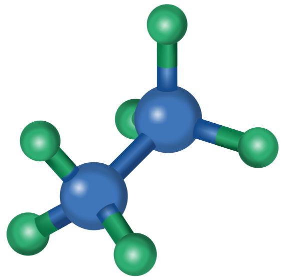
1. **Newman's projection formula :** (Front view/Back view)

- Front view projection of 3D molecules is known as Newman's projection formula.
- C—C bond does not represent in this projection formula.

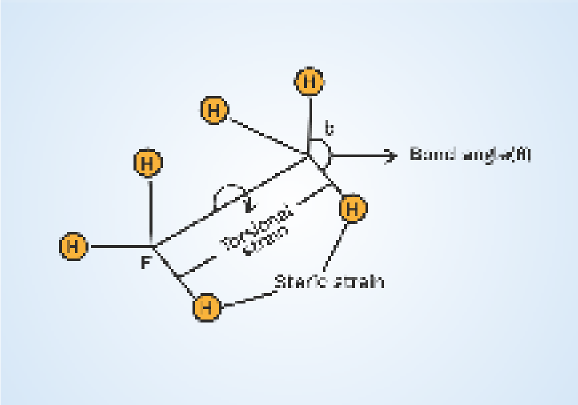


2. Saw-horse projection formula : (Side view projection of 3D molecules)





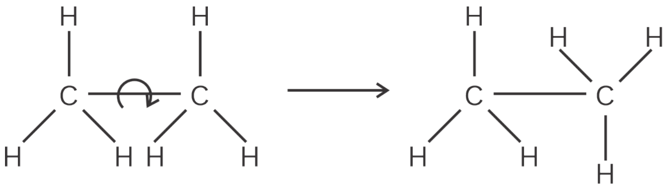
Stability factor of conformers



Bond angle : The angle between 2 bonds of a same atoms lying in same plane.

Dihedral angle : The angle between 2 bonds of adjacent atoms.

Conformers of ethane :



Concept Ladder

Types of strain for Acyclic compound :
(1) Steric strain (SS)
(2) Torsional strain (TS)

Rack your Brain

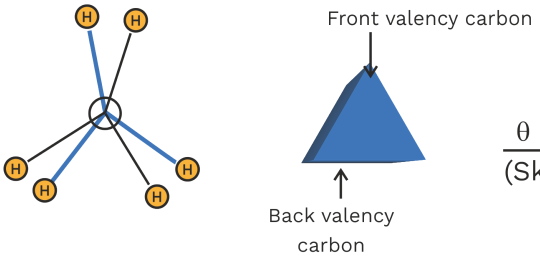
What is the effect of conformational isomers on bond angle and bond length?

Previous Year's Questions

Dihedral angle in staggered from of ethane is

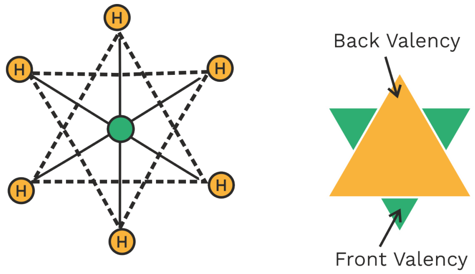
[AIPMT]

(1) 0° (2) 120° (3) 60° (4) 180°



(Eclipsed from)
(θ=0°, 120°, 240°, 960°)

$\xrightarrow[\text{(Skew From)}]{\theta\text{ - All rest}}$



(Staggered form)
(θ=60°, 180°, 300°)

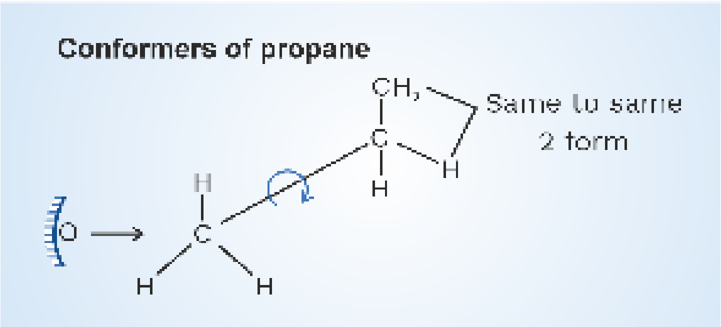
→ Maximum steric strain and torsional strain.
→ Maximum inter-electronic repulsion.
→ Maximum inter-electron energy.
→ Minimum stability.

→ Maximum steric strain and torsional strain.
→ Minimum inter-electron repulsion.
→ Minimum inter-electron energy.
→ Maximum stability.

NOTE :

Energy order ⇒ Eclipsed > Skew > Staggered
Stability order ⇒ Staggered > Eclipsed

Skew form : Infinite conformations in between eclipsed and staggered (anti) form is known as skew forms.



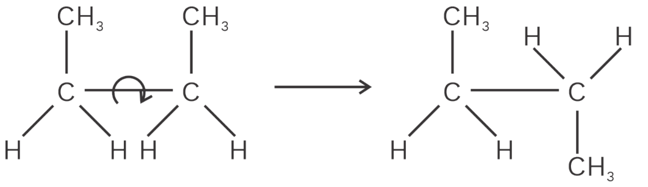
Rack your Brain

Which conformation has highest potential energy?

NOTE :

Energy orders ⇒ Eclipsed > Skew > Staggered
Stability order ⇒ Staggered > Skew > Eclipsed

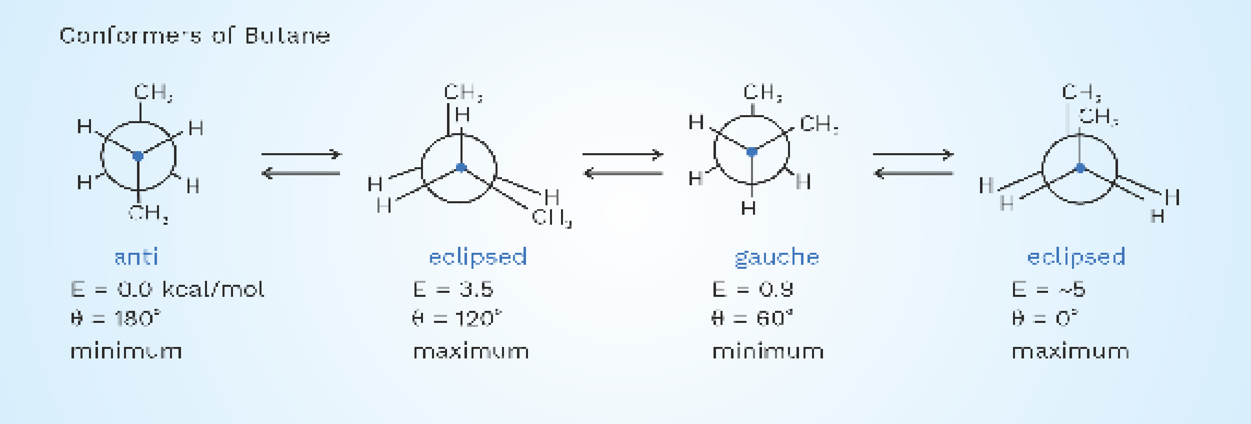
Conformers of Butane :



Previous Year's Questions

The isomers, which can be converted into another form by rotation of the molecules around single bond, are **[AIIMS]**

(1) conformers (2) enantiomers
(3) diastereomers
(4) geometrical isomers



Conformational Analysis :

(1) Torsional strain : I ≅ III, II ≅ IV IV >II > III > I

(2) Steric strain : I ≠ III, II ≠ IV IV >II > III > I

Energy order ⇒ Fully eclipsed > Partially eclipsed > Gauche > Anti
Stability order ⇒ Anti > Gauche > Partially eclipsed > Fully eclipsed

Conformers :

Out of infinite conformations which are formed at minimum possible energy profile curve, are conformers.

- All conformers are conformations but vice-versa not true. (Stable form)
- Conformations of ethane = ∞
  Conformer of ethane = 1 (Staggered)

Rack your Brain

How many conformers of butane are optically active?

Stability :

Vanderwal repulsion (S.S. and T.S.)

Staggered (more stable) > Eclipsed

Gauche form may be more stable than Anti/ staggered form if following factors are present in Gauche form.

(1) Hydrogen bonding

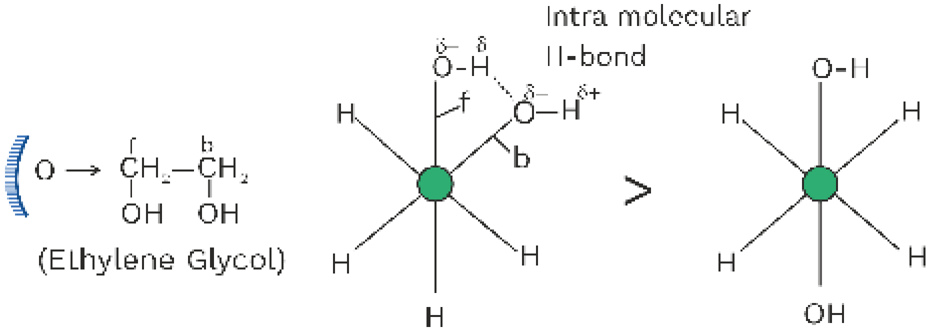
(2) Electrostatic attraction

Concept Ladder

Due to hydrogen bonding and electrostatic attraction, Gauche form of butane is more stable than Anti form/staggered.

Ex.

(1)



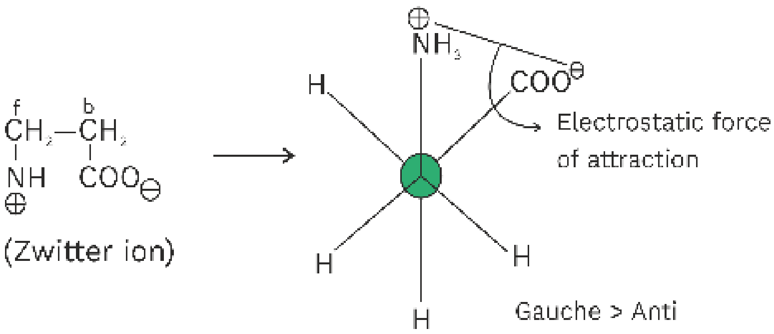
(Ethylene Glycol)

(Gauche form)

(Anti form)

In case of eclipsed form repulsion is more (H-bonding is not eclipsed).

(2)

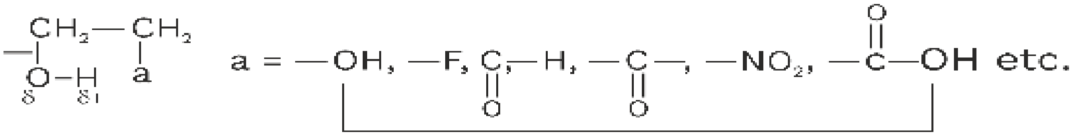


(Zwitter ion)

Electrostatic force of attraction

Gauche > Anti

(3)

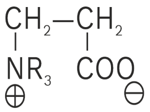


$$\underset{\overset{\delta}{O}-\overset{\delta}{H}}{CH_2}-\underset{a}{CH_2} \quad a = -OH,\ -F,\ -\underset{\underset{O}{\|}}{C}-H,\ -\underset{\underset{O}{\|}}{C}-,\ -NO_2,\ -\overset{\overset{O}{\|}}{C}-OH \text{ etc.}$$

Gauche > Anti
(Stability)

(Hydrogen bonding)

(4)

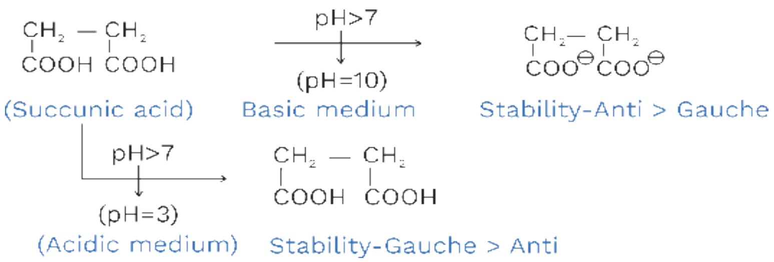


$$\underset{\overset{\oplus}{NR_3}}{CH_2}-\underset{COO^{\ominus}}{CH_2}$$

Gauche>Anti

(Electrostatic force of attraction)

(5)



(Succunic acid)

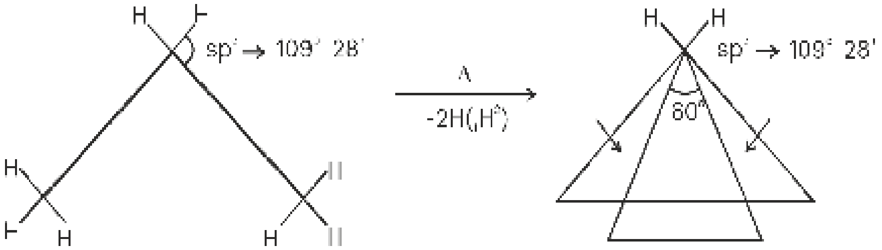
Basic medium

Stability-Anti > Gauche

(Acidic medium)

Stability-Gauche > Anti

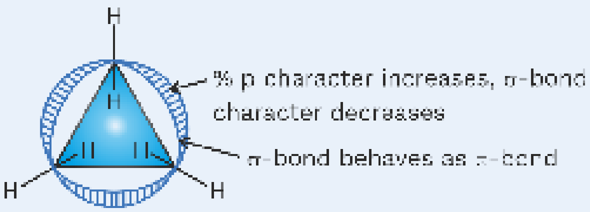
Conformers of cyclic ring (Cycloalkane) :



Real bond angle in propane → 109° 28’
Bond angle in cyclopropane → 60°
Angle strain → 49° 28’

Relationship between p-character and bond angle :

$$\boxed{\%p \propto \frac{1}{\text{Bond angle}}}$$



- High angle strain, planar molecule.
- No flexibility.
- Cyclopropane does not form conformers.

(1) Cyclopentane

→ Forms envelop at room temperature. (appears like wave).
→ Highly unstable.

Rack your Brain

What are the consequences of p and s-character on bond angle?

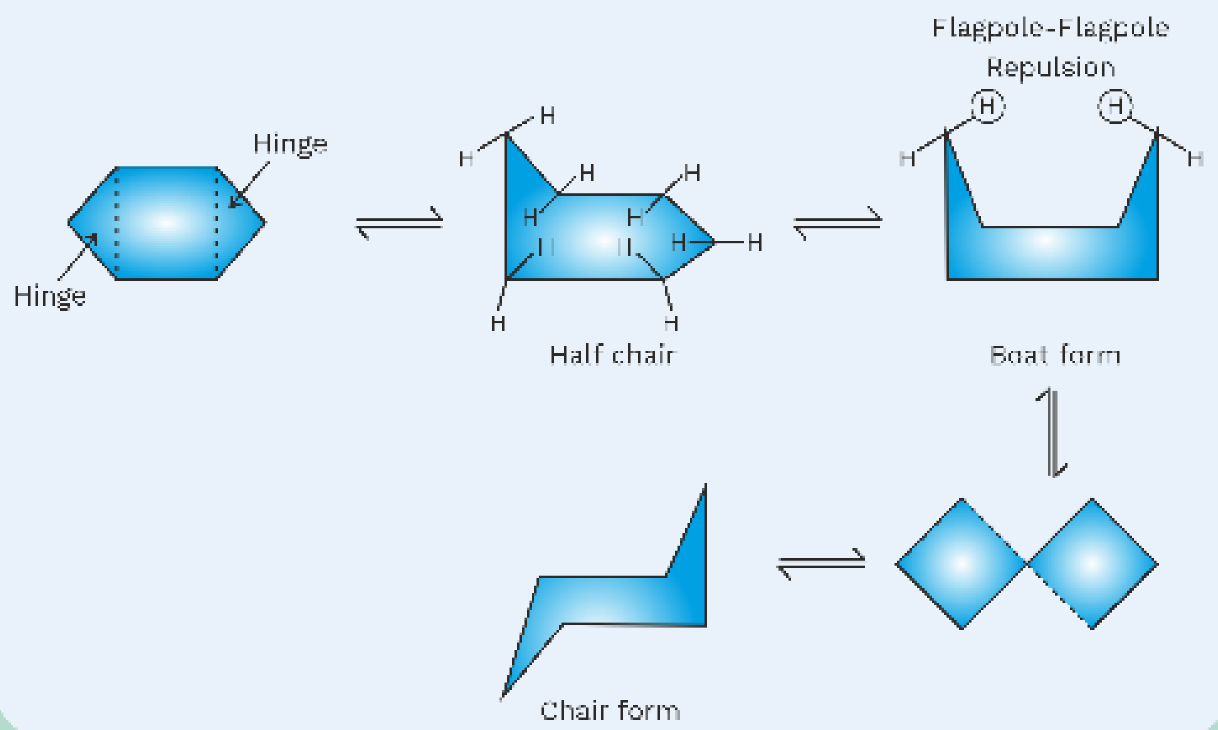
Concept Ladder

Types of strain for cyclic compound:
(1) Steric strain (SS)
(2) Torsional strain (TS)
(3) Angle strain (AS)

Concept Ladder

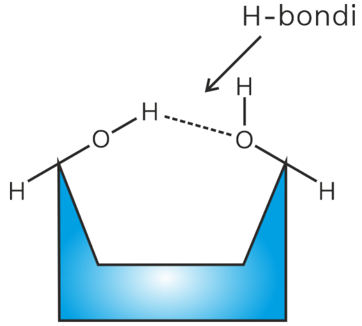
	% p	% s	Bond angle
sp^3	75%	25%	109° 28’
sp^2	66%	33%	120°
sp	50%	50%	180°

(2) Cyclohexane :



Stability order ⇒ Chair form > Twisted boat > Boat form > Half chair

Exception ⇒



>Twisted boat form

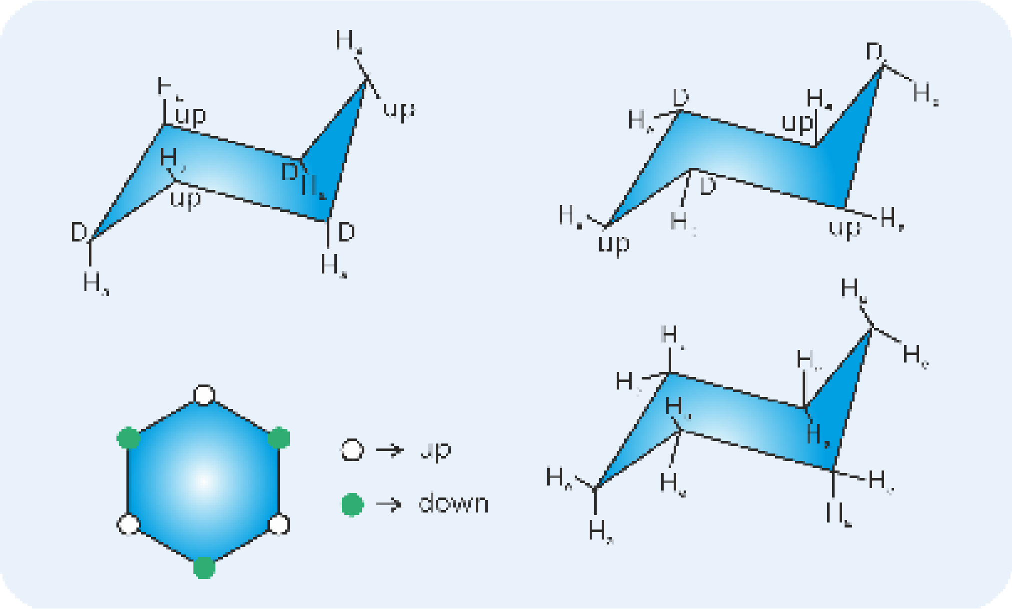
Previous Year's Questions

Among the following the most stable compound is

[AIIMS-2005]

(1) cis-1,2-cyclohexanediol
(2) trans-1,2-cycloehxanediol
(3) cis-1,3-cyclohexendiol
(4) trans-1,3-cyclohexanediol

Chair form of cyclohexane :



Most symmetric molecule.

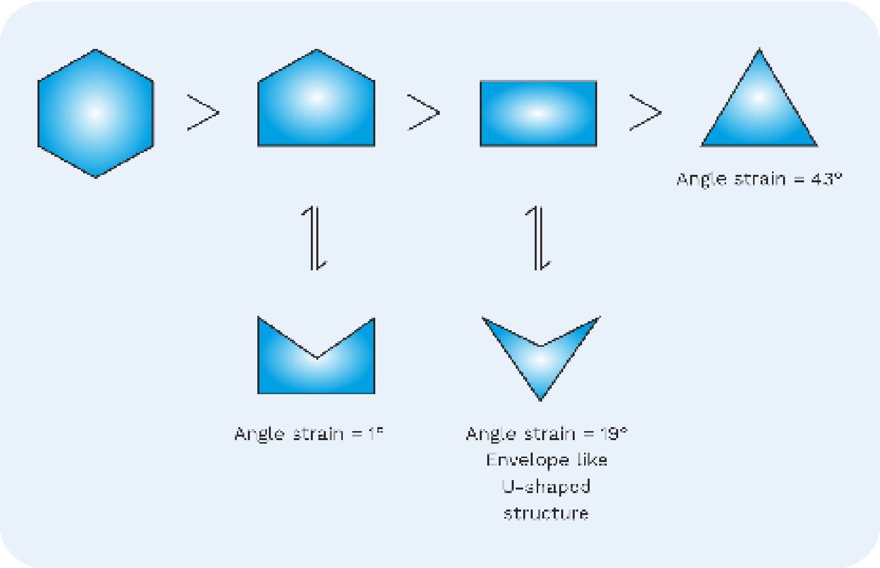
→ Thermodynamically stable molecule.

→ Every carbon bear 2 ideal tetrahedral.

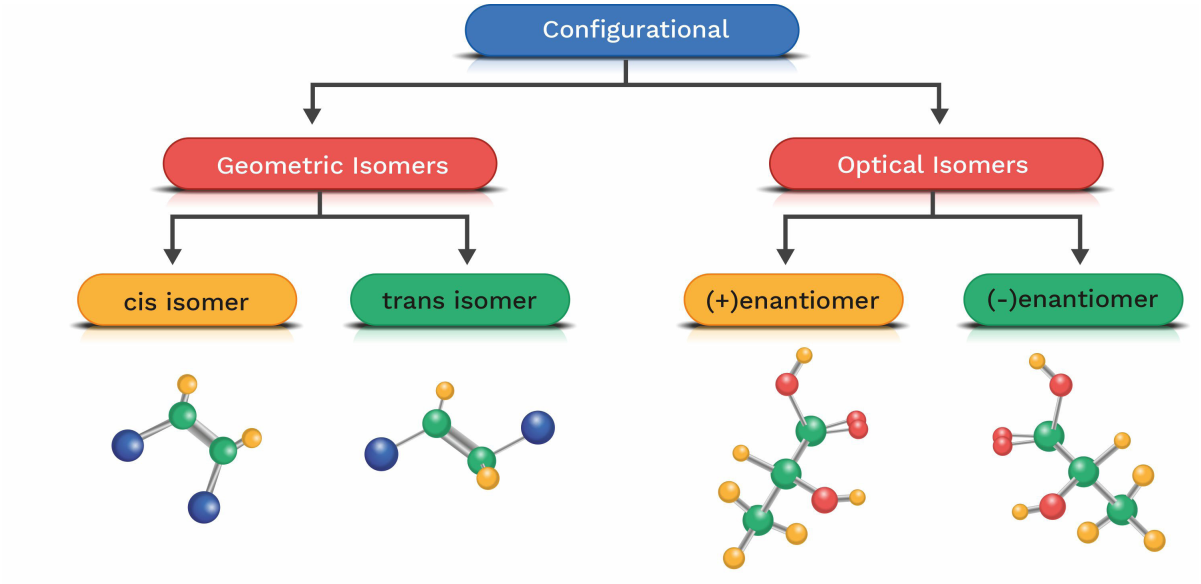
→ Conformer of cyclohexane = 3 (1 Chair + 2 Twisted boat) Optically active.

up — up → cis
up— down → trans
down — up → trans
down — down → cis

Stability of ring :



Configurational isomerism

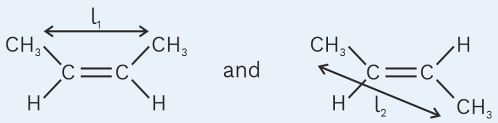


Examples: cis-dichloroethane | trans-dichloroethane | L-(+)-Lactic acid | D-(-)-Lactic acid

1. Geometrical Isomerism

- Geometrical isomers occur due to differential distance between terminal group.

Example : $CH_3–CH=CH–CH_3$



$l_1 \neq l_2$ (Due to different aerial distance)

Both are Geometrical Isomers.

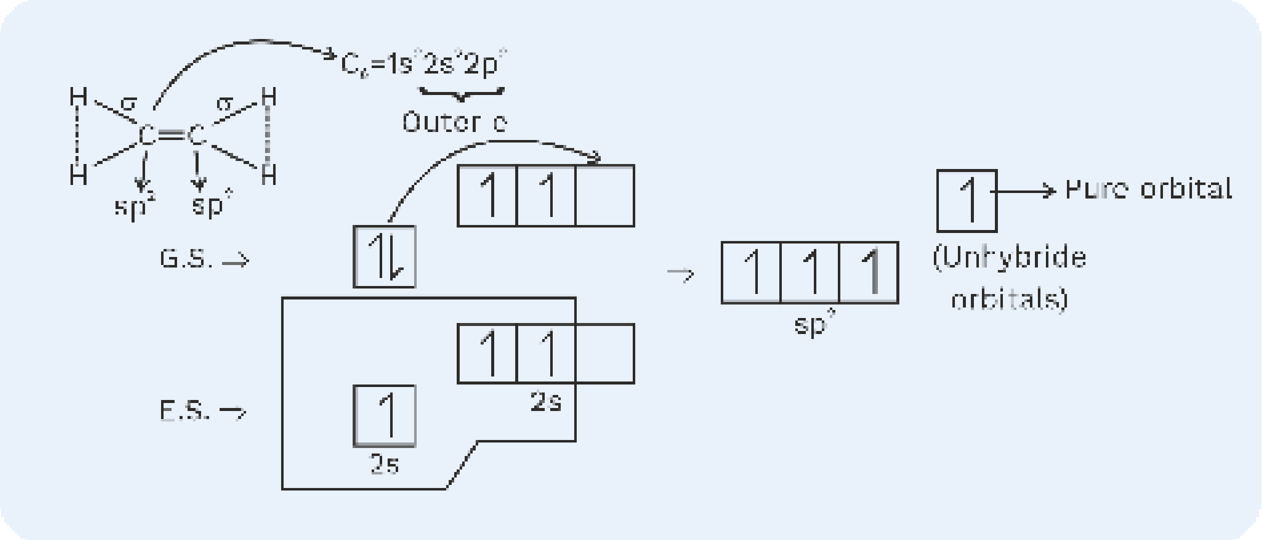
→ G.I. are not interconvertible at room temperature because of π-bond dissociation energy (62 Kcal).

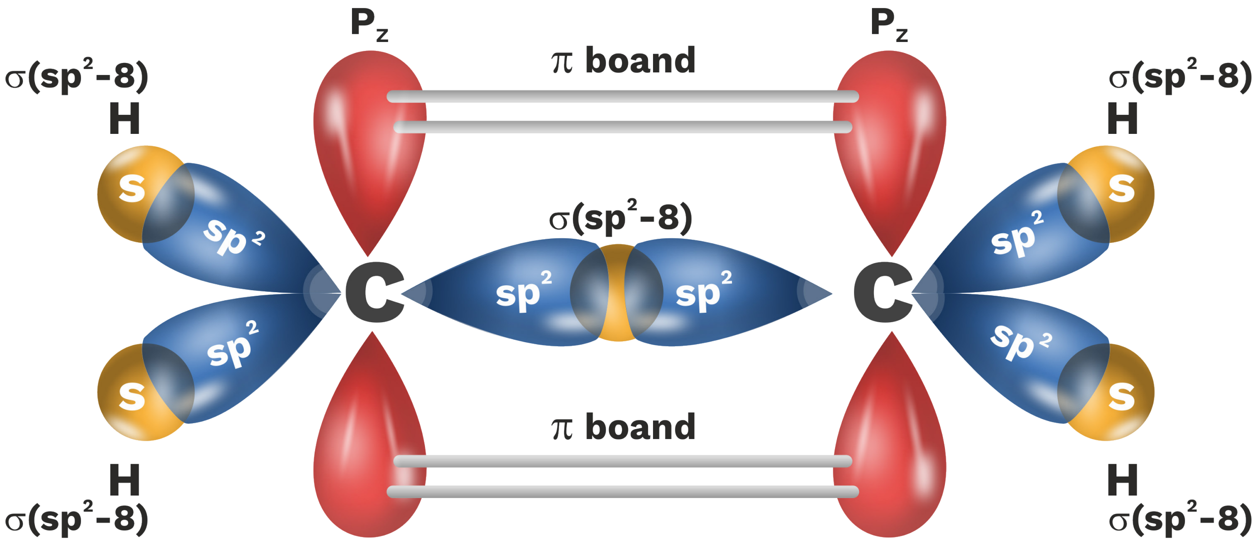
Compound must has R.R.S./absence of free rotation/Rigid system/hindered rotation/Frozen rotation to exhibit configurational isomerism.

Definition

The stereoisomers which have different 3-D relative around a restricted rotatory system (RRS) is known as Geometrical isomers, this phenomenon is known as Geometrical isomerism.

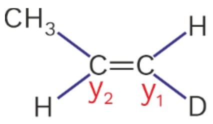
Type of R.R.S :
Double bonded R.R.S





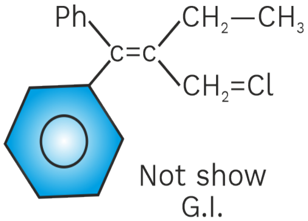
1. GI in Alkene :

(1)



Show G.I.

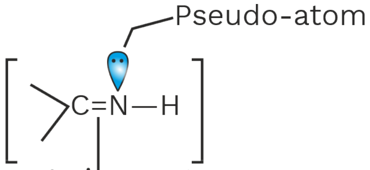
(2)



Not show G.I.

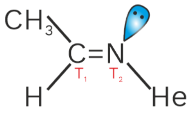
(A) GI in Imine :

(1)



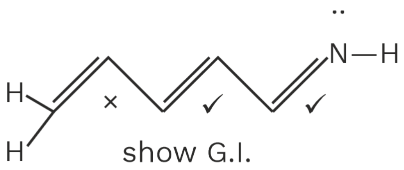
Imine system

(2)



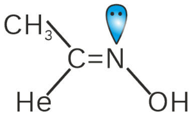
Show G.I

(3)



show G.I.

(B) G.I. in oxime :



(1) Same Not show G.I

Concept Ladder

sp^2 carbon must be attached with different groups (Terminal position).

Previous Year's Questions

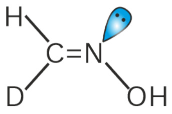
2-butene shows geometrical isomerism due to :

[AIPMT]

(1) restricted rotation about double bond
(2) free rotation about double bond
(3) free rotation about single bond
(4) chiral carbon

Rack your Brain

What will be the effect of a big gruop present in a molecule on geometrical isomerism?

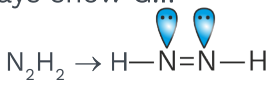
(2) 

show G.I

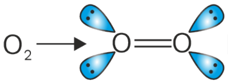
(C) G.I. in Azo-compounds : 

$[-N=N-H]$

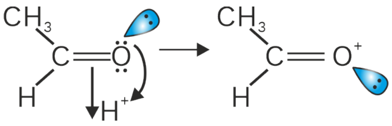
Always show G.I.

(1) 

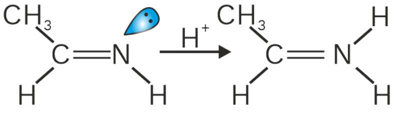
$N_2H_2 \rightarrow H-N=N-H$ show G.I.

(2) 

$O_2 \rightarrow O=O$ Not show G.I

(3) 

Not show G.I show G.I

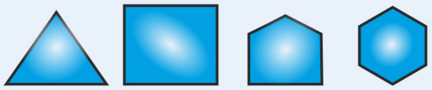
(4) 

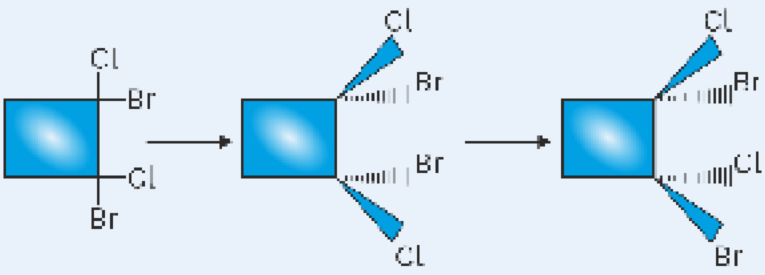
show G.I Not show G.I

Rack your Brain

Is unsaturation required for geometrical isomerism?

2. G.I. in cycloalkane :

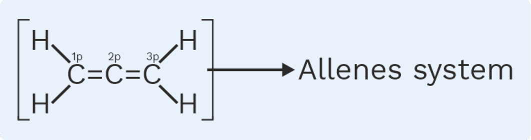




Concept Ladder

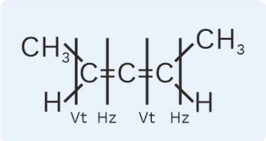
Minimum 2 sp^3 carbon must be attached with different group to show G.I. in cycloalkane.

3. G.I. in Allene :

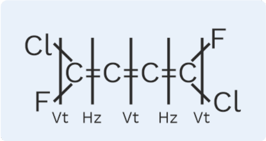


→ When 2 double bonds are continuously present in a system then it is called allene system.

→ When more than 2 double bonds are present in a system then it is called cumulated dienes.



Not show G.I.



Show G.I.

Concept Ladder

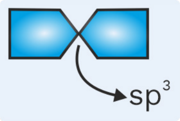
When terminal groups are different, then odd number double bonds allenes and spiro system shows G.I. due to square-planar environment. and even number double bond containing allenes and spiro system do not show G.I. due to tetrahedral environment.

Rack your Brain

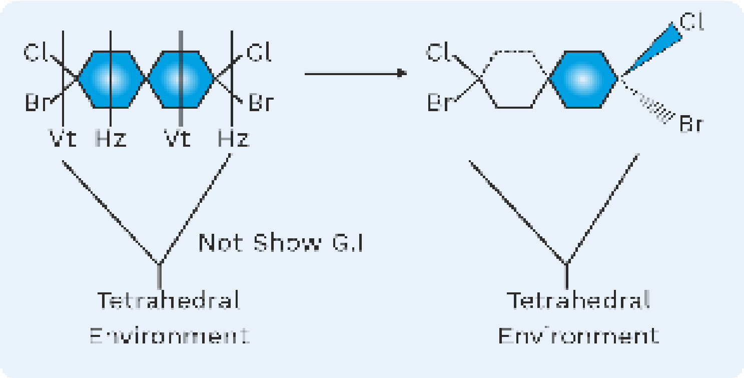
Why is it easy to separate geometrical isomers by physical methods?

5. G.I. in spiro compound :

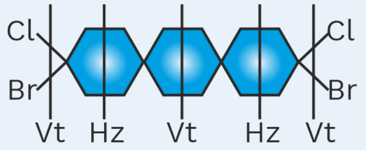
When two rings are fused at the same C-atom then it is called as spiro compound. (Both rings are perpendicular to each other).



(1)



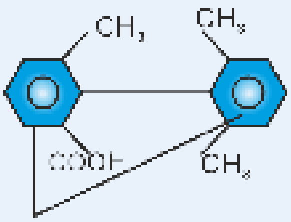
(2)



Square planar
environment
↓
Show G.I

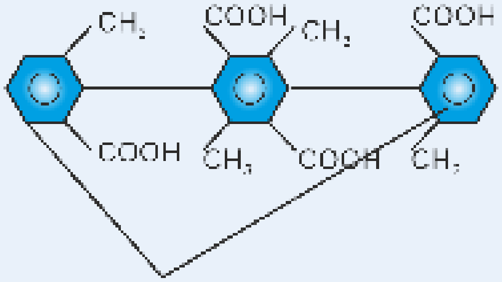
5. G.I. in Biphenyl and Triphenyl System :

(1)

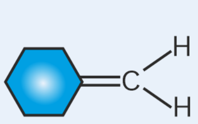


Both ring are perpendicular
tetrahedral environment

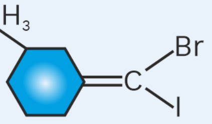
(2)



Square planar environment
(Both ring in same plane)



Not show G.I



Show G.I

Concept Ladder

In Biphenyl system each ring must be attached with different bulky group to exhibit G.I.

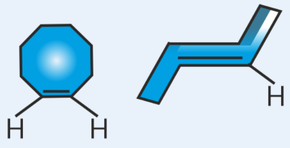
At R.R.S. both terminal group must be in a same plane.

Rack your Brain

Find out the total no. of Keto oxime with the molecule formula of $C_5H_{10}O$.

G.I. in endo-cyclic π-bond :

Minimum 8 carbon ring with double bond shows geometrical isomerism.



Cis Trans

Rack your Brain

Why G.I. do not exists for 3 to 7 membered ring?

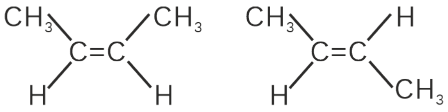
NOTE : In case of endocyclic π-bond 8 to 11 membered ring. Cis form is more stable compare to trans form and after 12 or 12 membered ring trans form is more stable compare to cis form.

Nomenclature system for G.I. :

- **Cis-trans system :**

  If two identical group at RRS on same side = cis

  If two identical group at RRS on opposite side = trans



Cis Trans

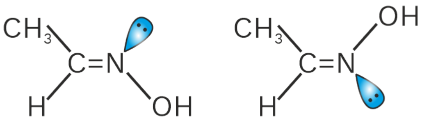
- **Syn-Anti system :**

  Whenever one terminal or both terminals of RRS have lone pair then Syn-Anti system applied.

  (1) Oximes :

  (I) Aldoxime :

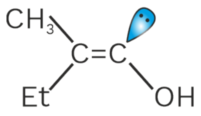
  - If H & OH group both are on same side = Syn.
  - If H & OH group both are on opposite side = Anti.

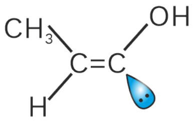


Syn Anti

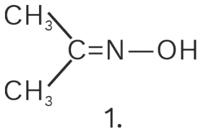
  (II) Ketoxime :

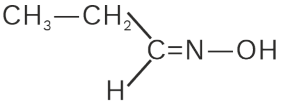
  - Unsymmetrical ketoxime gives G.I.
  - Alphabetically preferred alkyl group & OH group on same side – Syn.
  - Alphabetically preferred alkyl group & OH group both on opposite side – Anti.


Syn


Anti

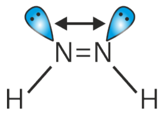
Ex. Oximes are formed with the molecular formula of C_3H_6O is

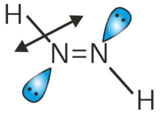

1.


2. G.I

Total = 3.

(2) Azo-compounds :


Syn


Anti

- Both I.P. on same side = Syn.
- Both I.P. on opposite side = Anti.

Concept Ladder

Whenever all the groups are different at both terminal of RRS then the new system E–Z applied.

E → ENTGEGAN (Opposite side)

Z → Zusamann (Same side)

(3) E–Z system :

CIP rule : Cohn, Ingold, Prolong

Rack your Brain

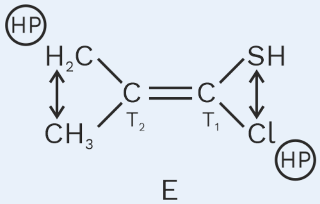
Find out the total no. of G.I. with the molecular formula of $C_2FClBrI$.

Priority rules :

Rule-1 : Priority of atoms or groups is given as per the atomic number of atom which is directly attached to terminal of R.R.S.

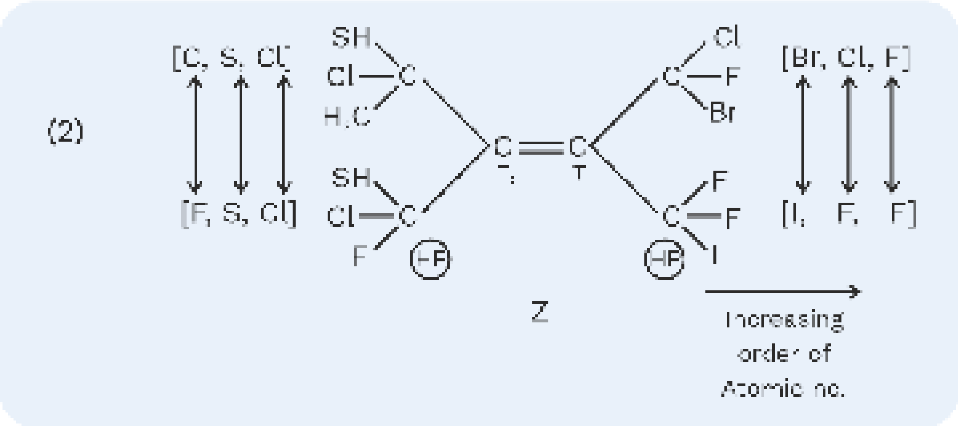
(1)

(1)


E

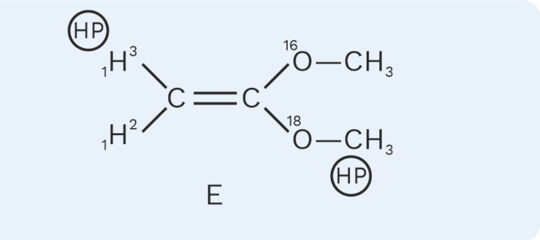
Rule-2 : If first rule fails then atomic number of next atom will be considered.

(2)



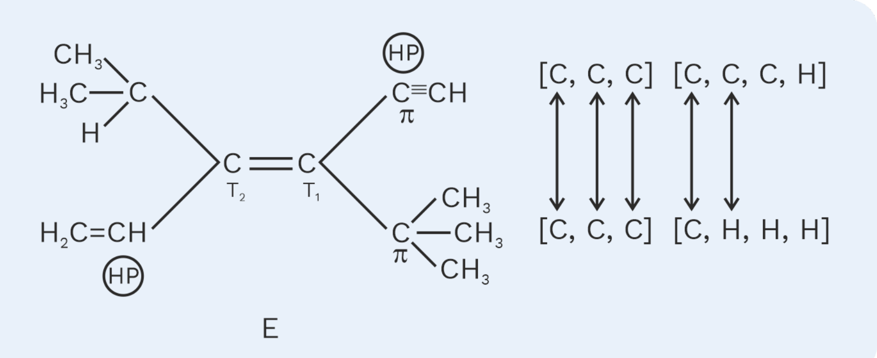
Rule–3 : If multiple bonds are present, then each will be analysed and designated as E or Z.

(3)



Rule–4 : If isotopes present, [Priority will be given as per the atomic mass]

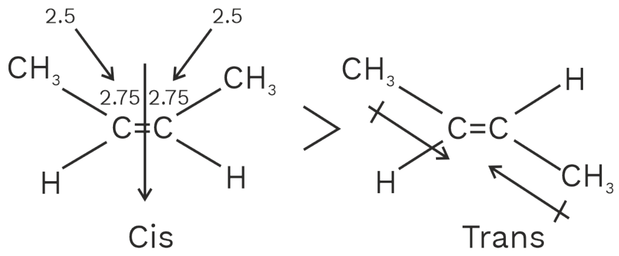
(4)



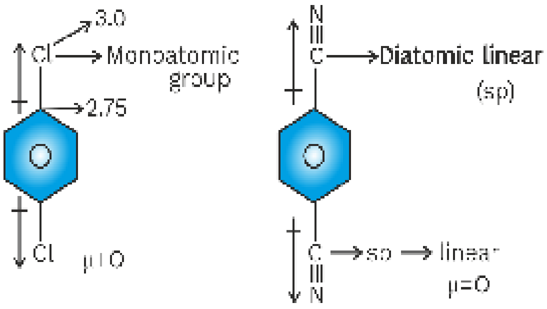
Physical Properties

1. **Dipole Moment :** Degree of polarity will be measured by dipole moment. Dipole moment is a vector quantity.

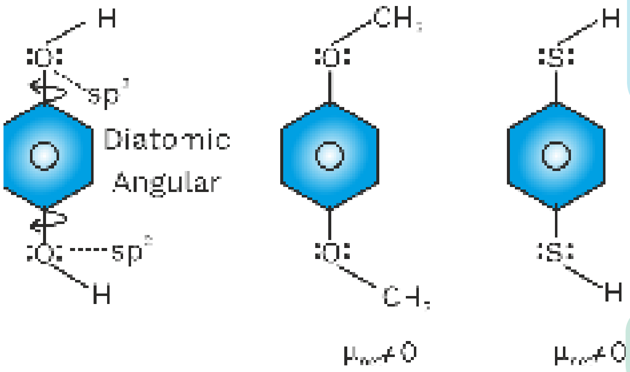
(1)



(2)



(3)



Concept Ladder

When diatomic angular group is present at para-position of benzene molecule, angular group forms infinite conformations around a single bond, so in this case, $m_{net} \neq 0$ (Non-zero).

Concept Ladder

Stronger the Van der Waals forces higher the B.P.

Previous Year's Questions

The dipole moment is the highest for

[AIIMS]

(1) trans-2-butene
(2) 1,3-dimethylbenzene
(3) acetophenone
(4) ethanol

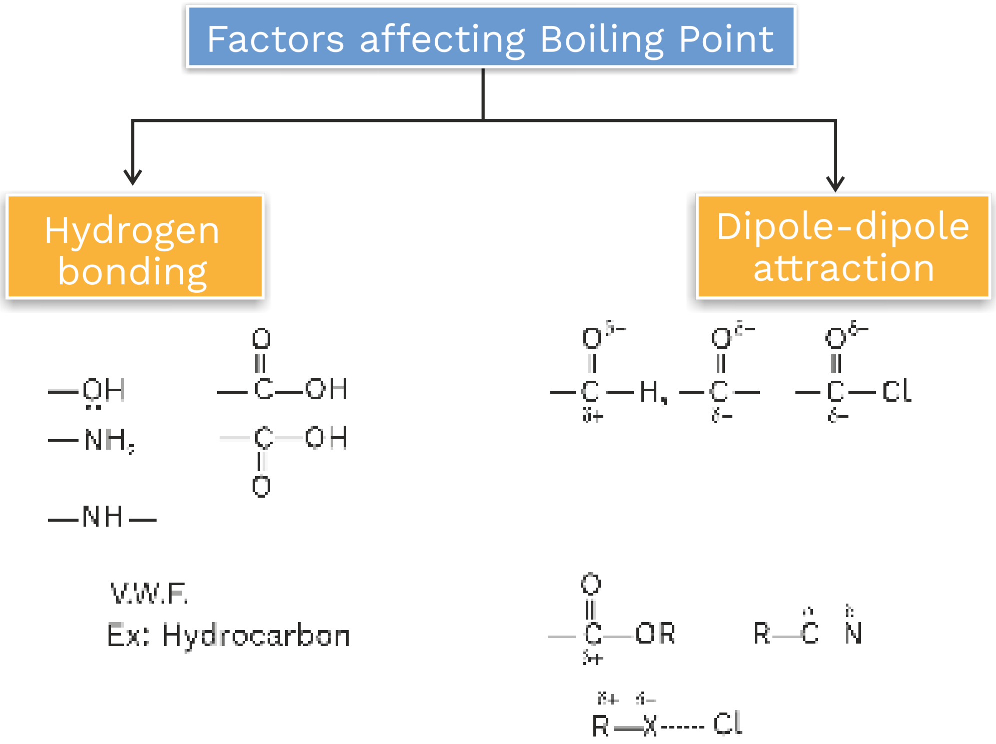
2. **Boiling point :**

Key points :

B.P. $\propto$ Molecular weight (MW)

$$\text{B.P.} \propto \frac{1}{\text{Branching}}$$

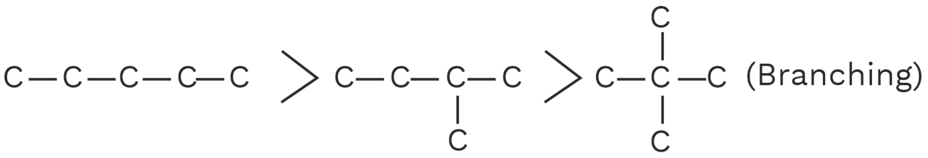
B.P. $\propto$ Intermolecular forces of attraction



V.W.F.
Ex: Hydrocarbon

Ex.

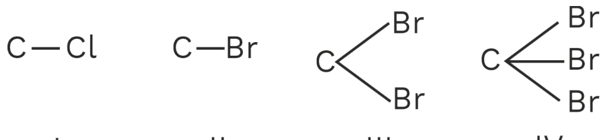
(1)



$$C{-}C{-}C{-}C{-}C > C{-}C{-}\underset{\mid\atop C}{C}{-}C > C{-}\overset{C\atop\mid}{\underset{\mid\atop C}{C}}{-}C$$

(Branching)

(2)



I II III IV

IV > III > II > I
(M.wt.)

3. Melting Point

Key points :

M.P. $\propto$ Molecular weight

M.P. $\propto$ Packing efficiency (interlocking)

M.P. $\propto$ Symmetry of molecule

M.P. $\propto$ Branching

Cis

I

Trans

II

P.E : II > I

M.P : II > I

Concept Ladder

Like dissolves Like

Example of polar substances protic is HCl in water

Example of non polar substances is hexane in benzene

4. Solubility

G.I. having high dipole moment will be more soluble in polar solvent and geometrical isomers having less dipole moment will be more soluble in none-polar solvent.

p-nitrophenol > o-nitrophenol

5. No of Geometrical Isomerism

Types of Geometrical isomers

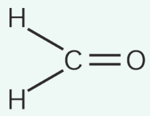
(1) Symmetrical System

(2) Unsymmetrical system

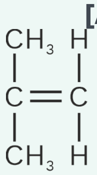
Previous Year's Questions

Which of the following has the highest dipole moment?

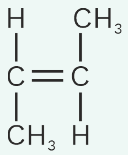
[AIIMS]

(1) 

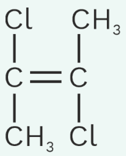
$H_2C{=}O$

(2) 

$$\begin{array}{ccc} CH_3 & & H \\ | & & | \\ C & = & C \\ | & & | \\ CH_3 & & H \end{array}$$

(3) 

$$\begin{array}{ccc} H & & CH_3 \\ | & & | \\ C & = & C \\ | & & | \\ CH_3 & & H \end{array}$$

(4) 

$$\begin{array}{ccc} Cl & & CH_3 \\ | & & | \\ C & = & C \\ | & & | \\ CH_3 & & Cl \end{array}$$

SYSTEM	GEOMETRICAL ISOMERISM
Unsymmetrical Compound	2^n
Symmetrical Compound	If n = even $2^{n-1} + 2^{(n/2)-1}$
	If n = odd $2^{n-1} + 2^{(n-1)/2}$

Ex. (1) $CH_3-CH=CH-CH_2-CH_3$

G.I = $2^n = 2^1 = 2$

(2) $CH_3-CH=CH-CH=CH-CH_2-CH_3$

G.I = $2^n = 2^2 = 4$

(3) $CH_3-CH=CH-CH=CH-CH_3$

Symmetrical even

n = 2

G.I = $2^{n-1} + 2^{(n/2)-1} = 3$

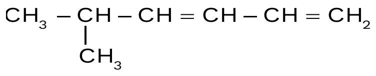
(4) $CH_3-CH=CH-CH=CH-CH=CH-CH_3$

Symmetrical Odd

n = 3

G.I = $2^{n-1} + 2^{(n-1)/2} = 6$

(5)



$CH_3-CH(CH_3)-CH=CH-CH=CH_2$

G.I = $2^n = 2^1 = 2$

Previous Year's Questions

How many geometrical isomers are possible in the following two alkenes?

(i) $CH_3-CH=CH-CH=CH-CH_3$

(ii) $CH_3-CH=CH-CH=CH-Cl$

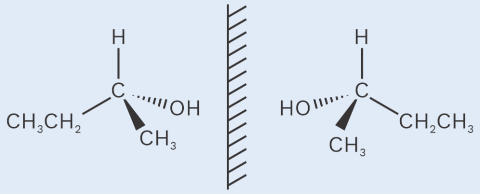
[AIIMS]

(1) 4 and 4	(2) 4 and 3
(3) 3 and 3	(4) 3 and 4

Optical Isomerism

Optical isomers have non-superimposable mirror images of each other.
Each non-superimposable mirror image structure is called Enantiomers.

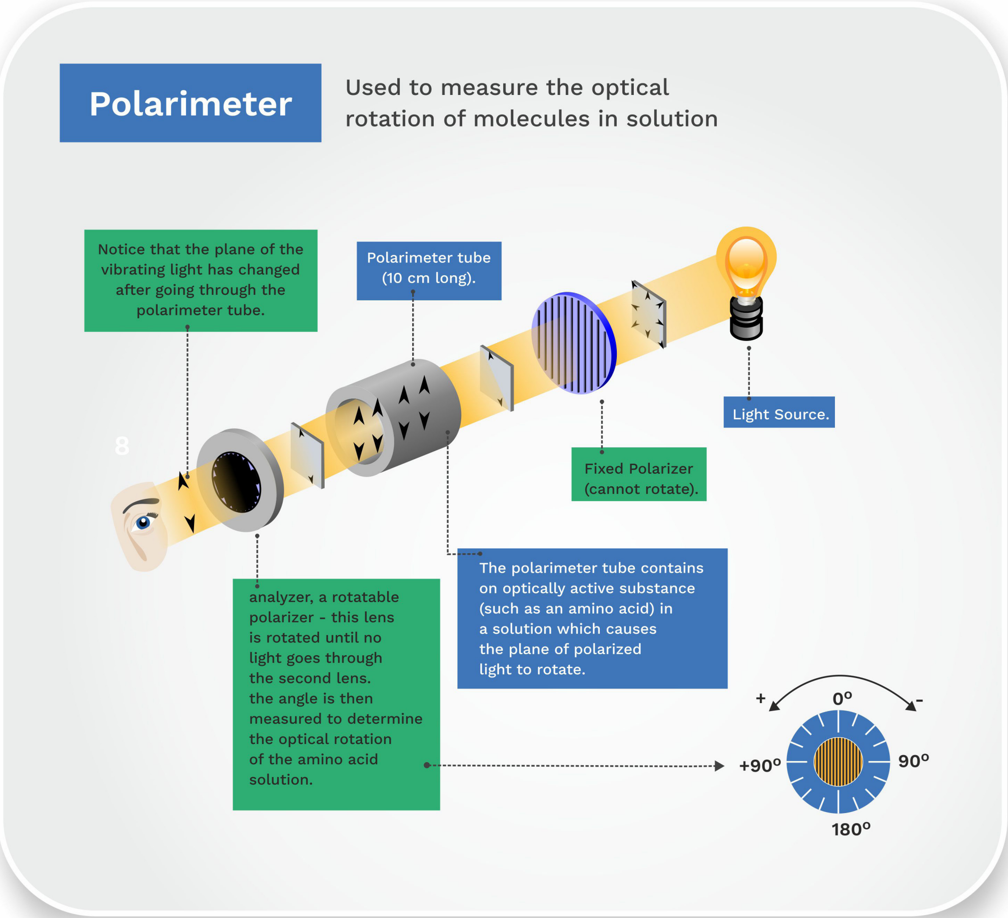
Ex.



Definitions

Compounds having same M.F., same structural formula but different behavior towards PPL are called optical isomers & this phenomena is known as optical isomerism.

Polarimeter experiment



Polarimeter

Used to measure the optical rotation of molecules in solution

Notice that the plane of the vibrating light has changed after going through the polarimeter tube.

Polarimeter tube (10 cm long).

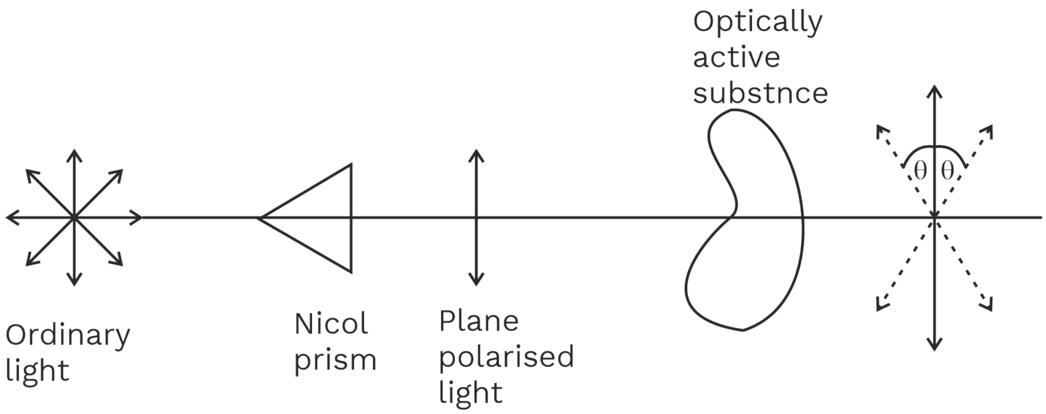
Light Source.

Fixed Polarizer (cannot rotate).

The polarimeter tube contains on optically active substance (such as an amino acid) in a solution which causes the plane of polarized light to rotate.

analyzer, a rotatable polarizer - this lens is rotated until no light goes through the second lens. the angle is then measured to determine the optical rotation of the amino acid solution.

In 2-D Representation



If rotation of light is anticlock wise → laevo rotatory (*l*-form)

If rotation of light is clock wise → dextro rotatory substance (*d*-form)

If there is no rotation of light then substance is called optically inactive.

Compound is optically inactive if :

- Compound does not give optical isomerism — Achiral molecule.
- Compound give optical isomerism but optically inactive — compound.
- Compound may be equimolar mixture of 'd' & 'l' isomers — Racemic mixture.

Some important terms

- **Optically active compounds :** Compounds which are capable to rotate PPL.
- **Optically inactive compounds :** Compounds which are not capable to rotate PPL.
- **Chiral molecule :** Unsymmetrical molecule is known as chiral molecule.
- **Achiral molecule :** Symmetrical molecule is known as achiral molecule.
    - All achiral molecules are optically inactive molecule.

Previous Year's Questions

Which one of the following pairs represents stereoisomerism?

[NEET]

(1) Structural isomerism and geometrical isomerism

(2) Optical isomerism and geometrical isomerism

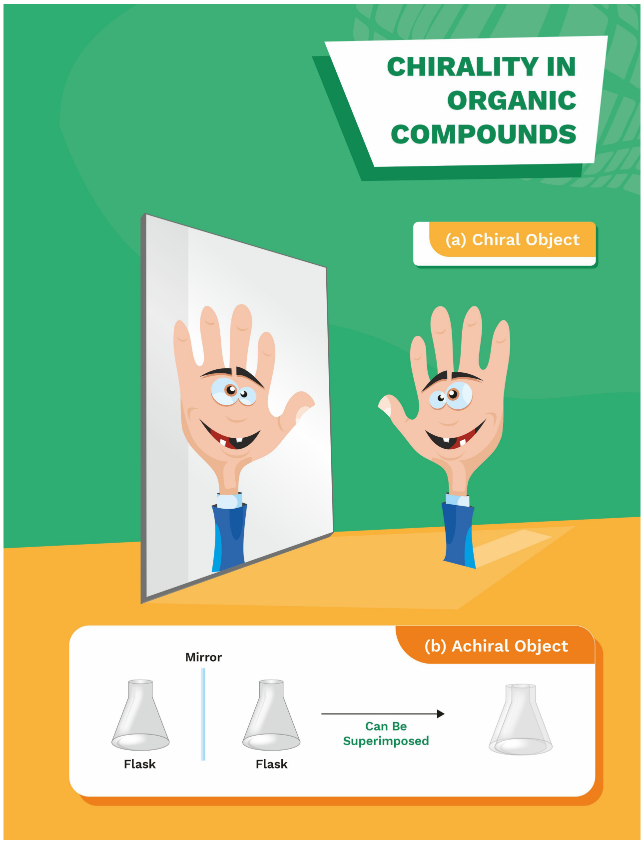
(3) Chain isomerism and rotation isomerism

(4) Linkage isomerism and geometrical isomerism

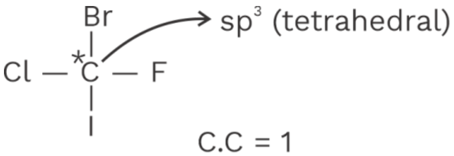
Rack your Brain

How to determine optical rotation of a molecule that consist of one chiral carbon?

- **Chiral centre (C.C) :** An sp^3-hybridised atom which have all 4 different groups is known as C.C (asymmetric centre).
  - Chiral centre is not a necessary condition for a compound to be optically active (optical activity).
  - Generally if compound has only one chiral centre then compound is optically active (Except – Amine flipping).

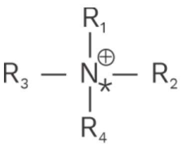


An sp^3 → (C, N, O, P, S)

(1)


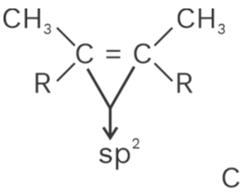
$$Cl-\overset{Br}{\underset{I}{\overset{*}{C}}}-F$$

C.C = 1

(2)


$$R_3-\overset{R_1}{\underset{R_4}{\overset{\oplus}{N}^*}}-R_2$$

C.C = 1

(3)


C.C = 0

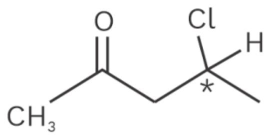
Previous Year's Questions

Which of the following is a chiral compound?

[AIIMS]

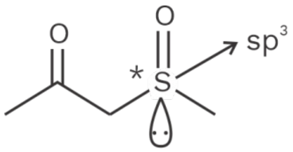
(1) Hexane
(2) n-Butane
(3) Methane
(4) 2,3,4-Trimethylhexane

(4)



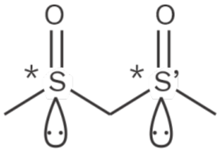
C.C = 1

(5)



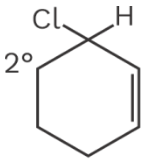
C.C = 1

(6)



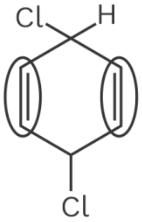
C.C = 2

(7)



C.C = 1

(8)

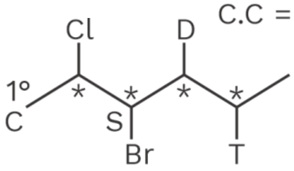


C.C = 0

(9)

C.C = 0

(10)



C.C = 4

Concept Ladder

Chiral → unsymmetrical → optically active

Achiral → symmetrical → optically inactive

Previous Year's Questions

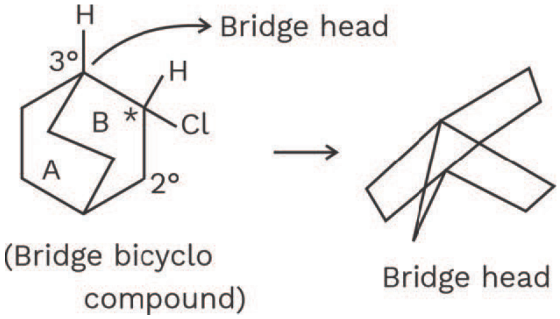
Which of the following alkanes is optically active?

[AIIMS]

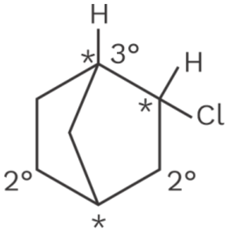
(1) 3-Methylhexane
(2) Propane
(3) 2,3,4-Trimethylpentane
(4) 2-Methylbutane

Rack your Brain

Why chiral molecules are optically active?

(11) 

(Bridge bicyclo compound)

(12) 

C.C = 3

Rack your Brain

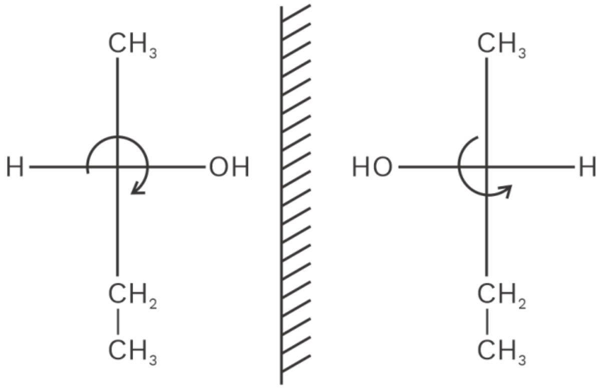
What are the conditions for a molecule to be optically active?

Conditions for Optical activity

Condition 1 : If a compound has only one chiral center then chiral centre is sufficient condition for a molecule to be optically active (optical activity).

Condition 2 : If a compound has more than one chiral centre then chiral centre is not a sufficient condition for a molecule to be optically active, in this case the whole molecule must be chiral or unsymmetrical for a molecule to be optically active.

Ex. 1



(d) (l)

(I) (II)

Previous Year's Questions

Which of the following molecule is not chiral?

[AIPMT]

(1) 2-butanol
(2) 2,3-dibromo pentane
(3) 3-bromo pentane
(4) 2-hydroxy propanoic acid

For a molecule to be optically active compounds positions must be different. Compound and its mirror image both are non-superimposable optically active.

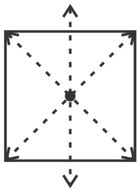
Symmetry elements

(i) COS — Centre of symmetry
(ii) POS — Plane of symmetry
(iii) AOS — Axis of symmetry

(i) Centre of Symmetry (COS)

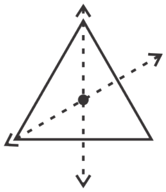
It is an imaginary point situated at the centre of molecule from the centre if we draw a straight line then they will meet at same atom, same distance but in opposite direction then molecule has COS.

(1)



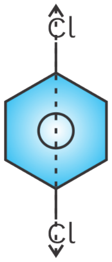
COS ✓

(2)



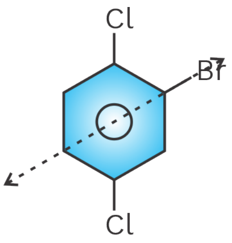
COS ✗

(3)



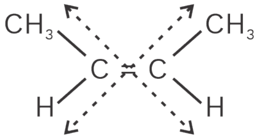
COS ✓

(4)



COS ✗

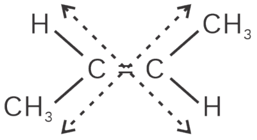
(5)



Cis

COS ✗

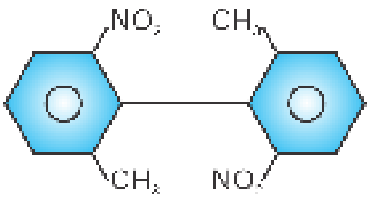
(6)



Trans

COS ✓

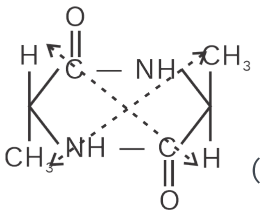
(7)



Tetrahedral enviroment

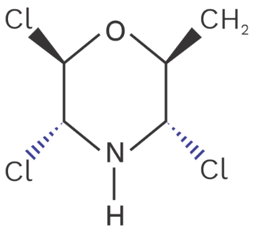
COS ✗

(8)



COS ✓

(9)



COS ✗

Key Points

(1) COS is different in odd number of atom containing ring.

(2) COS is different in cis isomers.

(3) COS is different in all the molecules which can form tetrahedral environmental.

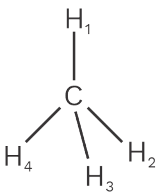
Rack your Brain

Which geometrical isomer will exhibit COS in case of 2-butene?

(ii) Plane of Symmetry (POS)

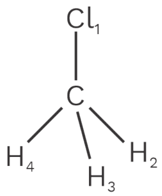
It is an imaginary plane, passing through a molecule which can bisect a molecule into two equal halves & both half are mirror image of each other. Such plane is known as POS.

(1)



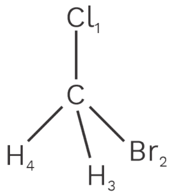
1, 2 → 1 POS
1, 3 → 1 POS
1, 4 → 1 POS
2, 3 → 1 POS
2, 4 → 1 POS
3, 4 → 1 POS

(2)



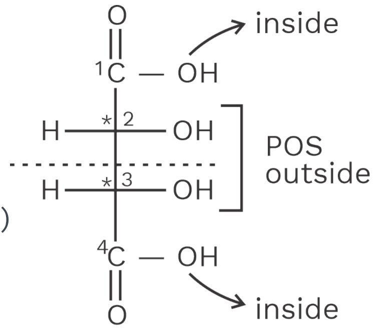
1, 2 → 1 POS
1, 3 → 1 POS
1, 4 → 1 POS

(3)



1, 3 → 1 POS

(4)



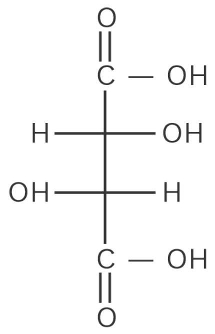
Chiral center = 2

Optically active d or l tartaric acid
Not mirror images.

Rack your Brain

Find out total no. of symmetry present in cubane.

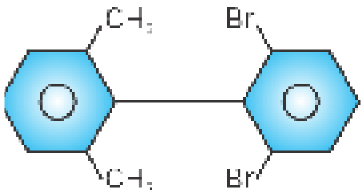
(5)



POS ×

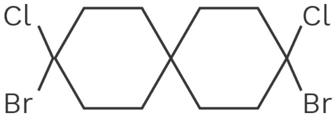
COS ×

(6)



Optically inactive

POS ×



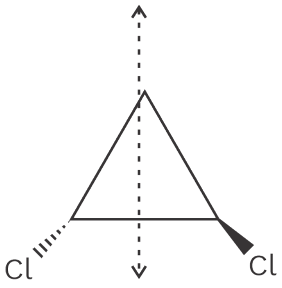
(7)

COS ×

POS ×

Optically active

NOTE : Chiral center is not a necessary condition for a compound to be optically active.

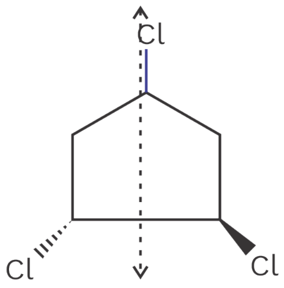


(8)

COS ×

POS ×

Optically active



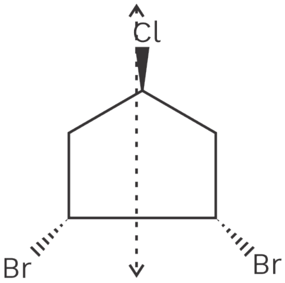
(9)

COS ×

POS ×

Optically active

(10)



POS ✓

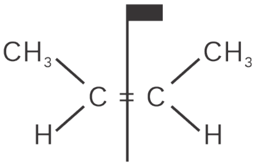
Optically inactive

Molecule POS

Every planar molecule will have POS along the plane in which they exist called as molecular POS.

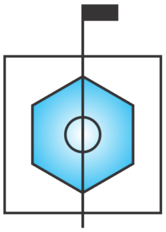
Here molecular POS is represented by flag.

(1)



Molecular POS

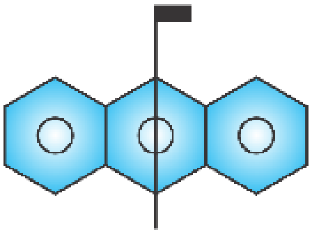
(2)



Molecular POS

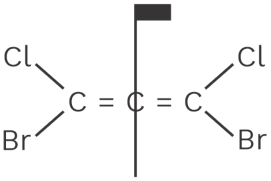
Total 7

(3)



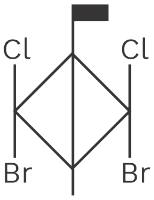
Molecular POS

(4)



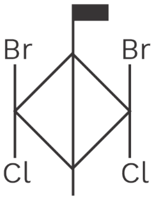
Molecular POS

(5)



Molecular POS

(6)



Molecular POS

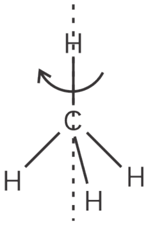
(iii) Axis of symmetry

If new images are obtained by rotation of a molecule by an angle ‘θ’ about an axis passing through a molecule thus it gets similar orientation, then molecule has AOS.

$$\boxed{\theta = \frac{360^\circ}{n}}$$

Here n → fold of axis

(1)

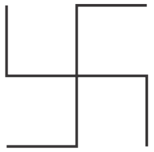


$C_3 \rightarrow$ AOS

n = 3

θ = 120°

(2)

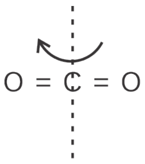


$C_4 \rightarrow$ AOS

n = 4

θ = 90°

(3)



$C_2 \rightarrow$ AOS

n = 3

θ = 180°

Concept Ladder

For a molecule to be optically active COS & POS should be different.

Polarimeter Experiment

Optical activity of a molecule can be predicted at the plane of paper by difference of COS & POS, but direction of rotation & angle of rotation is experimental value & measured by polarimeter [dextro & levo].

Specific Rotation

Specific rotation given information about optical strength of a molecule whenever length of polarimeter tube is 1 dm^3 & concentration of solution is 1 gm/ml then the observed rotation is specific rotation.

$$\alpha_{\text{observed}} = \alpha_{\text{specific}} \times L.C$$

$$\because \ \alpha_{\text{specific}} = \text{constant}$$

$$\therefore \ \boxed{\alpha_{\text{observed}} = L.C}$$

Concept Ladder

$$\boxed{\alpha_{\text{specific}} = \frac{\alpha_{\text{observed}}}{LC}}$$

L → length of polarimeter tube (taken in dm)

C → concentration of solution (taken gmL^{-1})

Factors affecting angle of rotation (α observed)

(1) Length of polarimeter tube

$\alpha_{observed} \propto l$, $l \uparrow, \alpha_{observed} \uparrow$

(2) Concentration of solution

$\alpha_{observed} \propto C$, $C \uparrow, \alpha_{observed} \uparrow$

(3) Solvent
Solvent must be chemically & optically inert.

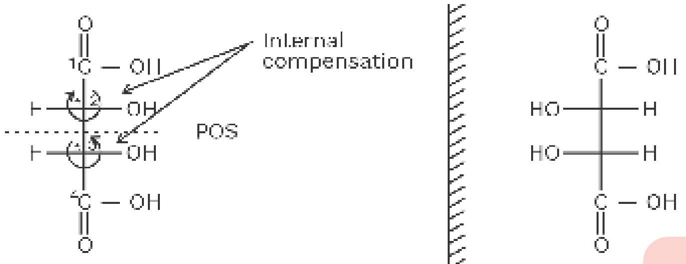
(4) Temperature
Polarimeter experiment carried out at room temperature.

(5) Source of light
Generally Na lamp used ($\lambda = 589$ Å)

Meso Compound

- Optical isomers having chiral center more than one, with symmetrical elements (COS & POS) is Meso.
- Meso compound give optical isomerism but optically inactive.
- Mirror image of Meso compound represent its identical molecule.
- Meso compound is optically inactive due to internal compensation or intro-molecular neutralization or molecular symmetry.
- Meso is achiral compound.
- Meso compound cannot have enantiomers.

(1)



Meso tartaric acid
Net rotation – 0
C.C – 2

Rack your Brain

A sample of (+)-2-chloropentane has an optical purity of 56%. What % of this sample is (–)-2-chloropentane?

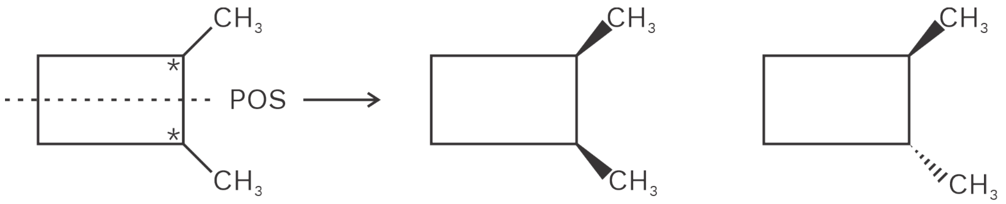
Definition

Meso compounds are achiral compounds that have multiple chiral center and they are superimposed on their mirror images.

Rack your Brain

Why meso compound are optically inactive?

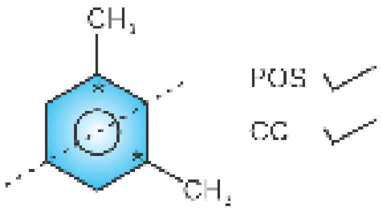
(2)



Cis (Optical
Meso isomerism)

Trans (No POS)

(3)



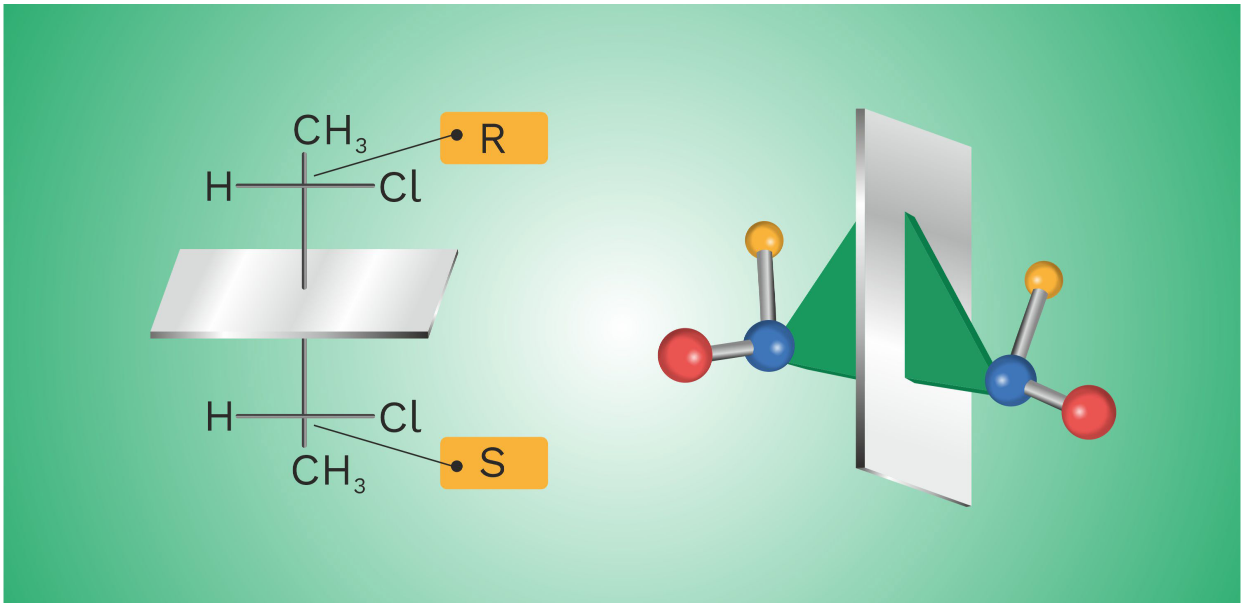
Give optical Isomerism

Previous Year's Questions

Among the following which one can have a meso form?

[AIIMS]

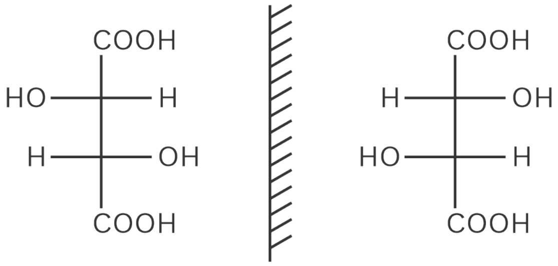
(1) $CH_3CH(OH)CH(Cl)C_2H_5$
(2) $CH_3CH(OH)CH(OH)CH_3$
(3) $C_2H_5CH(OH)CH(OH)CH_3$
(4) $HOCH_2CH(Cl)CH_3$



Enantiomers

- Enantiomers have different behavior toward each other.
- Enantiomers have same physical property.

(1)

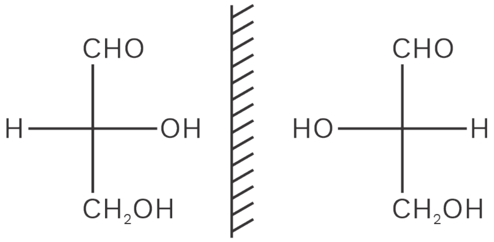


Tartaric acid (d)

Tartaric acid (l)

Both are enantiomers

(2)

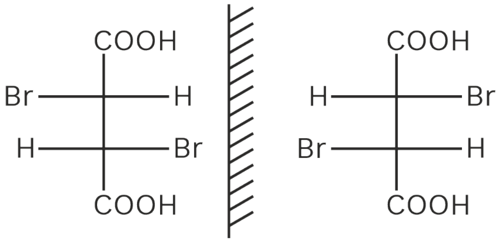


Glyceraldehydes (d)

Glyceraldehydes (l)

Both are enantiomers

(3)



Both are enantiomers

Definitions

Enantiomers are chiral molecules that are mirror images of each other.

Concept Ladder

Enantiomers with optically active compound will be different in comparsion to optically inactive compound which are same..

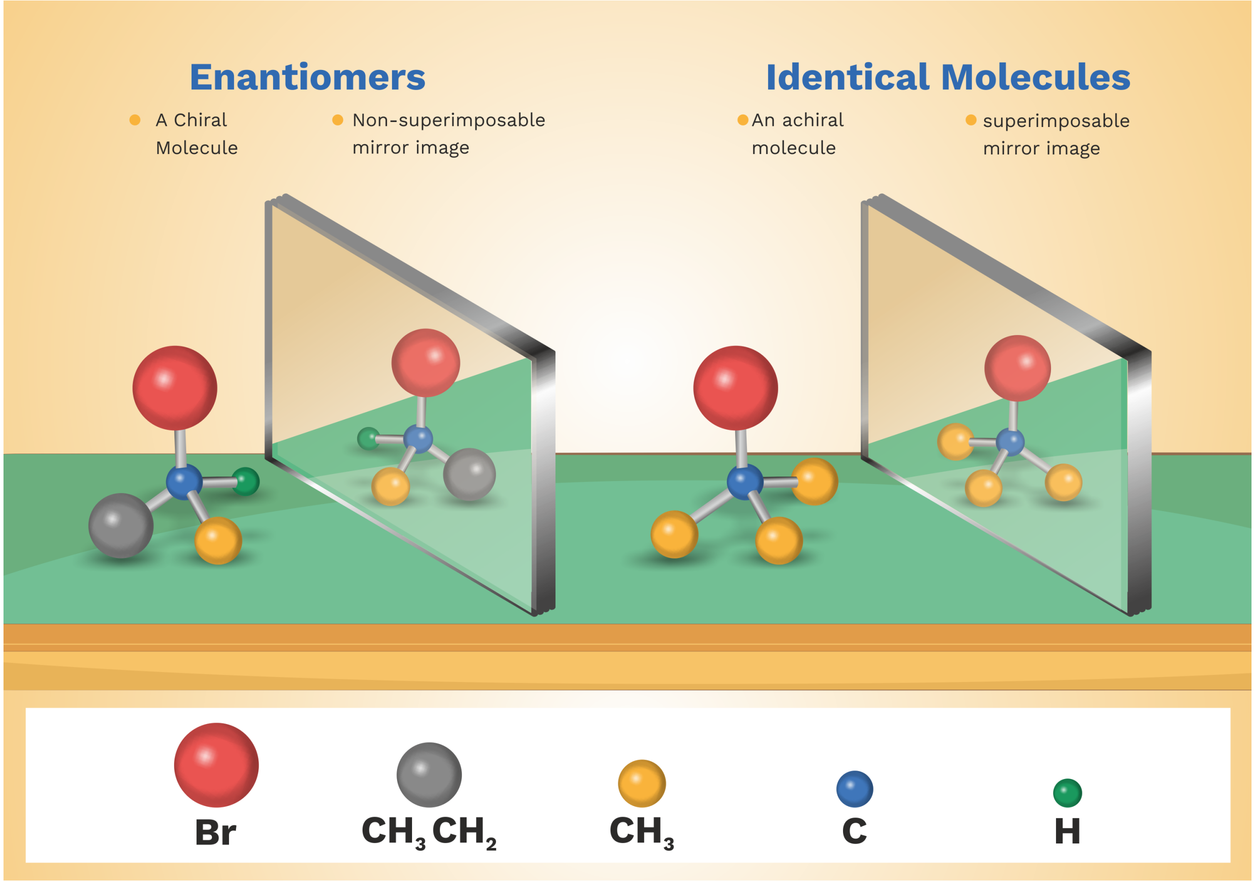
Rack your Brain

Why specific rotation of enantiomers have same magnitude but different sign?

Previous Year's Questions

Which of the following compounds may not exist as enantiomers? **[AIPMT]**

(1) $CH_3CH(OH)CO_2H$
(2) $CH_3CH_2CH(CH_3)CH_2OH$
(3) $C_6H_5CH_2CH_3$
(4) $C_6H_5CHClCH_3$

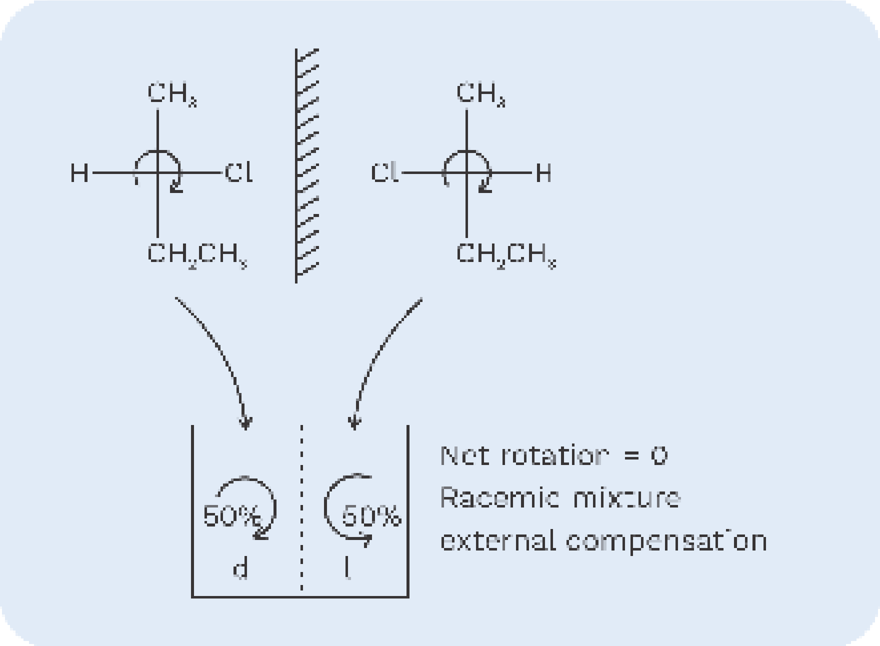


Racemic Mixture

- Racemic mixture is a resolvable mixture, separation of d & l isomers is known as optical resolution.
- A racemic modificationi s always optically inactive when enantiomers are mixed together, the rotation caused by a molecule of one enantiomer is exactly cancelled by an equal and oposite rotation caused by a molecule of its enantiomers.

Definition

A mixtrue of equal amounts of enantiomers is called a racemic mixture.



(1) d = 50% and l = 50%
R.M. = 100%
Optical Purity (O.P.) = 0%

(2) d = 100% and l = 0%
R.M. = 0%
O.P. = 100%

(3) d = 80% and l = 20%
R.M. = 40%
O.P. = 60%
Net rotation = dextro

(4) d = 60% and l = 40%
R.M. = 20%
O.P. = 80%
Net rotation = dextro

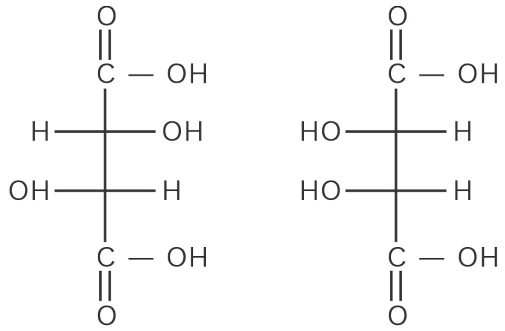
Rack your Brain

Why racemic mixture is optically inactive?

Diastereomers

- Diastereomers have different physical property and separated by functional distillation.
- Diastereomers have different specific rotation.
- Diastereomers may have optically active or inactive compounds.

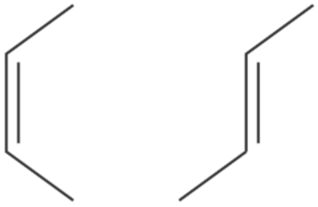
(1)



(I) (II)

(I) and (II) are diastereomers

(2)



(I) (II)

(I) and (II) are diastereomers

(3)

(I) (II)

(I) and (II) are diastereomers

Definition

Diastereomers are stereoisomers which are non mirror images of each other.

Rack your Brain

Why Diastereomers are easily seprated by physical method?

Concept Ladder

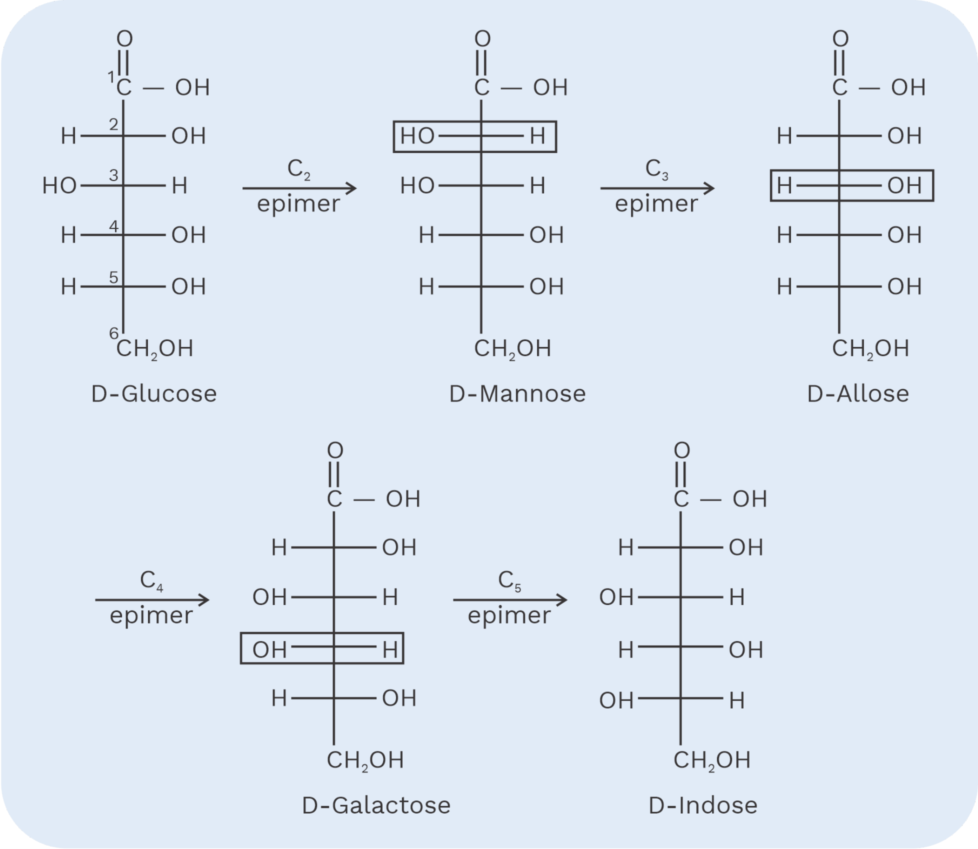
All geometrical isomers show diasteromerism but all diastereomers do not show geometrical isomerism.

Epimers

- One of a pair of stereoisomers that differ in the absolute configuration of a single stereocenter. When the molecule has only one stereocenter then the epimers are enantiomers. When the molecule has two or more stereocenters then the epimers are diastereomers.
- Epimerization is the interconversion of one epimer to the other epimer

Definition

Two monosaccharide different form each other in their configuration around a single specific carbon is known as epimer of each other.

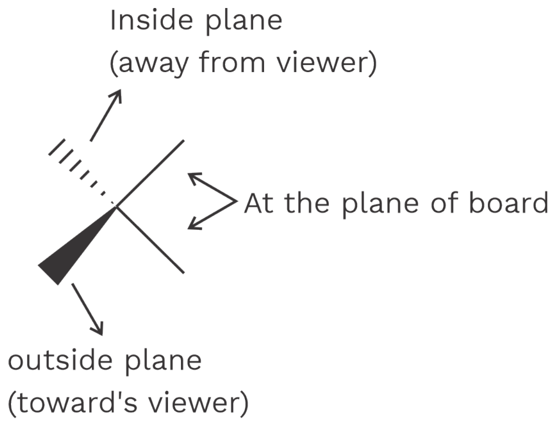


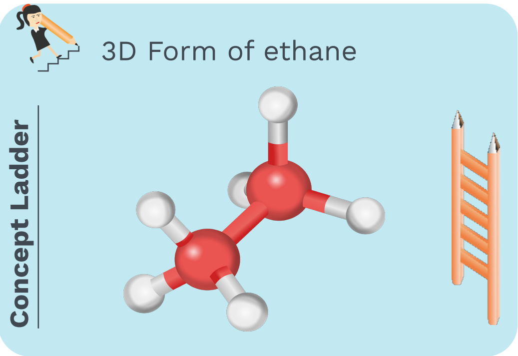
Concept Ladder

All epimers are diasteromers but all diastereomers are not epimers.

Representation of Optical isomers

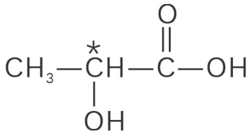
1. Wedge – Dash formula (3D)

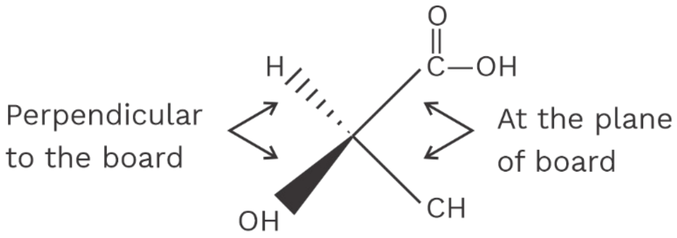




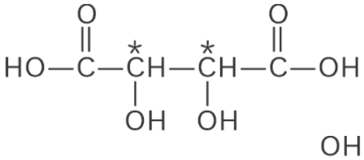
3D Form of ethane

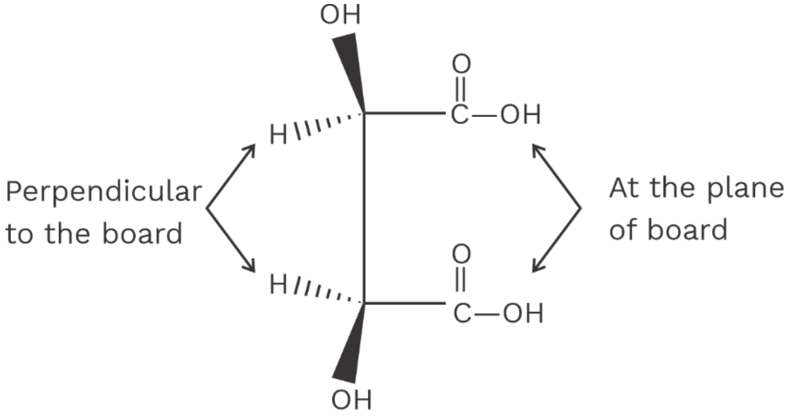
(i) Lactic Acid


$\mathrm{CH_3-\underset{OH}{\underset{|}{\overset{*}{C}}}H-\overset{O}{\overset{\|}{C}}-OH}$



(ii) Tartaric Acid


$\mathrm{HO-\overset{O}{\overset{\|}{C}}-\underset{OH}{\underset{|}{\overset{*}{C}}}H-\underset{OH}{\underset{|}{\overset{*}{C}}}H-\overset{O}{\overset{\|}{C}}-OH}$



2. Fischer Projection Formula (2D)

- Fisher projection is a 2D plane projection formula.
- In it one is vertical plane (only one) & other is horizontal plane (one or more than one).
- In it C-chain always in vertical line & top most figure at top position of vertical line.
- Fischer is a map of molecule.
- Fischer projection represent tetravalency.

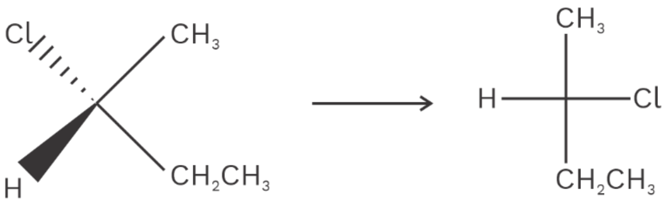
Concept Ladder

In FPF, vertical line groups represent away from the viewer & Horizontal groups represents towards the viewer and Fischer Projection is always formed in eclipsed form.

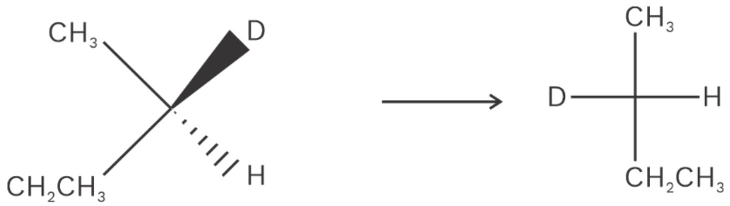
Conversion of different projection formula

1. Wedge Dash into Fischer projection formula

(i)



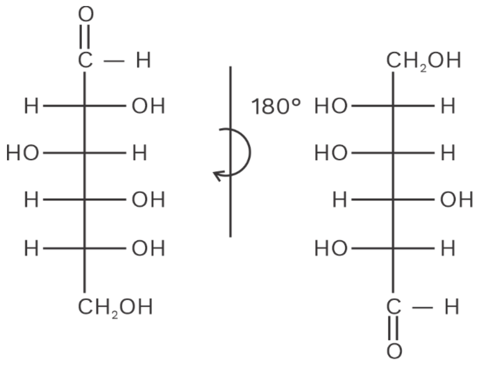
(ii)



NOTE : When an atom or group of atom is moved form vertical board's plane. then wedge group comes at its place.

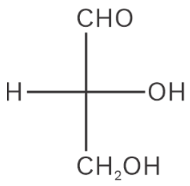
2. Fischer projection into Wedge Dash formula

Statement 1 : If Fischer projection formula is rotated by 180° at the plane of paper then it represents its identical molecule.

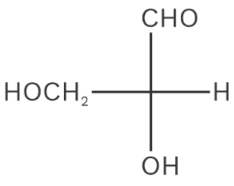


Identical/homomer

Statement 2 : If Fischer projection formula is kept fixed at one unit, rest all 3 units rotated in clockwise or anticlockwise direction then it represents its identical molecule.



(I)

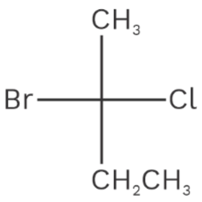


(II)

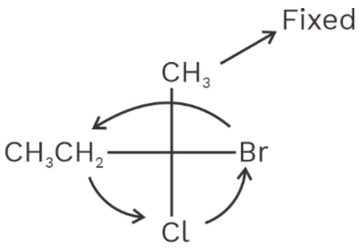
Identical/homomer

Q. Find out relation in given compounds.

(1)

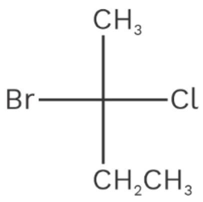


(I)



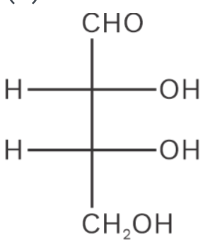
(II)

$\equiv$

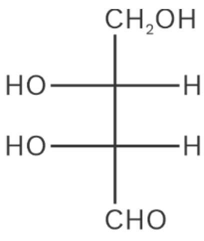


Identical

(2)



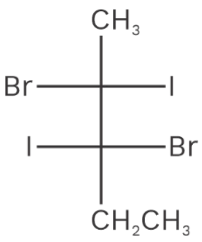
(I)



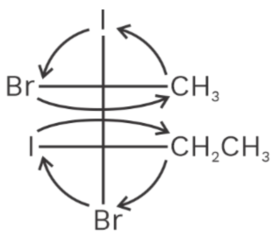
(II)

$\equiv$ Identical

(3)

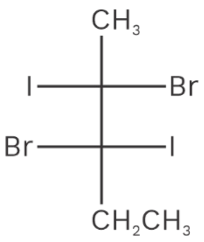


(I)

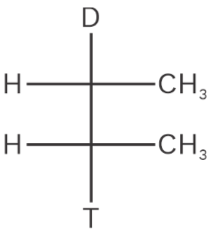


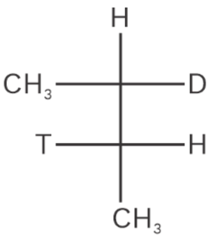
(II)

$\equiv$



non super
enantiomers
(mirror image)

(4) 
(I)


(II)

≡ Identical

Configuration of Optical Isomerism's

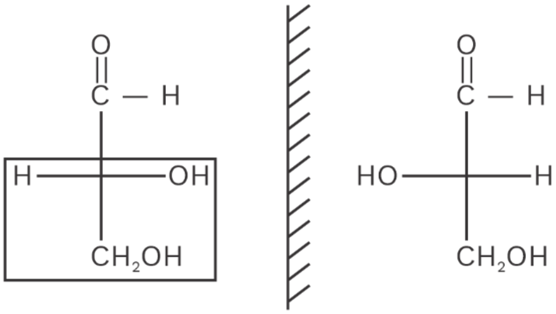
(1) D/L configuration (Relative configuration)

(2) R/S configuration (Absolute configuration)

(1) D/L Configuration

Carbohydrate : Polyhydroxy aldehyde or ketonic compound with mini one chiral compound is known as carbohydrate.

- D & L configuration is standard relative configuration of glyceraldehyde. There is no relation with d and l isomers (optical activity).
- D & L configuration valid for carbohydrate and amino acid like structure.


D-Glyceraldehyde L-Glyceraldehyde

- If at last C.C $\boxed{-OH / NH_2}$ group on right side = D
- If at last C.C $\boxed{-OH / NH_2}$ group on left side = L

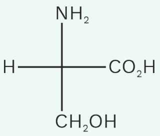
Concept Ladder

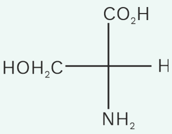
D & L have enantiomeric relation and they are not valid for symmetric system.

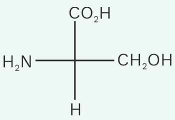
Previous Year's Questions

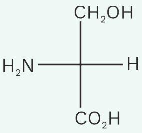
Among the following L-serine is:

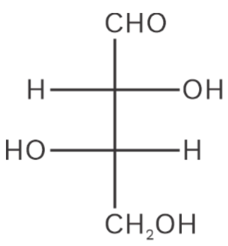
[AIIMS]

(1) 

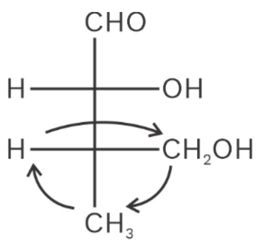
(2) 

(3) 

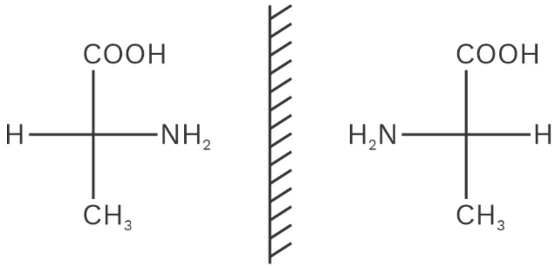
(4) 

(1) 

L-

(2) 

L-

(3) 

D-Alanine

L-Alanine

(2) R/S Configuration

R ⟶ Rectus ⟶ Right side ↻ C.W ⟶ R

S ⟶ Sinister⟶ Left side ↺ A.C.W ⟶ S

Give conformation about arrangement of unit at C.C not rotation of PPL (d & l).

(a) R/S Configuration in Fisher Projection Formula

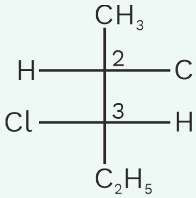
- Assign the priority according to CIP rule (E/Z configuration)
- [Priority of atom group $\propto$ Atomic Number]
- In Fischer projection formula, if lower priority group (4) present away from viewer (vertical line) then clockwise direction is in 'R' configuration and in anticlockwise direction is 'S' configuration.

Rack your Brain

Will cylic form of D/L configuration exists for a molecule?

Previous Year's Questions

The absolute configuration of the following compound is :



[AIIMS]

(1) 2S, 3R (2) 2S, 3S
(3) 2R, 3S (4) 2R, 3R

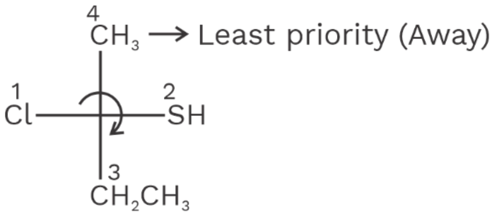
Concept Ladder

If the 4th priority group is present in horizontal line then we move our eyes from $1 \rightarrow 2 \rightarrow 3$, hence configuration is

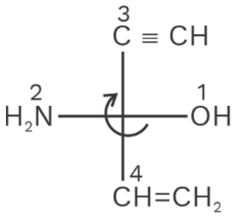
↻R ↺S
CW ACW

- If lowest priority group present towards the viewer (Hg line) then the real orientation just opposite to the observed orientation.

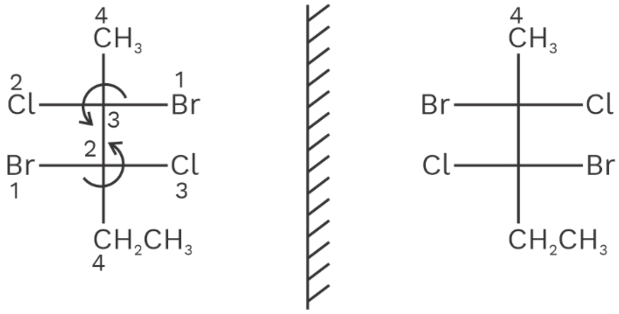
Always go through → 1 → 2 → 3
if lowest priority (4) presents in between ignore it.

(1)


R–

(2)


R–

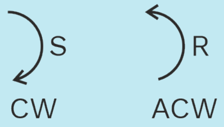
(3)


(2S, 3S)

(2R, 3R)

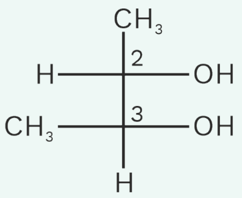
Concept Ladder

If the 4th priority group is present in vertical line then we move our eyes from 1 → 2 → 3, hence configuration is



Previous Year's Questions

Correct configuration of the following is

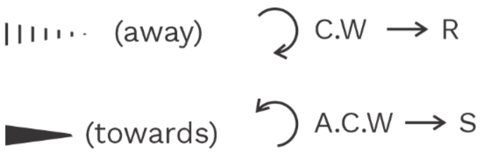


[AIIMS]

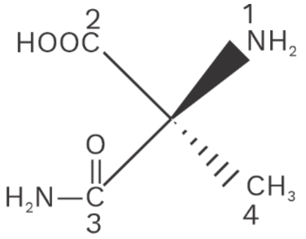
(1) 2S, 3R
(2) 2S, 3S
(3) 1R, 2S
(4) 2R, 3R

(b) R/S Configuration in Wedge-desh Formula

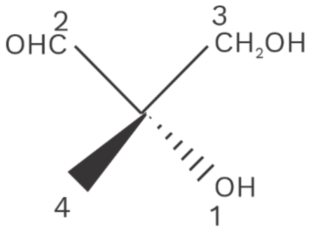
- Rules of R/S configuration in Fisher & Wedge desh formula → same – same.
- If lowest priority group 4 present at dash line then



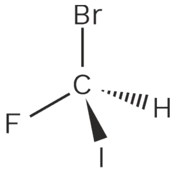
(1)



(2)



(3)



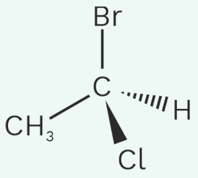
Concept Ladder

When lowest priority group is not present on wedge or dash line then we fix 1 unit and move another three units in clockwise and anti-clockwise direction and bring it to wedge or dash line.

Previous Year's Questions

The absolute configuration of the following compound is :

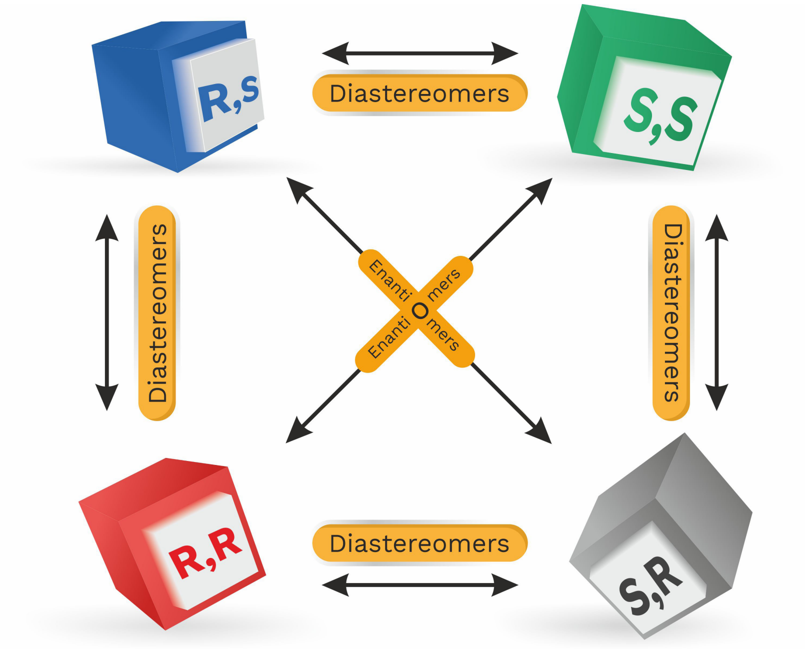
[AIPMT]



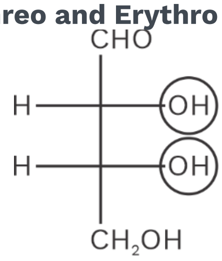
(1) E (2) R
(3) S (4) Z

Relation between different compounds

	COMPOUND 1	COMPOUND 2	RELATION
1.	R	R	Identical/Homomers
2.	S	S	Identical/Homomers
3.	R	S	Enantiomers
4.	RR	SS	Enantiomers
5.	RS	SR	Enantiomers (If unsymmetric) Meso (if symmetric)
6.	RR	RS	Diastereomers

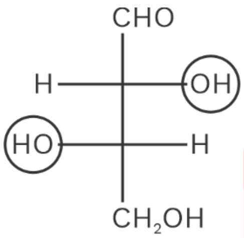


Threo and Erythro System



Erythro

(2)



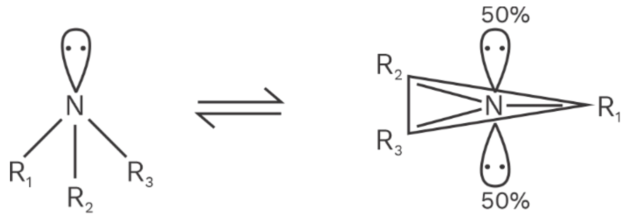
threo

Rack your Brain

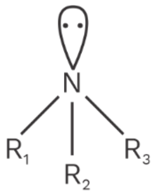
Why amines are not chiral?

Amine Flipping

Amine inversion also called umbrella inversion.

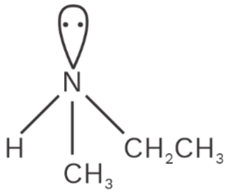


(1)



C.C. = 1
Optically inactive
Achiral molecule

(2)

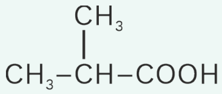


C.C. = 1
Optically inactive
Amine Flipping

Previous Year's Questions

Which of the following may exist in enantiomorphs **[AIPMT]**

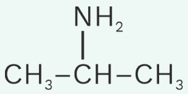
(1)



$CH_3-CH(CH_3)-COOH$

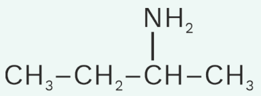
(2) $CH_2=CHCH_2CH_2CH_3$

(3)

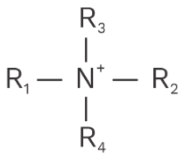


$CH_3-CH(NH_2)-CH_3$

(4)



$CH_3-CH_2-CH(NH_2)-CH_3$

(3) 
$R_1-\overset{\displaystyle R_3}{\underset{\displaystyle R_4}{N^+}}-R_2$

C.C. = 1
Optically active
N → extra bond

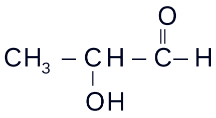
Previous Year's Questions

Find the number of stereoisomers of 1,2-dihydroxycyclopentane. **[AIIMS]**

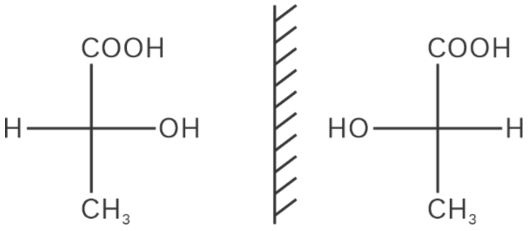
(1) 1
(2) 2
(3) 3
(4) 4

No. of Optical Isomers

	NO. OF OPTICALLY ACTIVE	MESO
Unsymmetrical Compound	$2^n/2$ = no. of stereogenic unit	Zero
Symmetrical Compound	If n = even 2^{n-1}	$2^{\frac{n}{2}-1}$
	If n = odd $2^{n-1} - 2^{\frac{n-1}{2}}$	$2^{\frac{n-1}{2}}$

(1) 
$CH_3-\underset{\displaystyle OH}{CH}-\overset{\displaystyle O}{\overset{\|}{C}}-H$

unsymmetrical



(I) (II)

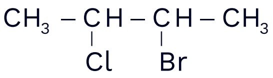
No. of stereo = $2^n = 2^1 = 2$

(a) Total no. of optically active isomers = 2

(b) Total no. of optically inactive isomers = 2

(c) Total no. of meso = 0

(d) Total no. of enantiomeric pair = 1

(2) 

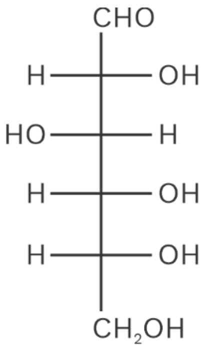
$CH_3-\underset{Cl}{\underset{|}{C}}H-\underset{Br}{\underset{|}{C}}H-CH_3$

Unsymmetrical

n = 2

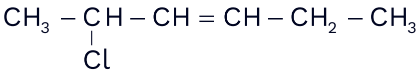
no. of stereo = $2^n = 2^2 = 4$

(3) Glucose



n = 4

no. of stereo = $2^n = 2^4 = 16$

(4) 

$CH_3-\underset{Cl}{\underset{|}{C}}H-CH=CH-CH_2-CH_3$

Unsymmetrical

n = 2

no. of stereo = $2^n = 2^2 = 4$

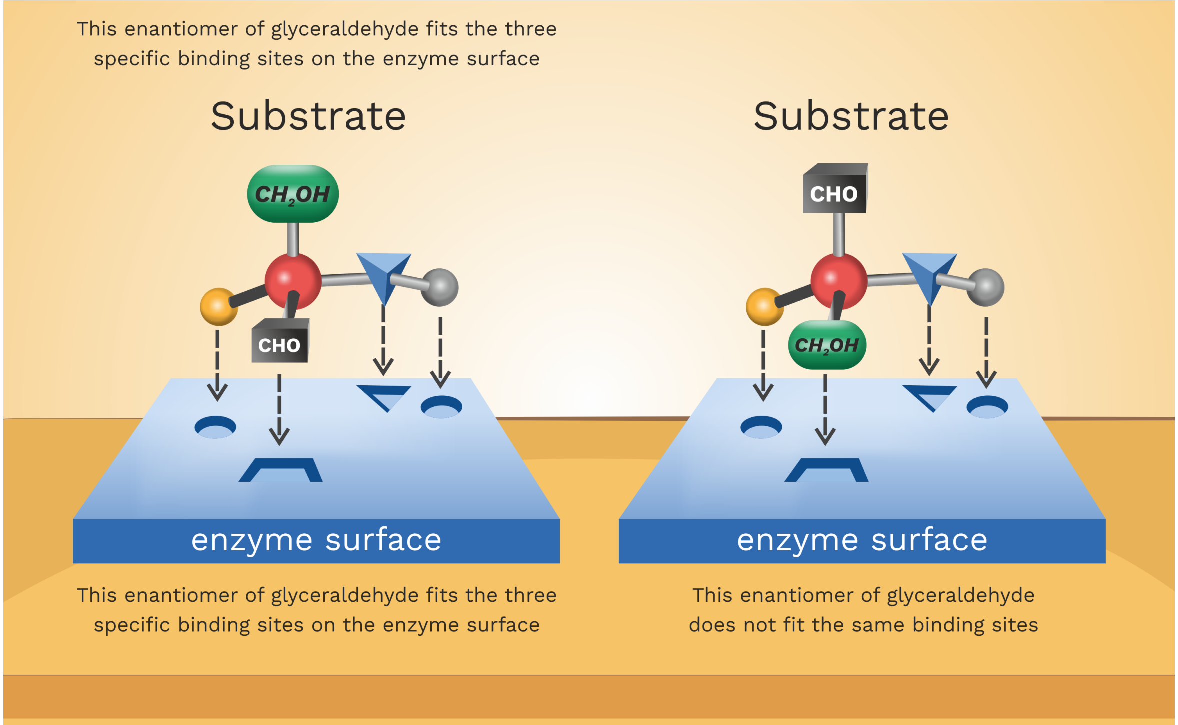
n = no. of stereogenic unit (G.I. + O.I.)

Previous Year's Questions

How many stereoisomers does this molecule have $CH_3CH{=}CHCH_2CHBrCH_3$

[AIPMT]

(1) 8
(2) 2
(3) 4
(4) 6



Summary

- Structural Isomerism is the type of isomerism in which one of two or more compounds have same number of compounds but different in their arrangement.
- Structural Isomers are classified into chain, position, functional group, metamers and tautomers.
- Stereoisomers are the compounds having same molecular formula but having unlike spatial arrangement.
- Number of stereoisomers = 2^n
- Geometrical (Cis/Trans) Isomerism also known as Configurational Isomerism.
- Compounds having same M.F., same structural formula but different behavior towards PPL are called optical isomers & this phenomena is known as optical isomerism.
- A number of stereoisomers which are formed due to free rotation around a single bond is known as conformations and this isomerism is known as conformational isomerism.
- Chiral compounds are unsymmetrical compounds where carbon is bonded with 4 different groups.
- Chiral compounds are optically active and Achiral are optically inactive.