General Introduction

[MF must be same]

1. Isomers have same molecular formula but different physical and chemical properties.
2. Compounds having same molecular formula, but different connectivity, different bonding pattern (structural isomerism) or different 3-D relative arrangement (stereoisomerism) is known as isomers.
3. This phenomenon is known as isomerism.
4. Isomers are those which can be separated at room temperature.
5. Isomers always have same Degree of Unsaturation (DU).

(IUPAC name diff)

(Connectivity same)

IUPAC name Same

Real Life Example

ISOMERISM

Same Molecular formula but Different Properties

Types of Isomerism

- Structural Isomerism
- Stereoisomerism
- Conformers

Types of Structural Isomerism

1. Chain Isomerism
2. Position Isomerism
3. Metamerism
4. Functional Isomerism
5. Tautomerism
6. Ring-Chain Isomerism

1. Chain Isomerism

Definition: Compounds which have same molecular formula but have different parent chain or side chain .

[M.F → same M.F]
IUPAC name diff
parent chain → diff

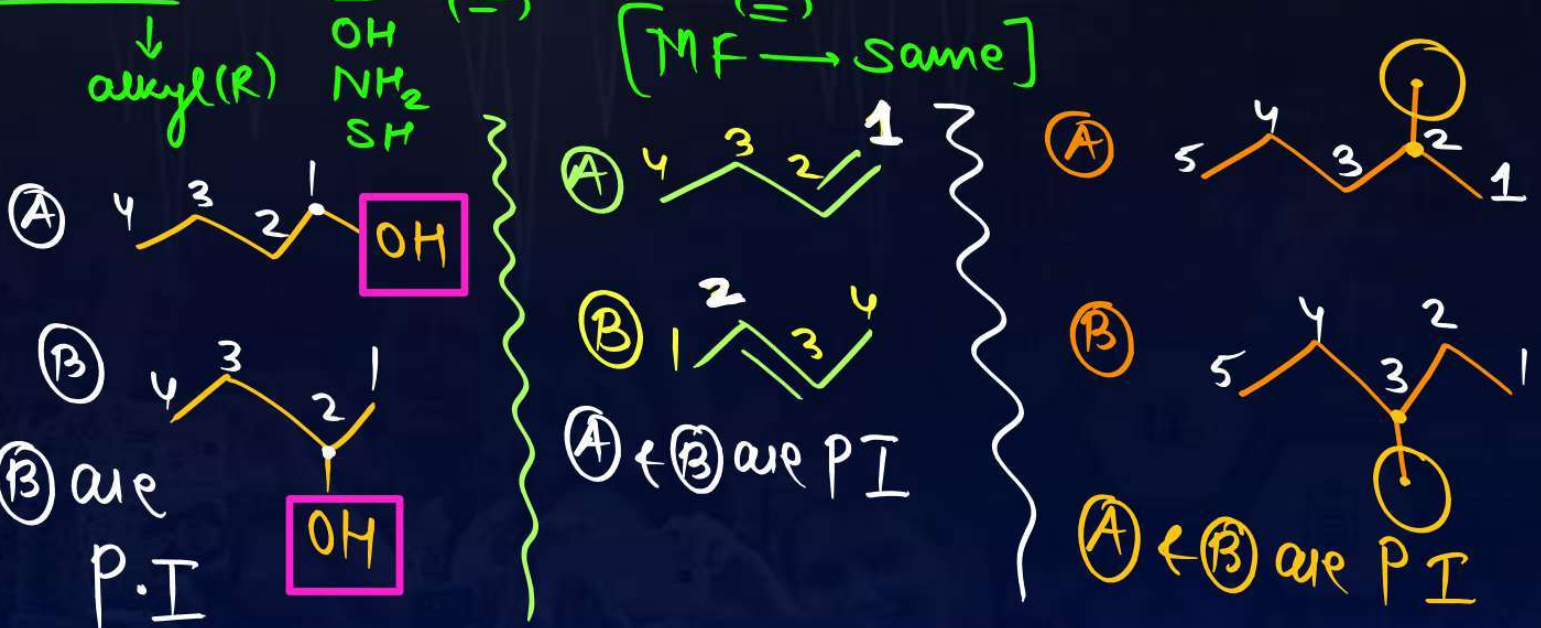
A and B are C.I

MF C_4H_{10} C_4H_{10}

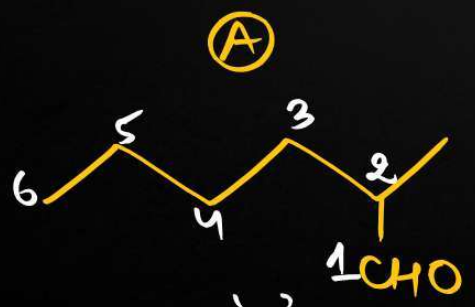
Parent chain 4 'C' 3 'C'

2. Position Isomerism

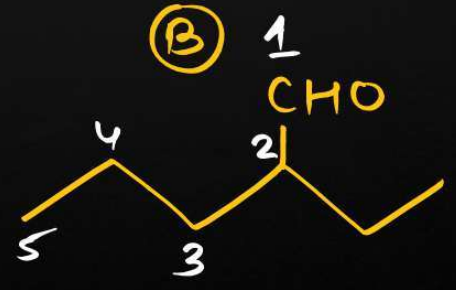
Definition: Compounds which have same molecular formula but have different position of branch or F.G (double or triple bond).



Q/



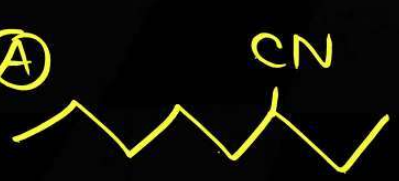
6 'C'

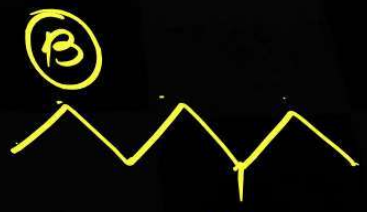


5 'C'

(A) & (B) are C·I

Q





MF diff

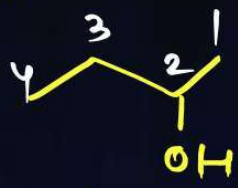
(A) & (B) are not isomers

C. Q. 01

Priority [C > P]

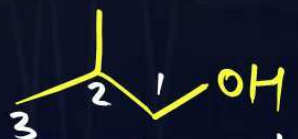
Which of the following pairs of compounds are chain isomers?

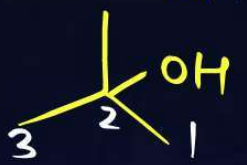
A n-Butyl alcohol and s-butyl alcohol



PI

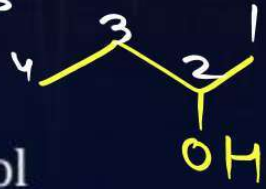
B isobutyl alcohol and t-butyl alcohol



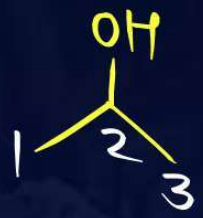


PI

C s-butyl alcohol and t-butyl alcohol



D n-propyl alcohol and isopropyl alcohol



PI

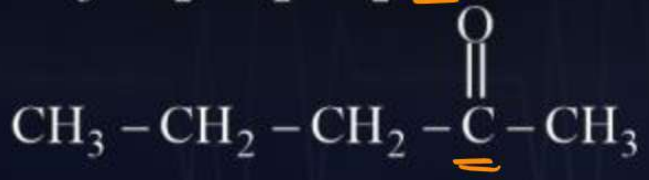
CI

C. Q. 02 [JEE Main Online 2015]

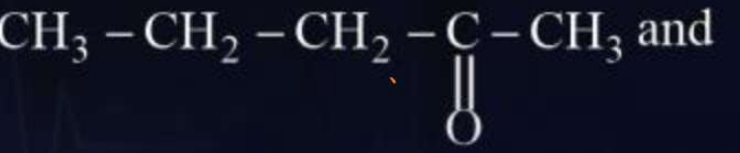
F.G same

Which of the following pairs of compounds are positional isomers?

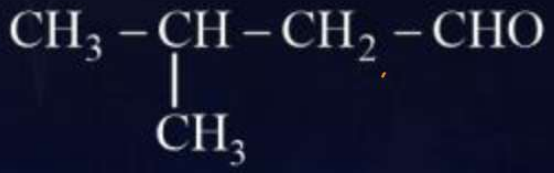
A $CH_3CH_2CH_2CH_2CHO$ and



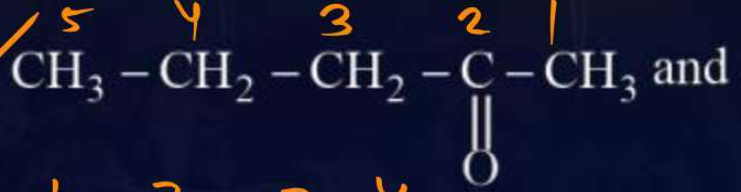
B



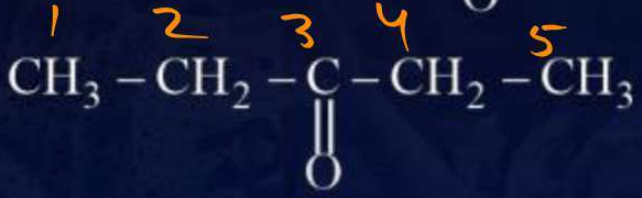
and



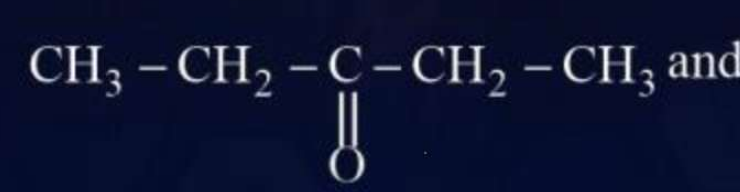
C



and

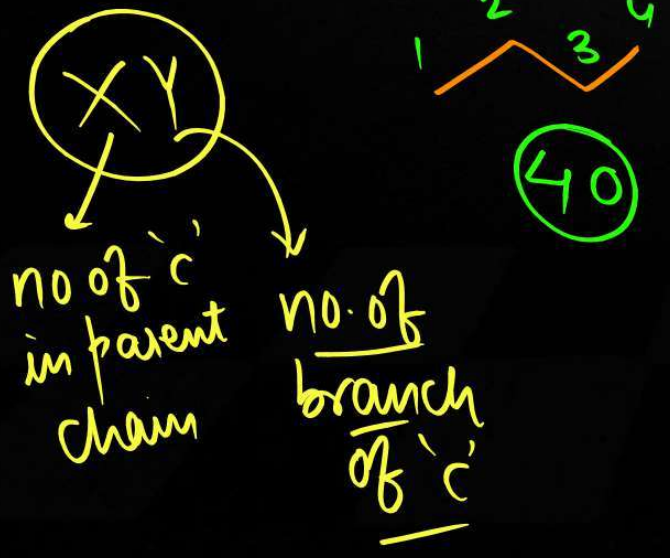


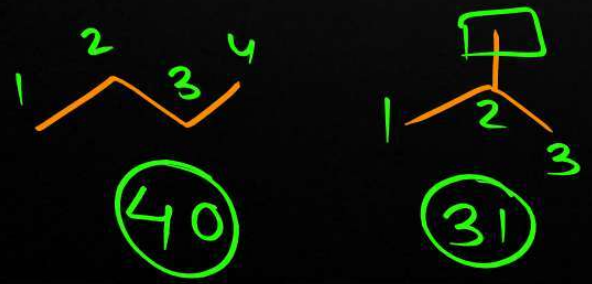
D



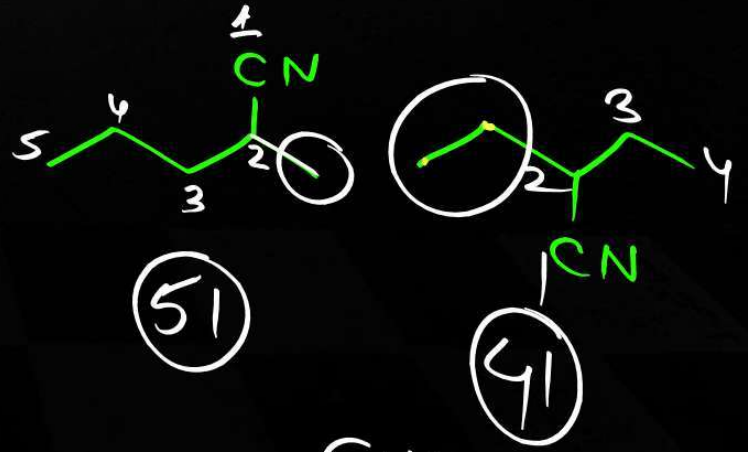
and

Magic no. (for CI or PI)

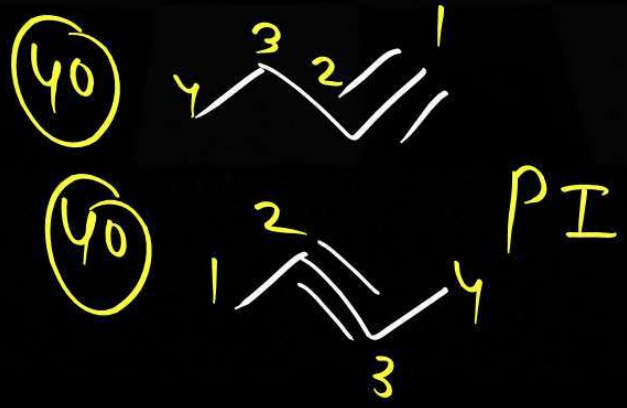




Magic no. diff CI Same PI

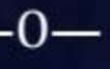


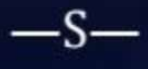
CI



3. Metamerism

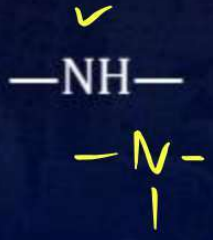
Different arrangement of atoms or groups from either side of B.F.G (Bridging func^{n} group)

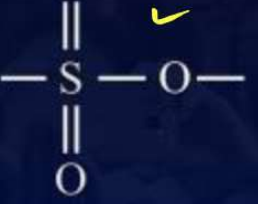
A 

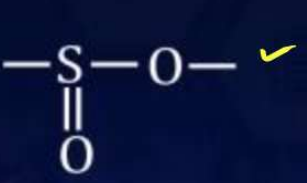
B 

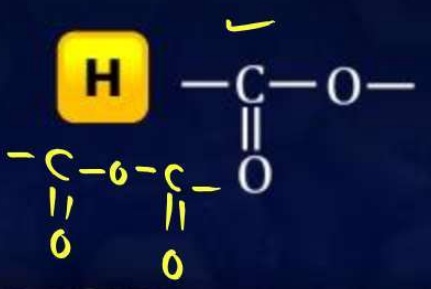
C 

D 

E 

F 

G 

H 

[M > C > P]
Priority

① (A) C–C–C–O–C
3 'C' (n)

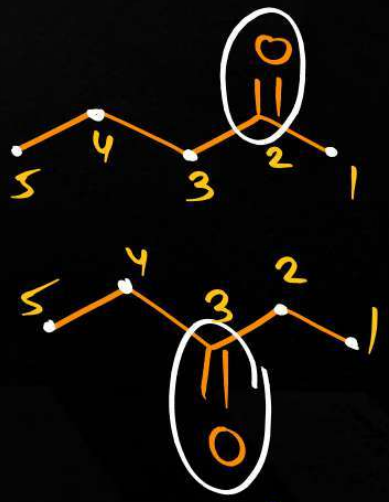
(B) C–C(C)–O–C
3 'C' (Branch)

(C) C–C–O–C–C
2 'C'

(A) & (B) M.I
(B) & (C) M.I
(A) & (C) M.I

② 

Metamer

③ 

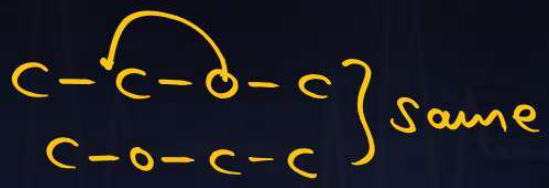
MI

PI

C. Q. 03 (NEET 2021)

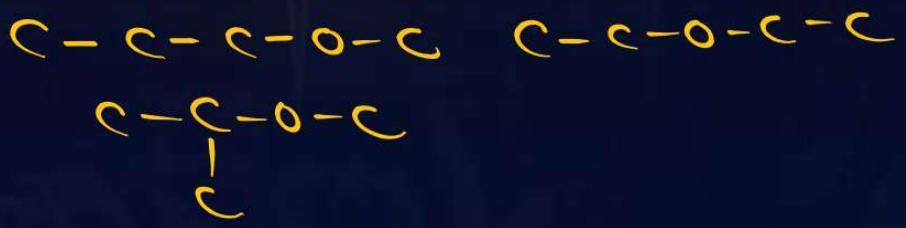
The compound which shows metamerism is:

A C_3H_8O



B C_3H_6O

C $C_4H_{10}O$ ✓



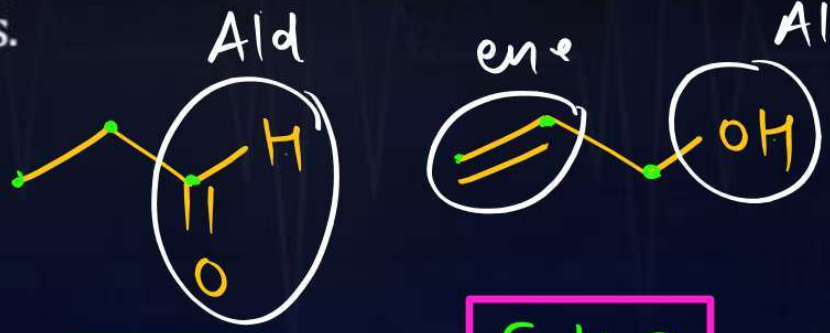
D C_5H_{12} ✗

4. Functional Isomerism

MF Same
F.G diff

Priority
F > M > C > P

Definition: Compounds which have same molecular formula but have different functional groups.



C_3H_6O

C_3H_6O

F.G diff

F.I

Some Important Functional Isomers:

A Alcohols and ethers

B Aldehydes and ketones

C Cyanides and isocyanides

D Primary, secondary and tertiary amines

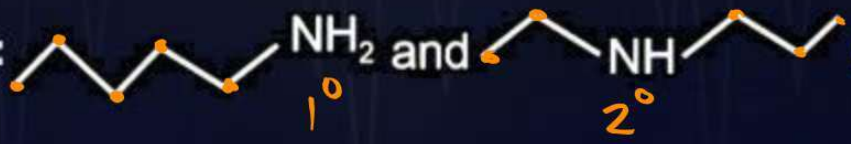
E Acids and esters

F Diene and yne

C. Q. 04 (JEE Mains 2025, 28 January Shift-2)

Given below are two statements:

Statement (I):  and are isomeric compounds.

Statement (II):  are functional group isomers.

In the light of the above statements, choose the correct answer from the options given below:

A Statement I is true but Statement II is false.

B Both Statement I and Statement II are true.

C Statement I is false but Statement II is true.

D Both Statement I and Statement II are false.

C. Q. 05 (JEE Mains 5th April 2024, Evening Shift)

Match List - I with List - II.

List - I (Pair of Compounds)	List - II (Isomerism)
(A) n-propanol and Isopropanol	(I) Metamerism
(B) Methoxy propane and ethoxyethane	(II) Chain Isomerism
(C) Propanone and propanal	(III) Position Isomerism
(D) Neopentane and Isopentane	(IV) Functional Isomerism

A (A)–(II), (B)–(I), (C)–(IV), (D)–(III)

B (A)–(III), (B)–(I), (C)–(II), (D)–(IV)

C (A)–(I), (B)–(III), (C)–(IV), (D)–(II)

D (A)–(III), (B)–(I), (C)–(IV), (D)–(II)

C. Q. 06 (NCERT Exemplar)

In which of the following, functional group isomerism is not possible?

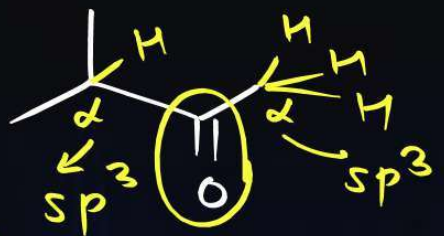
A Alcohols & Ether

B Aldehydes & Ketone

C Alkyl halides

D Cyanides & Isocyanide

5. Tautomerism



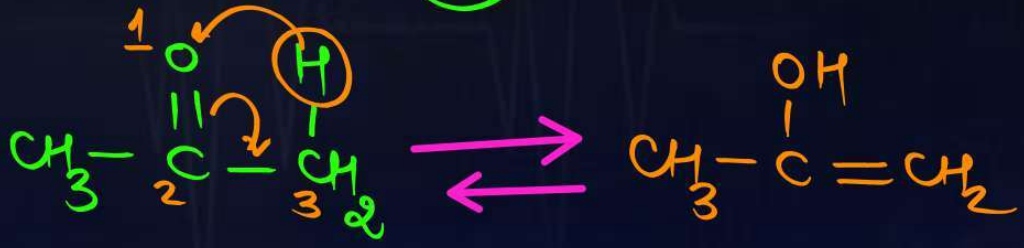
yes

yes

Definition: Intramolecular proton (H^+) transfer.

1,3-system

Keto-enol



Condⁿ

[α-C sp^3

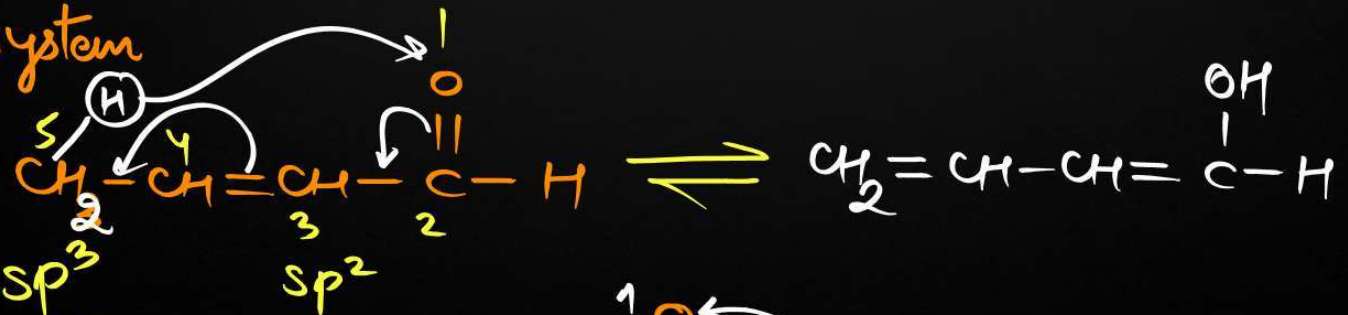
α-H atleast 1]

yes

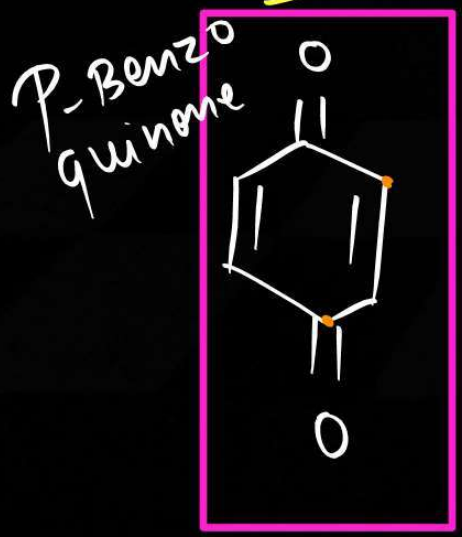
yes

1,5-system

1,3 fail

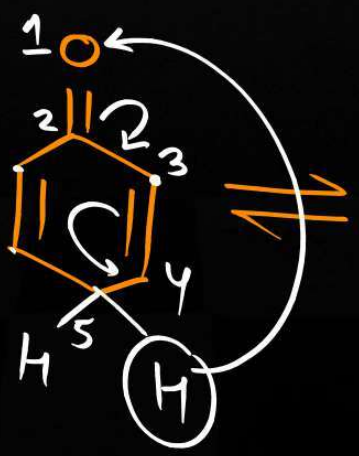


sp^3 sp^2

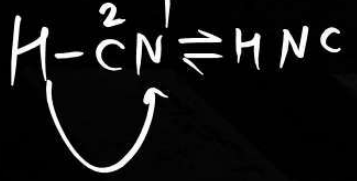


P-Benzo Quinone

NO



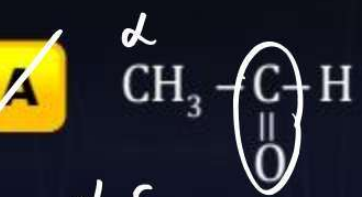
1,2-system



QUESTION

Tautomerism Exhibits or not?

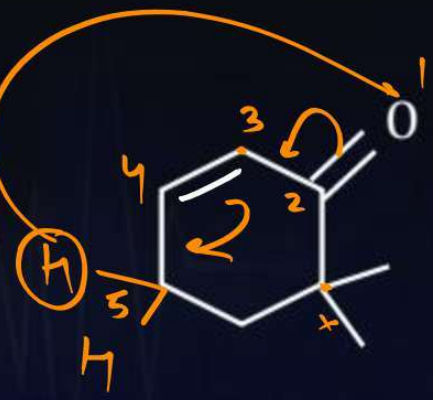
A



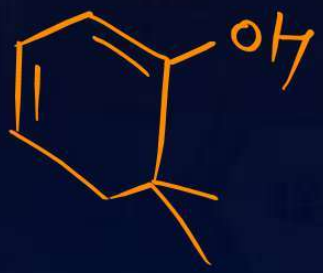
α-C
sp^3 ✓
αH ✓

Yes

B



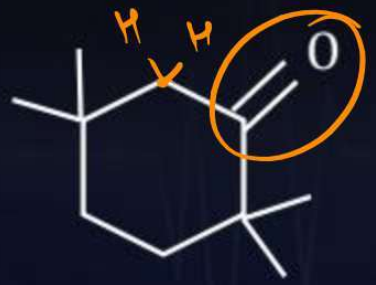
1,5



QUESTION

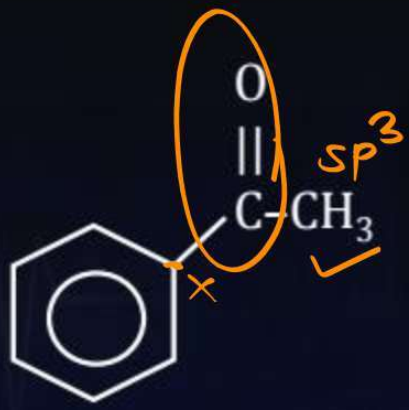
Tautomerism Exhibits or not?

A



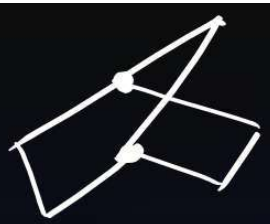
Yes

B

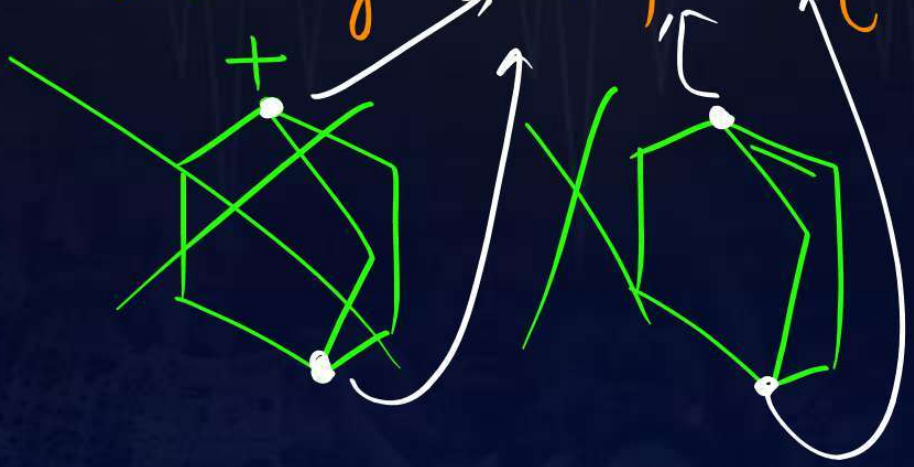


Yes

Bredt's Rule



Planarity does not exist on bridgeheaded position



C. Q. 07 (NEET 2016)

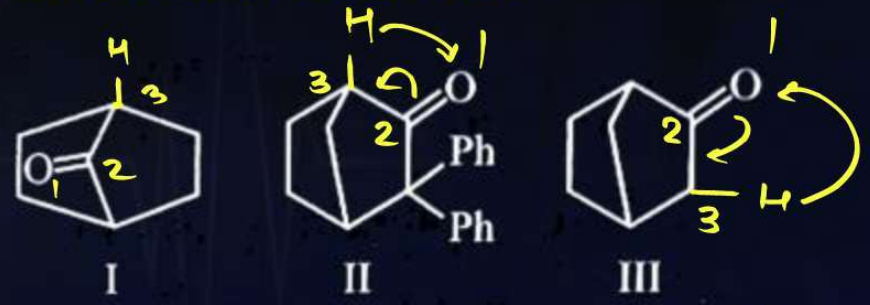
Which among the given molecules can exhibit tautomerism?

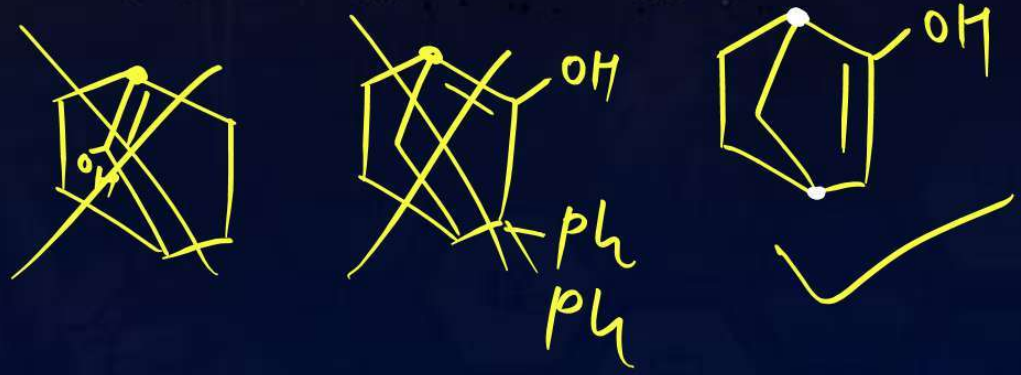
A III only

B Both I and III

C Both I and II

D Both II and III





6. Ring-Chain Isomerism

Definition: Compounds which have same molecular formula, but one compound is chain & other is cyclic.

C_3H_6

C_3H_6

C. Q. 08

Cyclobutane and but-2-ene are the examples of:

A Position isomerism

B Ring chain isomerism

C Metamerism

D None of these

Priority

$$R > T > F > M > C > P$$

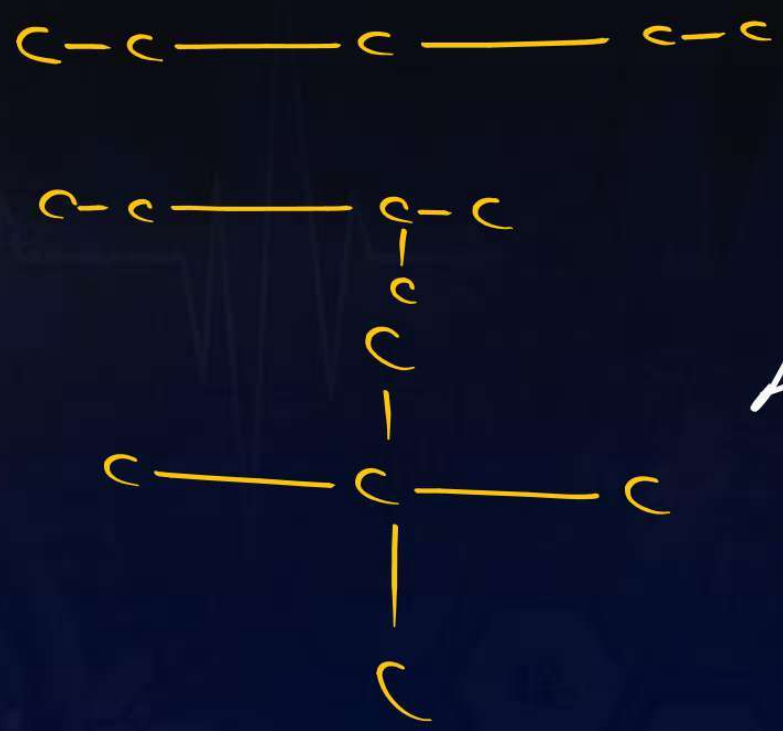
*Calculation of No. of Structural Isomers

C_5H_{12}

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

$$= (5+1) - \left(\frac{12+0-0}{2}\right)$$

$$= 6-6 = 0$$



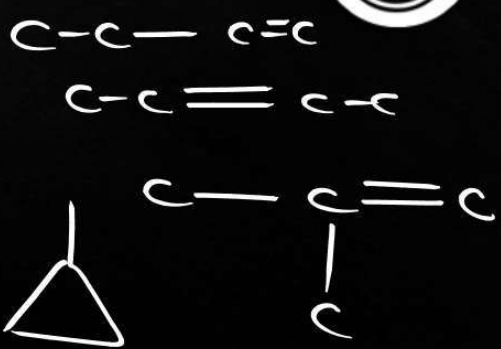
Ans (3)

Alkane	No. of struc iso
C_1H_4	1
C_2H_6	1
C_3H_8	1
* C_4H_{10}	2
* C_5H_{12}	3
* C_6H_{14}	5
* C_7H_{16}	9
C_8H_{18}	18
C_9H_{20}	35
$C_{10}H_{22}$	75

C_4H_8

DU = 1 → 1 π

1 Ring

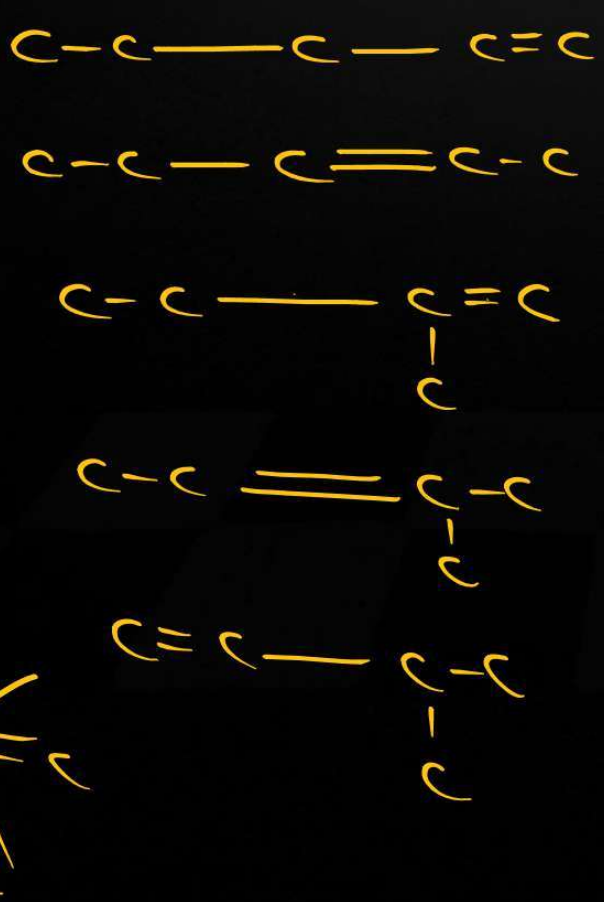


Ans (5)

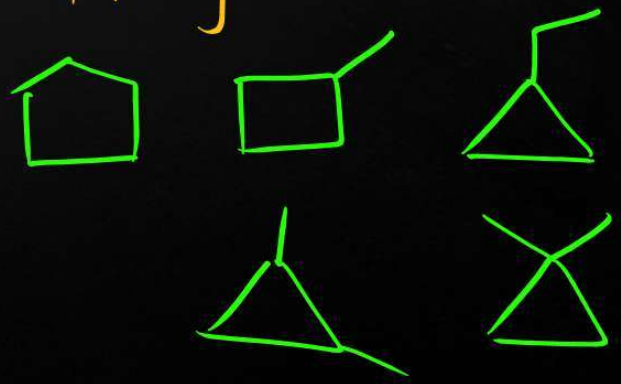
C_5H_{10}

DU = 1

1 π



1 Ring

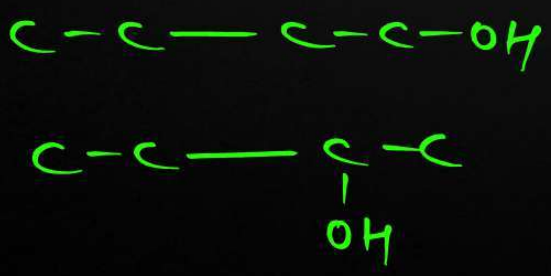


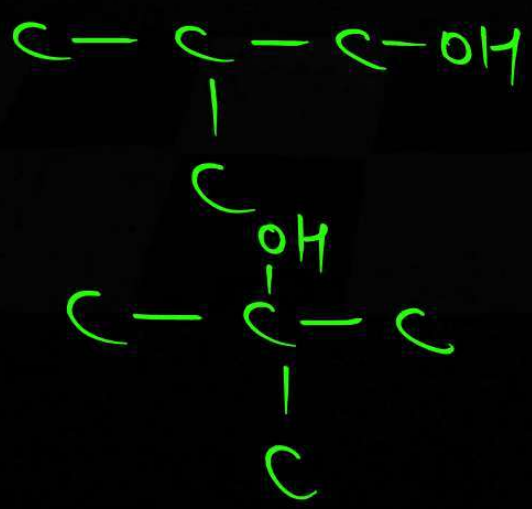
Ans (10)

$C_4H_{10}O$

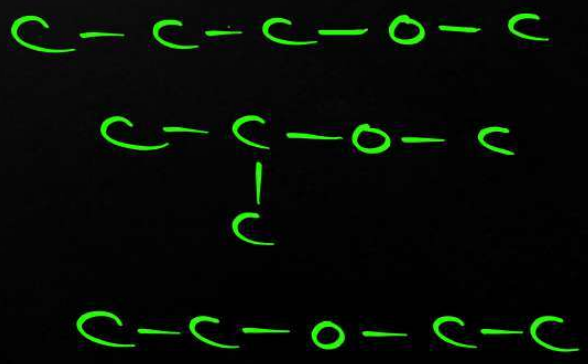
DU = 0

Alco





Ether



Ans (1)

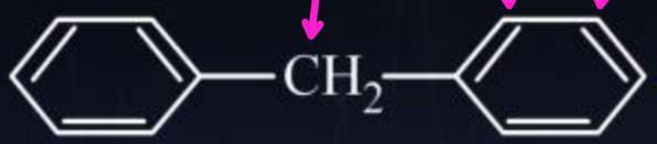
C. Q. 09 (JEE Mains 4th April 2024, Morning Shift)

The number of different chain isomers for C_7H_{16} is 9.

1 C_1
1 C_2
1 C_3
2 C_4
3 C_5
5 C_6
9 C_7
18
35
75

C. Q. 10 (AIPMT 2004)

The molecular formula of diphenyl methane,



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

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

A 4

B 8

C 7

D 6

C. Q. 11 (AIPMT 1995)

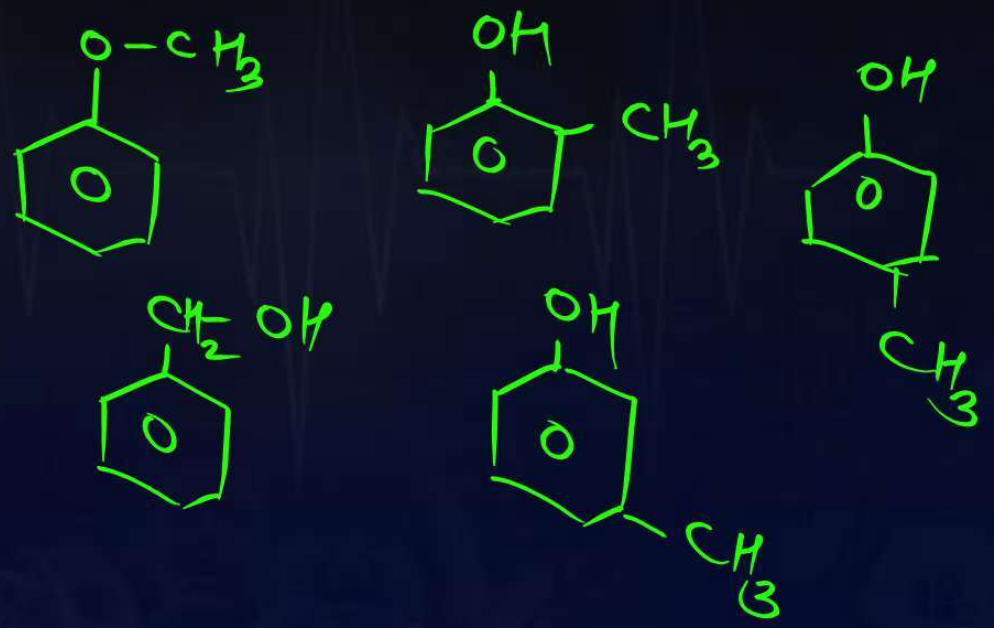
The number of possible benzenoid isomers of the compound with molecular formula C_7H_8O is:

A 3

B 5

C 7

D 9



Stereo Isomerism

IUPAC name Same

Definition: The compounds that have the same constitution and sequence of covalent bonds but differ in relative positions of their atoms or groups in space are called stereoisomers.

1) Geo
2) optical

C. Q. 12 (AIPMT 2005)

Which one of the following pairs represents stereoisomerism?

A. Structural isomerism and Geometrical isomerism

B. Optical isomerism and Geometrical isomerism

C. Chain isomerism and Rotational isomerism

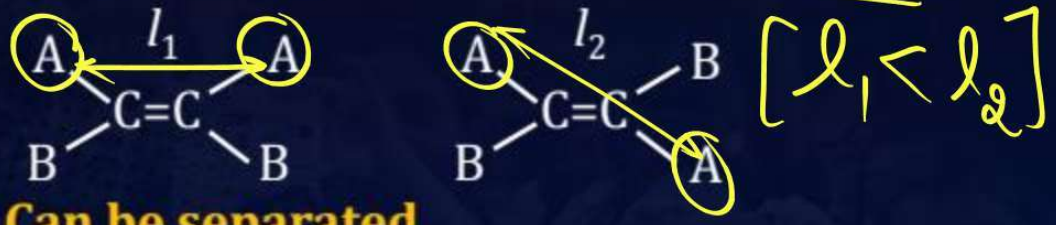
D. Linkage isomerism and Geometrical isomerism

Geometrical Isomerism

free rotation

Restricted Rotation

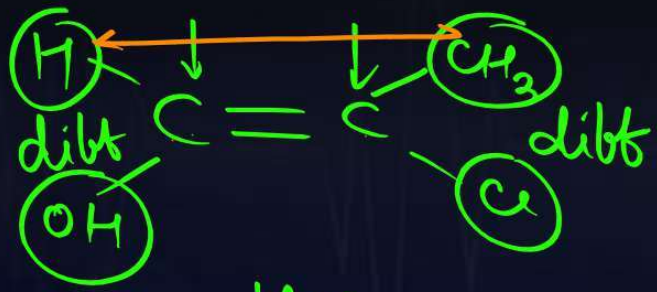
1. Arises due to Restricted rotation around
   C=C, C=N, N=N, Cycloalkanes etc.
   G.I. are not interconvertible at room temperature because of π-bond dissociation energy (62 Kcal).
2. G.I are also known as diastereomers (Not mirror image).
3. Areal Distance must be different ($l_1 \neq l_2$).

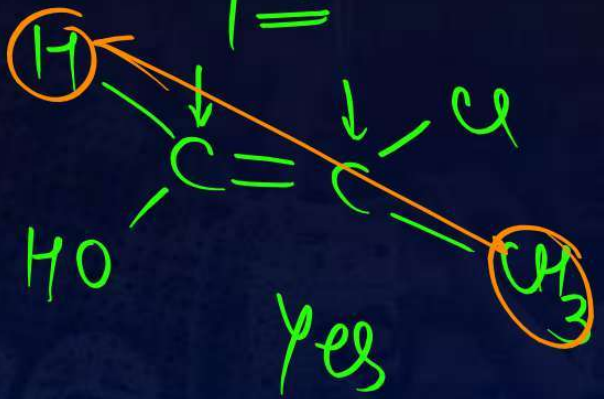


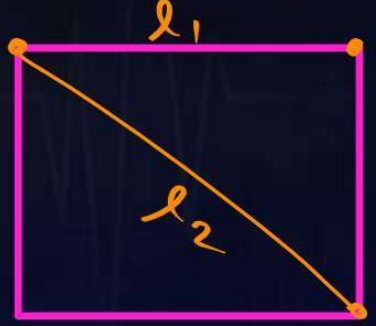
4. Can be separated.

Condition for exhibition of Geometrical Isomerism

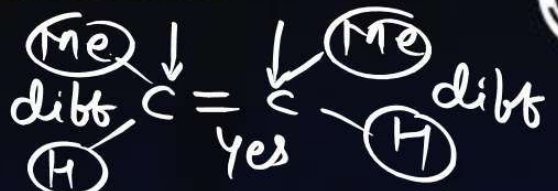
Restricted site must have different groups.

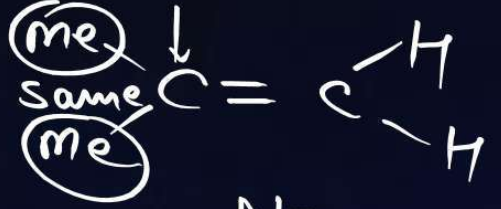






$l_2 > l_1$

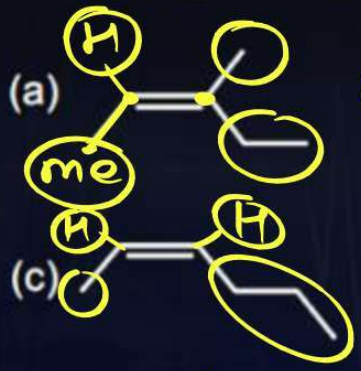




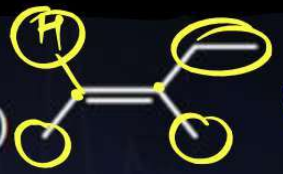
No

QUESTION

4-I exhibits or not ??

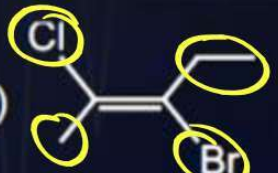
(a) 

yes

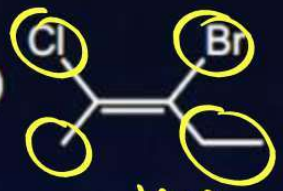
(b) 

yes

(c) yes

(d) 

yes

(e) 

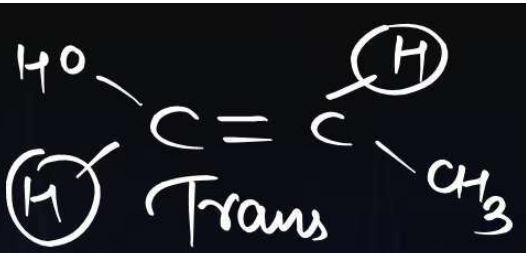
yes

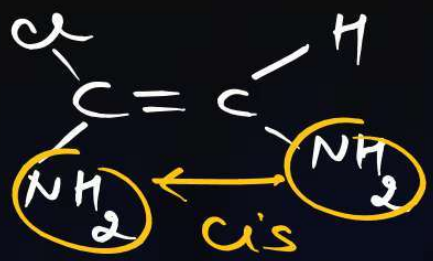
Types of G.I.

1. Cis-Trans
2. E/Z isomers

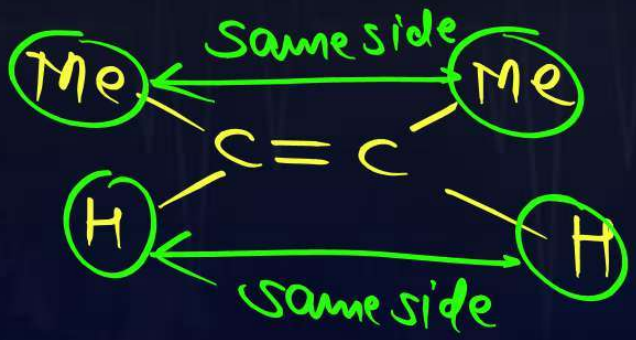
Case 01 Cis-Trans System

C=C

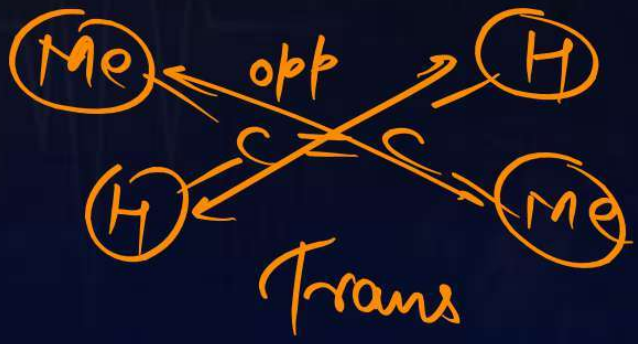




If similar groups are on the same side, then cis otherwise trans.



Cis



C. Q. 13 (AIPMT 2009)

Which of the following compounds will exhibit cis-trans (geometrical) isomerism?

A 1-Butanol 

B 2-Butene 

C 2-Butanol 

D 2-Butyne 

Case- 2 Z-E System

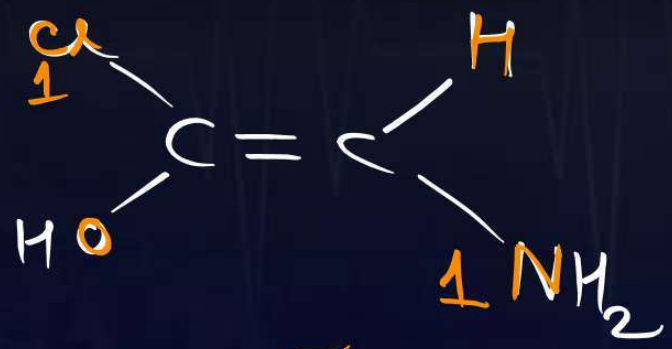
Entgegen (opp side)

zusamen (same side)

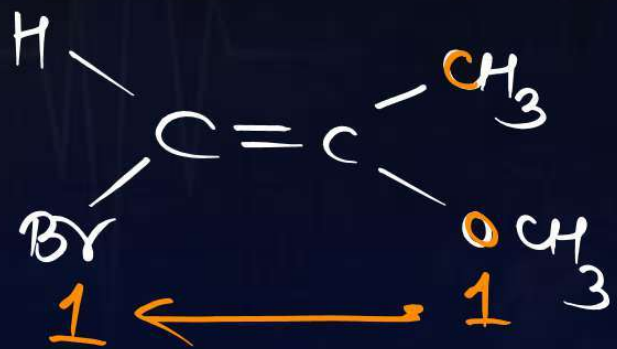
C.I.P. Rules

Cahn-Ingold & prelog.

Rule 01. Greater the atomic number, higher will be the priority.



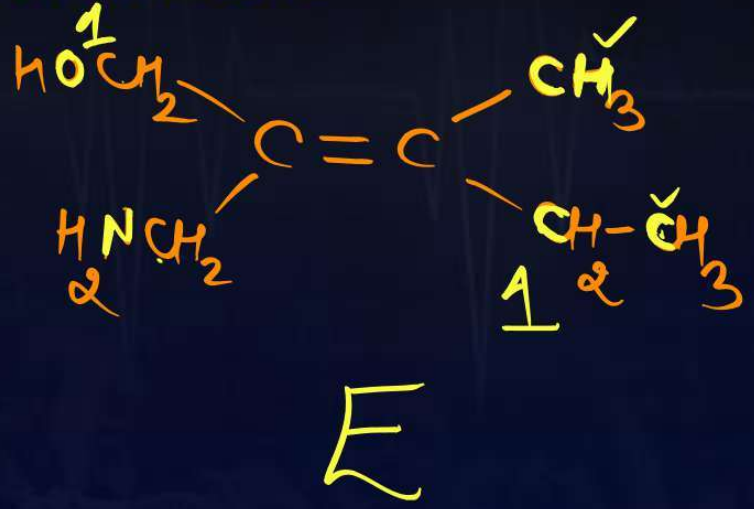
E



Z

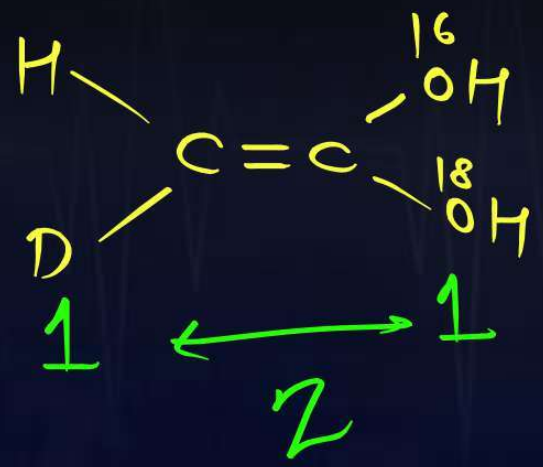
C.I.P. Rules

Rule 02. If the atomic number of first atom is same, then go for the next atom and apply the rule number 01.



C.I.P. Rules

Rule 03. In the case of isotopes higher mass number will be the higher priority.



C.I.P. Rules

Rule 04. In the case of multiple bonds

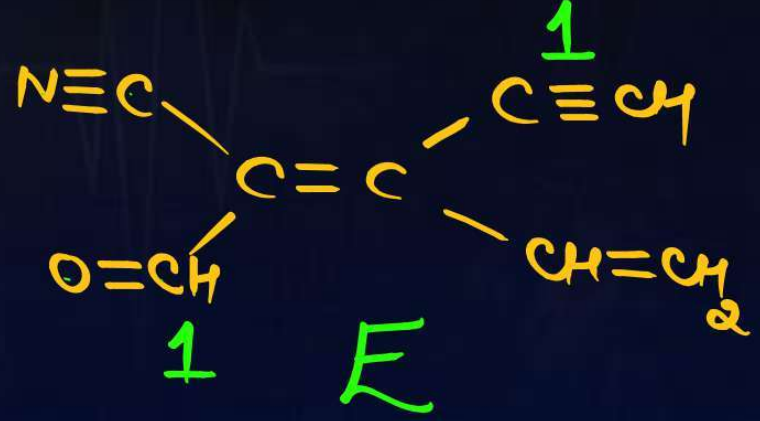
$A \equiv A > A = A > A - A$ } $A \equiv B > A = B > A - B$

$C \equiv C > C = C > C - C$

$C = O > C - O$

$C \equiv N > C = N > C - N$

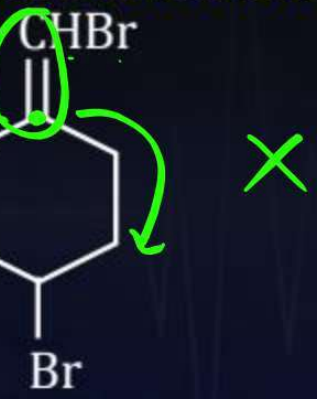
$C = O > C \equiv N$



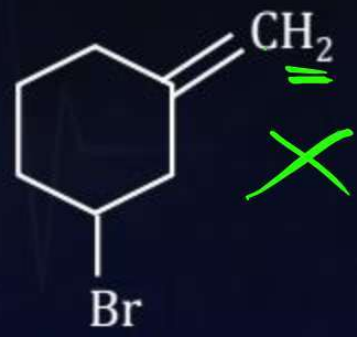
C. Q. 14 (JEE Mains 29 January 2024, Evening Shift)

Which one of the following will show geometrical isomerism?

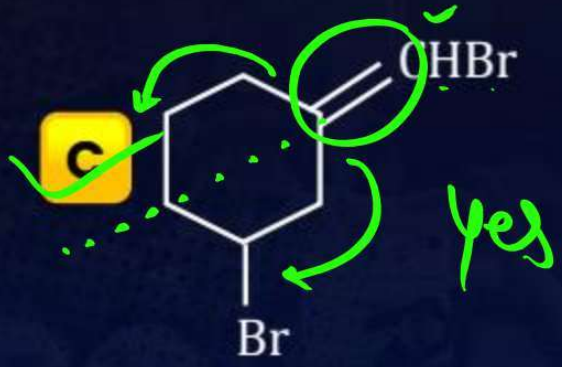
A



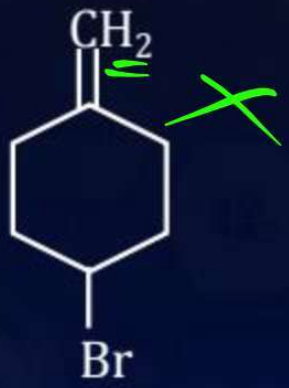
B



C

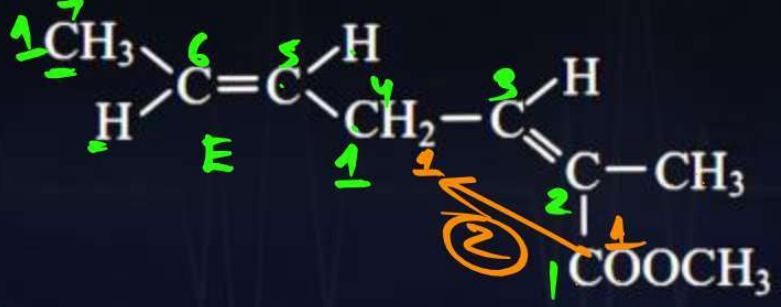


D



C. Q. 15

The correct stereochemical name of



A Methyl 2-methylhepta (2E, 5E) dienoate

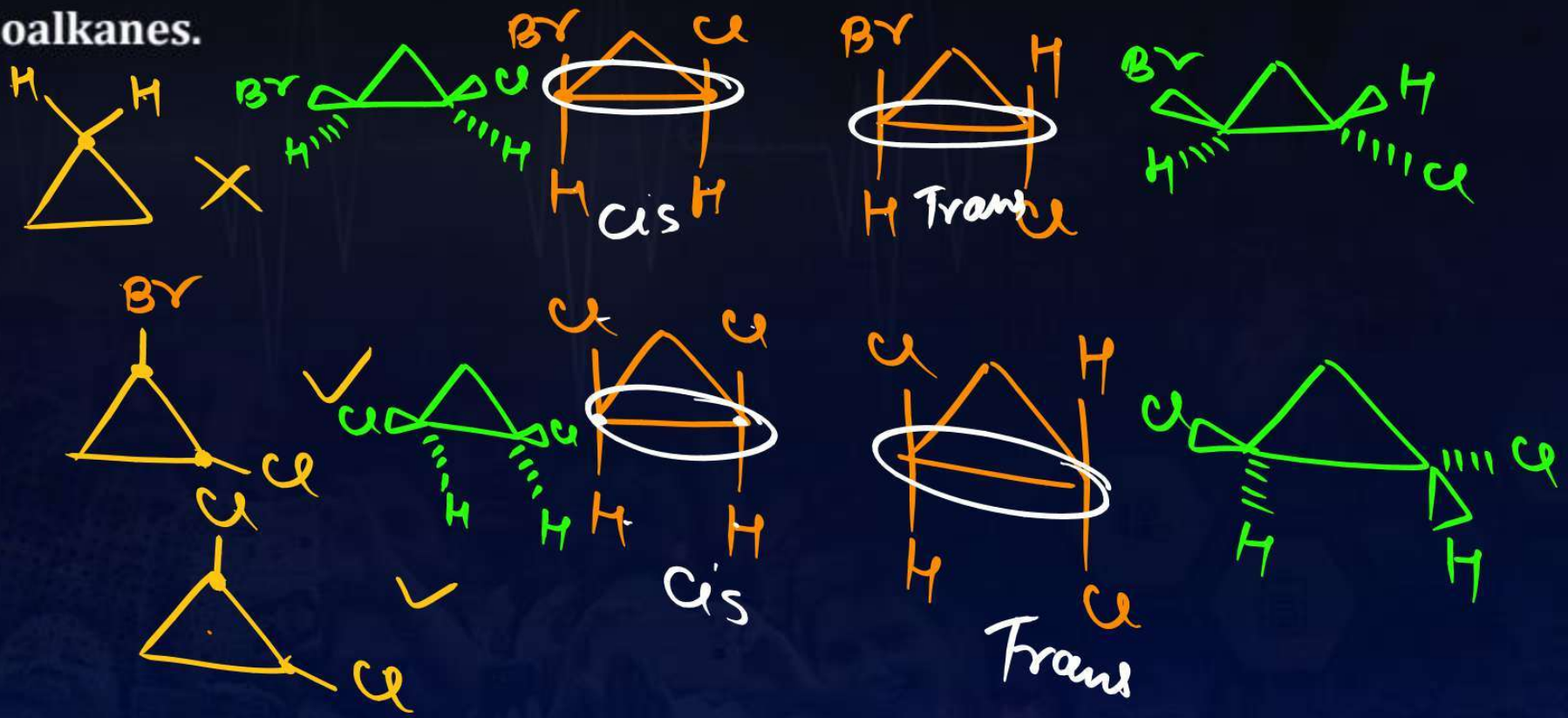
B Methyl 2-methylhepta (2Z, 5Z) dienoate

C Methyl 2-methylhepta (2E, 5Z) dienoate

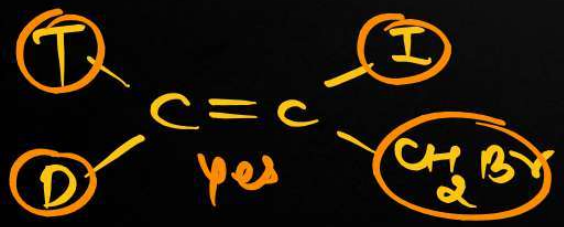
D Methyl 2-methylhepta (2Z, 5E) dienoate

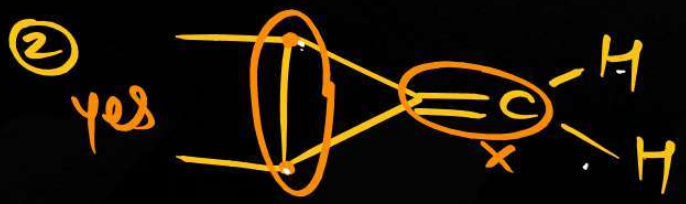
Case-3 Cycloalkanes

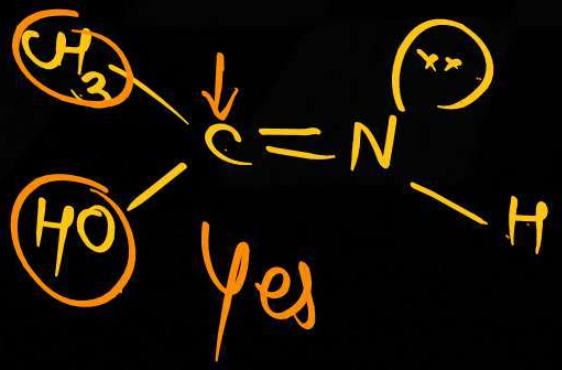
Minimum 2 sp^3 carbon must be attached at different site to show G.I in cycloalkanes.

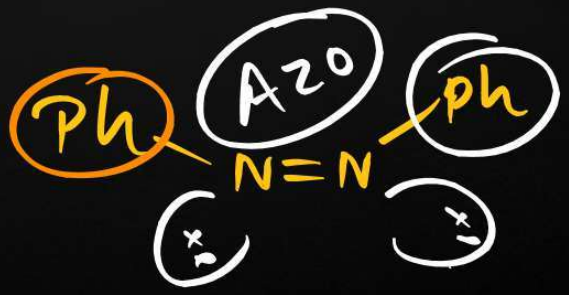


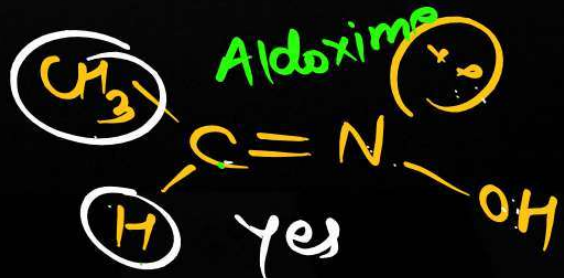
Q G-I exhibit or not ?

① 

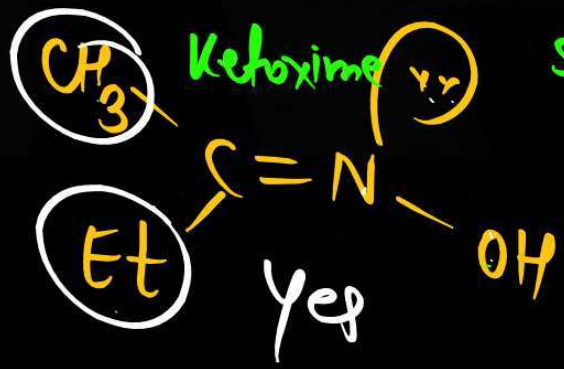
② 

③ 

④ 

⑤ 

(OH & H same side Syn)

⑥ 

Syn ethyl methyl oxime

or

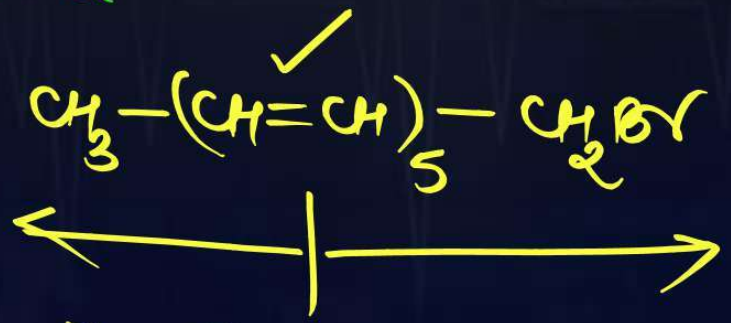
Anti methyl ethyl oxime

Calculation of no. of G.I.

Case 1. If End groups are different. (Unsymmetrical)

n = Geometrical area (double bond jo GI exhibit kar rahe hai)

Total GI $= 2^n$



n = 5

Total GI $= 2^5$

Calculation of no. of G.I.

Case 2. If End groups are same. (Symmetrical)

n = Geo area

$$\text{Total G.I} = 2^{n-1} + 2^{p-1}$$

$p = \frac{n}{2}$ n = even

$p = \frac{n+1}{2}$ n = odd

$CH_3-(CH=CH)_5-CH_3$

$n = 5$ $\quad p = \frac{5+1}{2} = \frac{6}{2} = 3$

$$\text{Total GI} = 2^{5-1} + 2^{3-1}$$

$$= 2^4 + 2^2 = 16 + 4 = 20$$

QUESTION

Calculate number of geometrical isomers for following compounds.

$C_6H_5-CH=CH-CH=CH-CH=CH-CH=CH-Cl$

$n=4 \quad 2^4=16$

$Cl-CH=CH-CH=CH-CH=CH-CH=CH-Cl$

$n=4 \quad P=\frac{n}{2}=2$

$2^{4-1}+2^{2-1}=2^3+2^1=10$

$C_6H_5-CH=CH-CH=CH-CH=CH-C_6H_5$

$n=3 \quad P=\frac{3+1}{2}=2 \quad 2^{3-1}+2^{2-1}=4+2=6$

C. Q. 16 (AIPMT 2001)

DU = 1

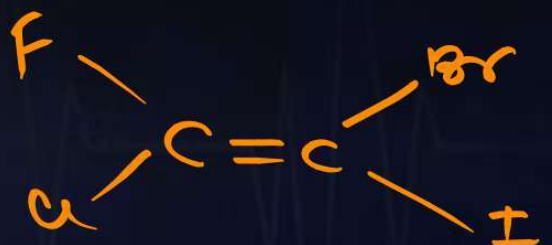
The number of isomers for the compound with molecular formula $C_2BrClFI$ is:

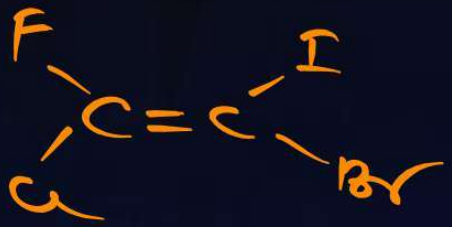
A 3

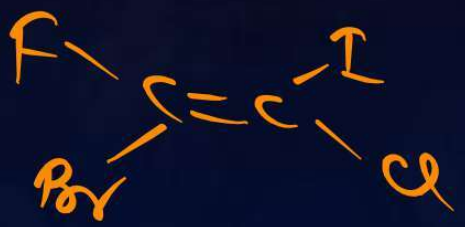
B 4

C 5

D 6







C. Q. 17

Predict the number of geometrical isomers for 2, 4-dimethylpent-2-ene.

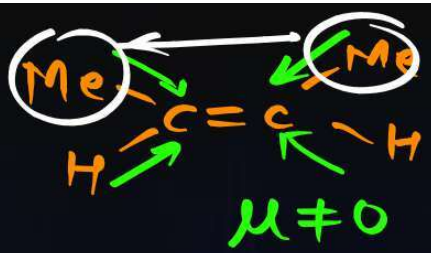
A 0

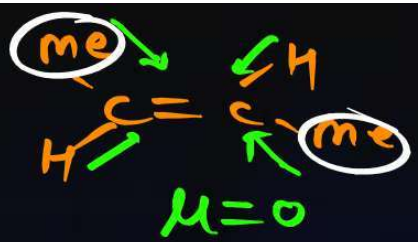
B 2

C 4

D 6

Properties of Cis-Trans





1. Dipole moment C > T
2. Boiling Point [BP ∝ D.M] C > T
3. Crystal Lattice Energy C < T
4. Melting Point MP ∝ C.L.E C < T
5. Stability C < T
6. Solubility C > T

C. Q. 18 (JEE Mains 2025, 22 January Shift-1)

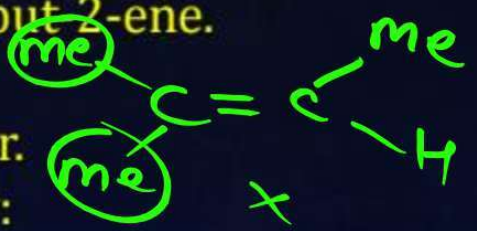
The **incorrect** statements regarding geometrical isomerism are:

(A) Propene shows geometrical isomerism.

(B) Trans isomer has identical atoms/groups on the opposite sides of the double bond.

(C) Cis-but-2-ene has higher dipole moment than trans-but-2-ene.

(D) 2-methylbut-2-ene shows two geometrical isomers.



(E) Trans-isomer has lower melting point than cis isomer.

Choose the correct answer from the options given below:

A (A) and (E) Only

B (B) and (C) Only

C (C), (D) and (E) Only

D (A), (D) and (E) Only

C. Q. 19 (JEE Mains 5th April 2024, Morning Shift)

Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): Cis form of alkene is found to be more polar than the trans form.

Reason (R): Dipole moment of trans isomer of 2-butene is zero.

In the light of the above statements, choose the correct answer from the options given below:

A Both (A) and (R) are true but (R) is NOT the correct explanation of (A).

B (A) is true but (R) is false.

C Both (A) and (R) are true and (R) is the correct explanation of (A).

D (A) is false but (R) is true.

C. Q. 20 (JEE Mains 6th April 2024, Evening Shift)

The **incorrect** statement regarding the geometrical isomers of 2-butene is:

A cis-2-butene and trans-2-butene are not interconvertible at room temperature.

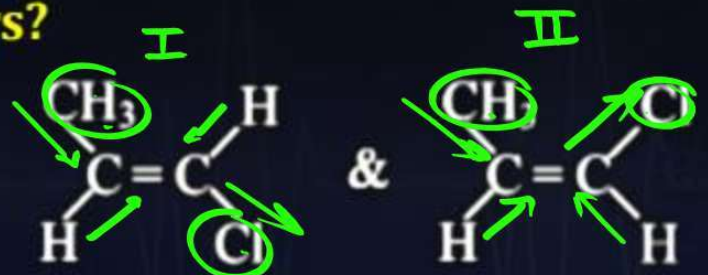
B cis-2-butene has less dipole moment than trans-2-butene.

C trans-2-butene is more stable than cis-2-butene.

D cis-2-butene and trans-2-butene are stereoisomers.

C. Q. 21

Which of the following is correct set of physical properties of geometrical isomers?

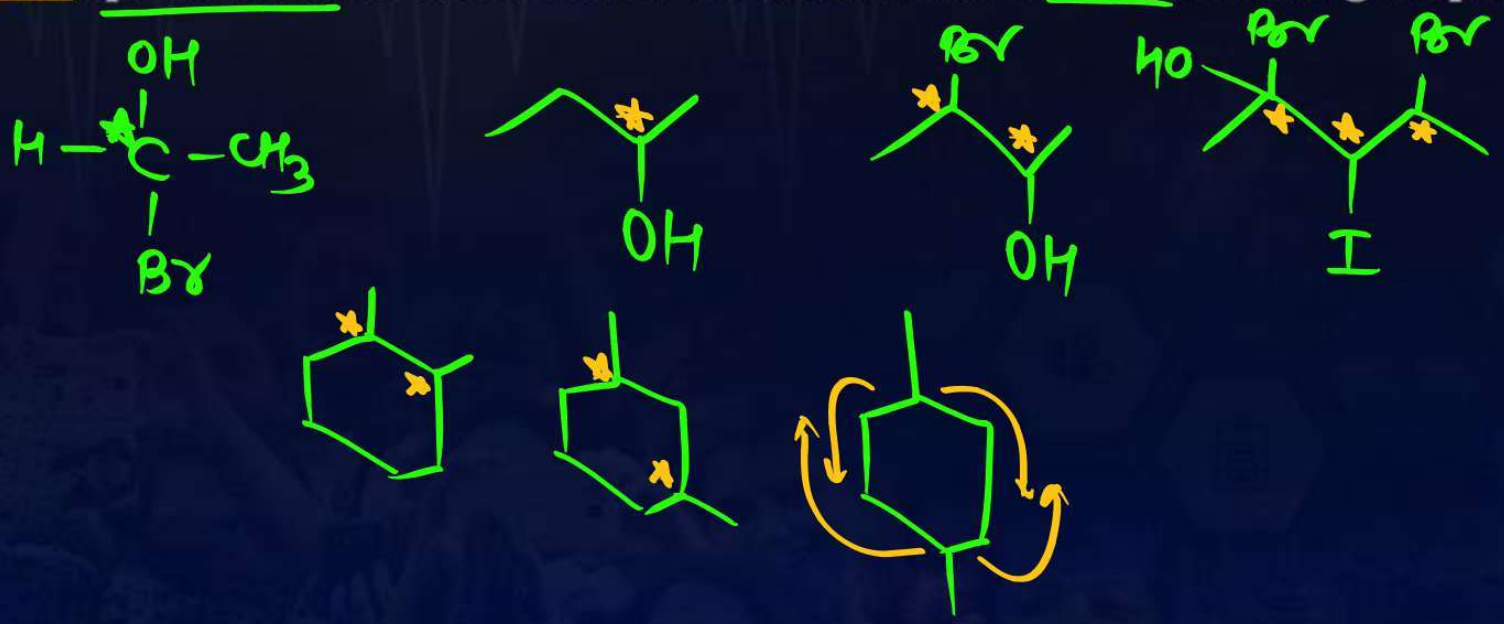


	Dipole moment	Boiling point	Melting point	Stability
(A)	I > II	I > II	II > I	I > II
(B)	II > I	II > I	II > I	II > I
(C)	I > II	I > II	I > II	I > II
(D)	II > I	II > I	I > II	I > II

Optical Isomerism

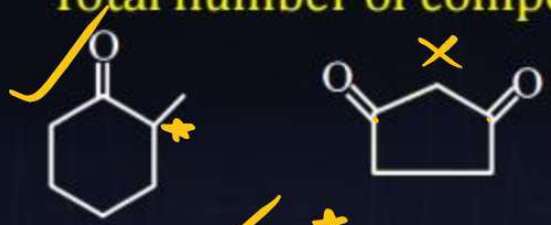
Basic Term:

Chiral Carbon: sp^3 tetrahedral carbon atom attached with four different groups.



C. Q. 22 (JEE Mains 27th January 2024, Evening Shift)

Total number of compounds with Chiral carbon atoms from following is _____.



$CH_3-CH_2-CH(NO_2)-COOH$

$CH_3-CH_2-CHBr-CH_2-CH_3$

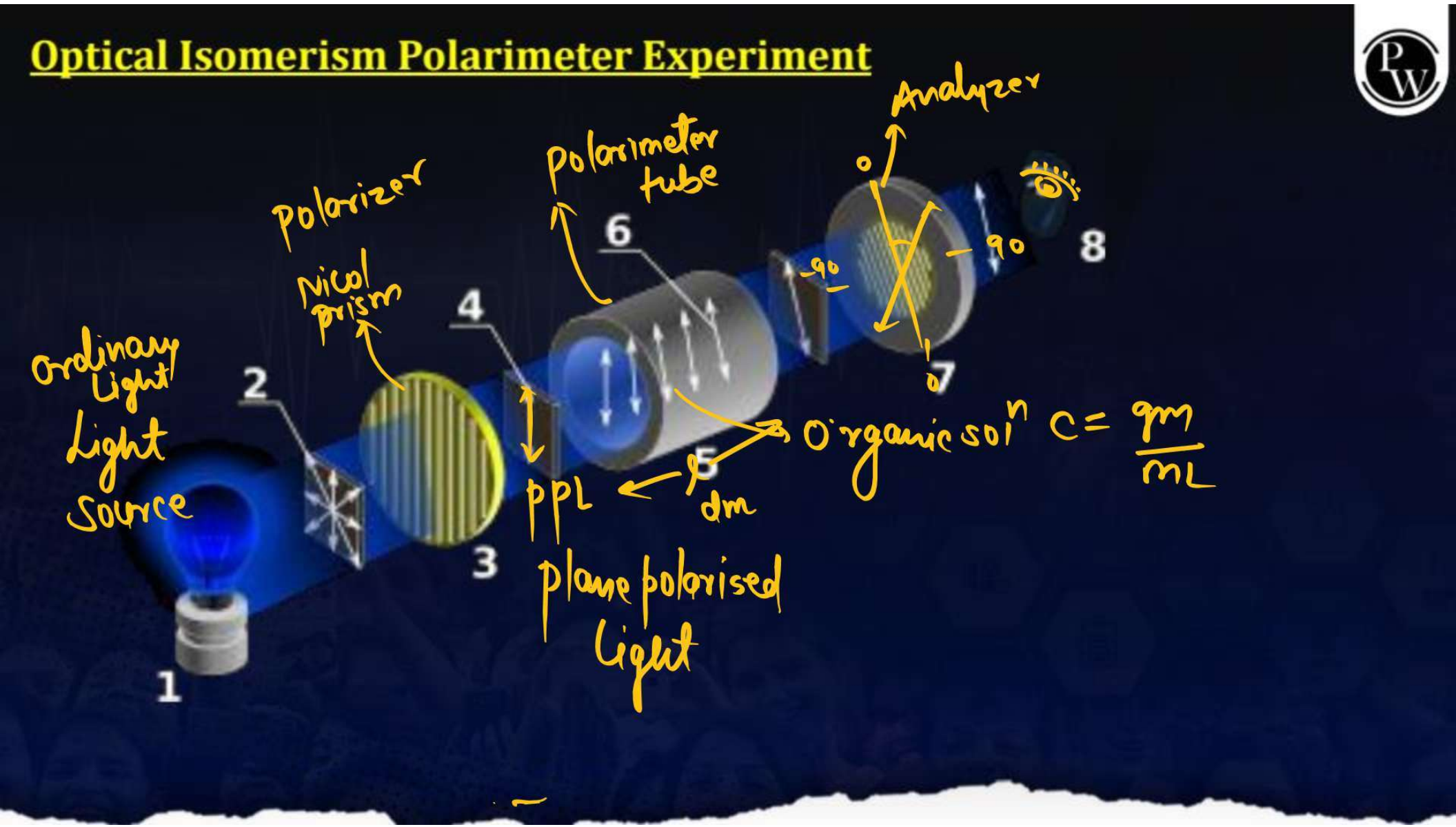
$CH_3-CH(I)-CH_2-NO_2$

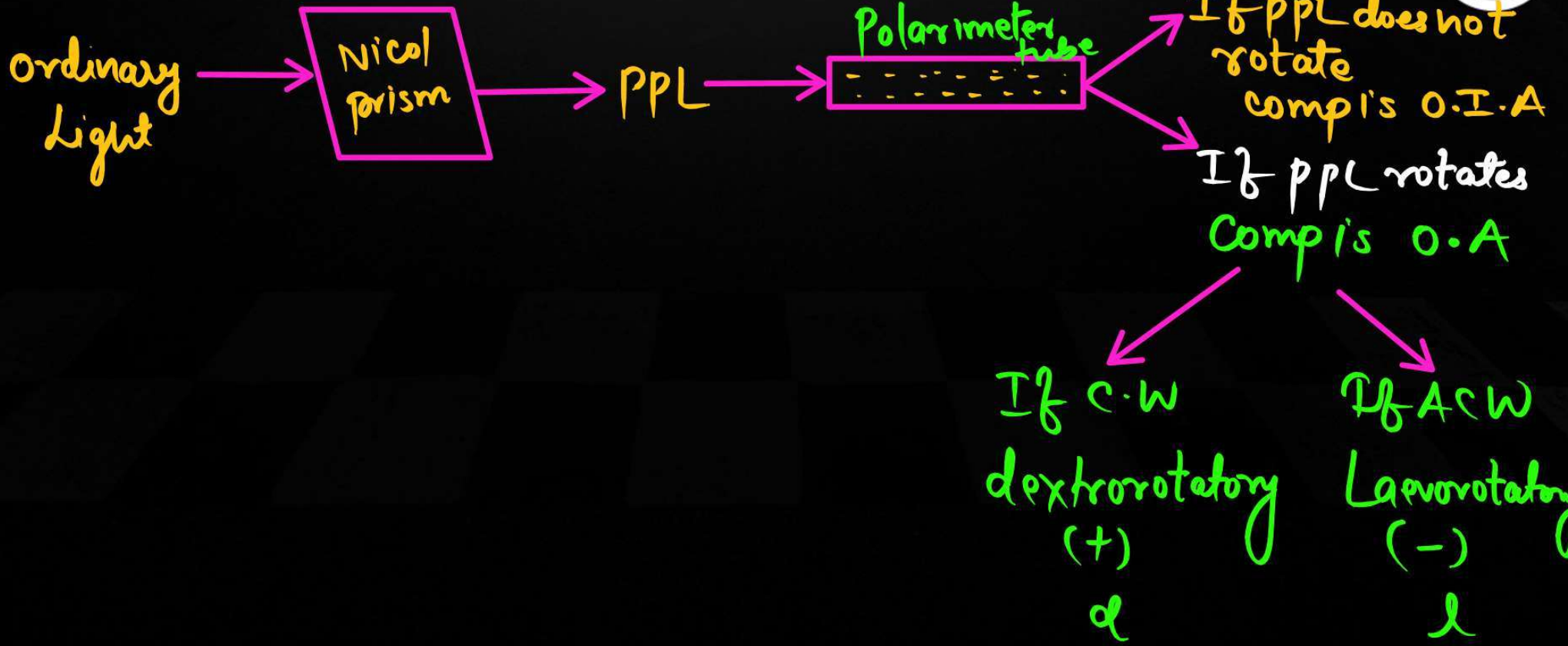
$CH_3-CH_2-CH(OH)-CH_2OH$

$CH_3-CH(I)-CH(I)-C_2H_5$

No. of Comp = 5

Optical Isomerism Polarimeter Experiment




Ordinary Light
Nicol prism
PPL
Polarimeter tube
If PPL does not rotate Compl's O.I.A
If PPL rotates Compl's O.A
If C.W
dextrorotatory
(+)
d
If A.C.W
Laevorotatory
(-)
l

Optical & Specific Rotation:

$$\alpha = \frac{\theta}{c \cdot l}$$

θ = observed rotation

c = conc^{n} $\frac{gm}{mL}$

l = dm

α = specific rotation

C. Q. 23

If solution of a compound (30g/100mL of solution) has measured rotation of +15° in a 2 dm long sample tube. The specific rotation of this compound is:

A +50°

B +25°

C +15°

D +7.5°

$$\alpha = \frac{\theta}{c\ell}$$

$$\alpha = \frac{15}{\frac{30}{100} \times 2}$$

POS (Plane of Symmetry)

An Imaginary plane which can divide a molecule into two equal parts. & these two parts are mirror images of each other

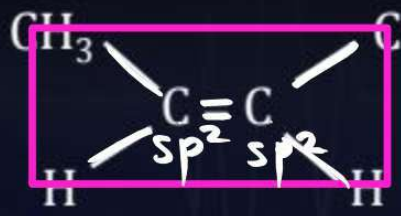
[Pos can be >1]

Pos ✓ OIA
Pos ✗ OA

C. Q. 24

Which of the following has no P.O.S. (plane of symmetry)?

A

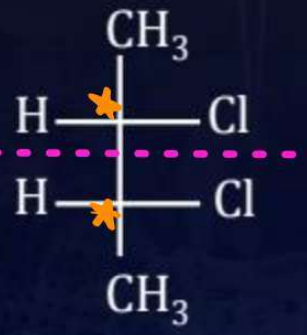


Pos(✓)
OIA

B

Pos(✓)
OIA

C



Pos(✓)
OIA

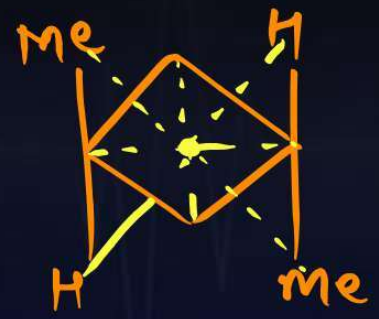
D

Pos(X)
OA

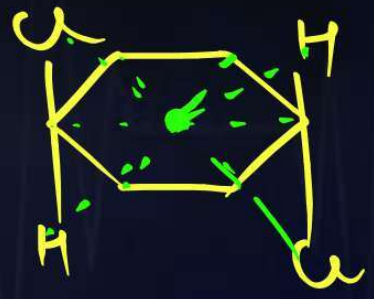
COS (Center of Symmetry) (4 & 6 ki ring)

An Imaginary point from which opposite lines are drawn same group will meet.

Cos = 1



Cos(v)

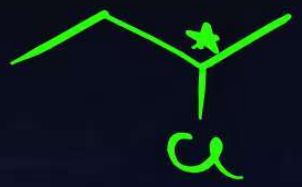


Cos(v)

Conditions for Optical Activity of Compounds

A. If only one chiral carbon is present.

Always O.A



Always O.A

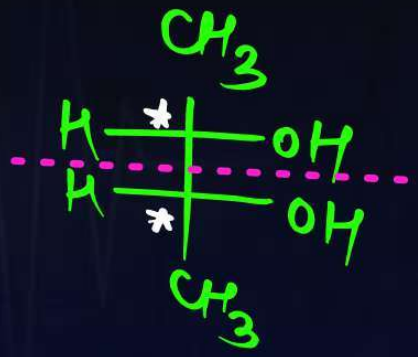
Conditions for Optical Activity of Compounds

B. If more than one chiral carbons are present.

(i) If molecule is acyclic.

Pos (✓) OIA

Pos (x) OA



2 Chiral Carbon

Pos (✓)

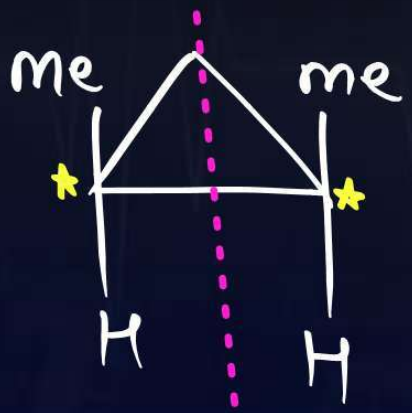
OIA

Conditions for Optical Activity of Compounds

B. If more than one chiral carbons are present.

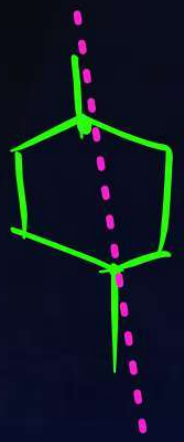
(ii) If molecule is cyclic with odd ring.

Pos(v) OIA
Pos(x) OA

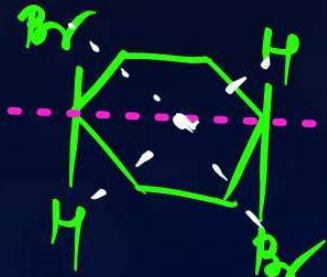


Pos(v)
OIA

Pos(x)
OA



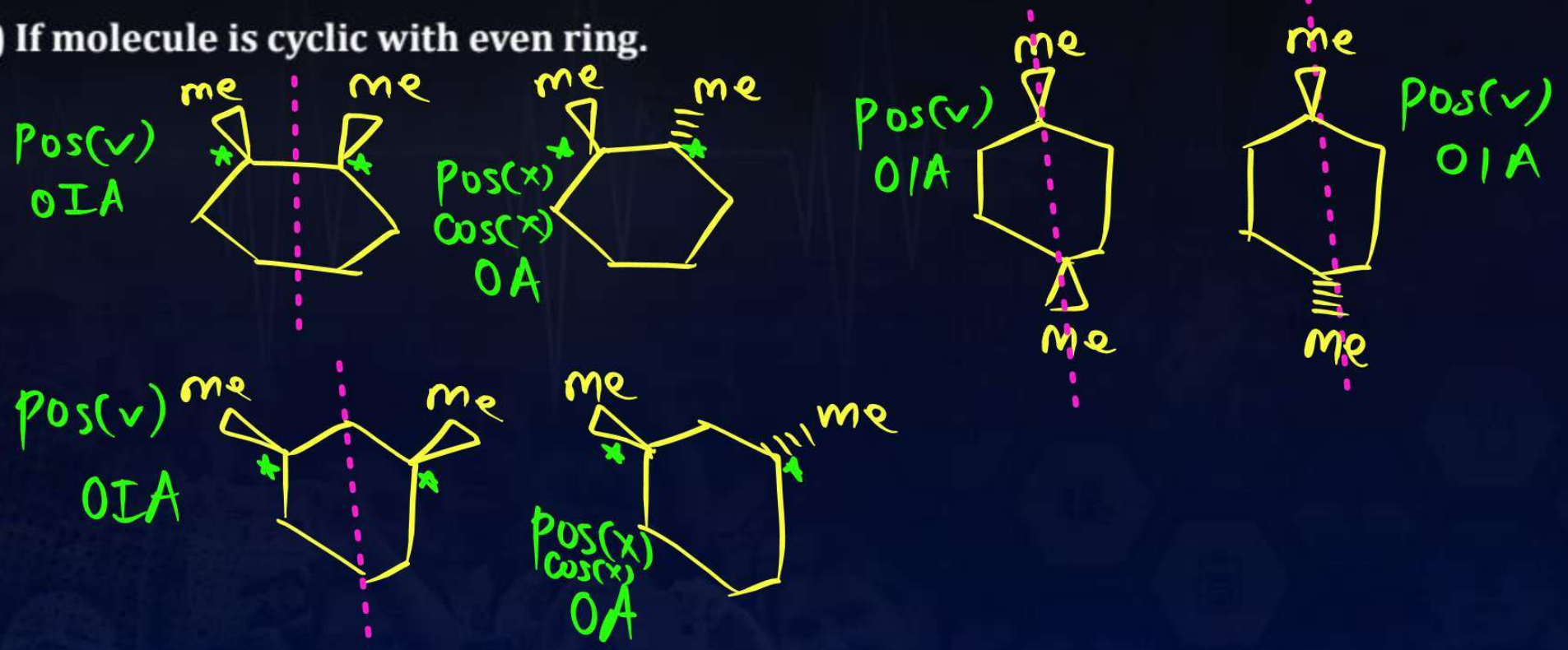
Pos(v)
OIA



Pos(v)
OIA
Cos(v)

Conditions for Optical Activity of Compounds

(iii) If molecule is cyclic with even ring.

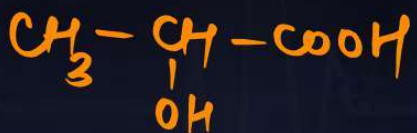



OA | OIA
even Cyclic
Pos
Cis
1 chiral Cor OA
2 chiral
Acylic
Pos
odd Cyclic
Pos

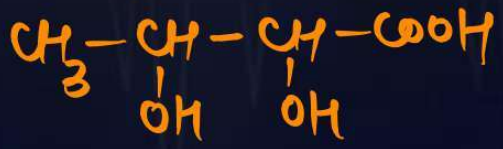
C. Q. 25 (AIPMT 2012)

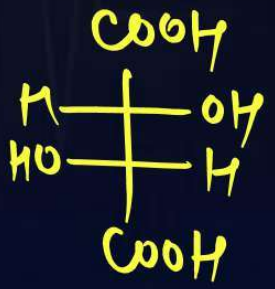
Which of the following acids does not exhibit optical isomerism?

A Lactic acid

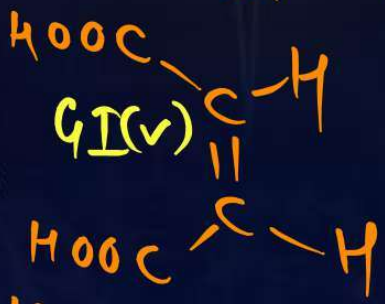


B Tartaric acid

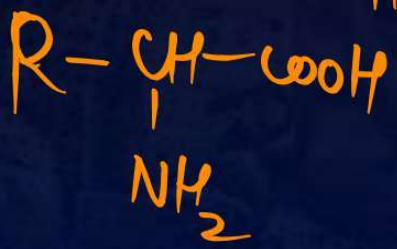




C Maleic acid



D α-amino acids

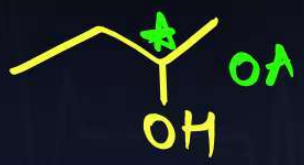


C. Q. 26 (AIPMT 2006)

Which of the following is not chiral?

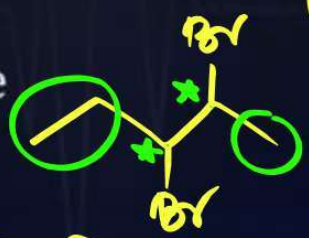
chiral compound

A 2-Butanol



O.A

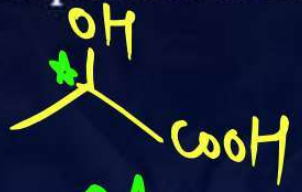
B 2, 3-Dibromo pentane



Pos(x)
O.A

C 3-Bromo pentane

D 2-Hydroxy propanoic acid



O.A

C. Q. 27 (AIPMT 2002)

Which of the following compounds exhibits stereoisomerism?

Geometrical

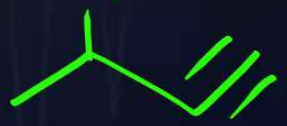
optical

GI OI

A 2-methylbutene-1

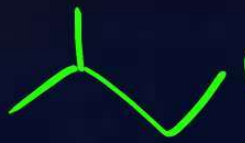
✗ ✗

B 3-methylbutyne-l



✗ ✗

C 3-methylbutanoic acid



✗ ✗

D 2-methylbutanoic acid ✓

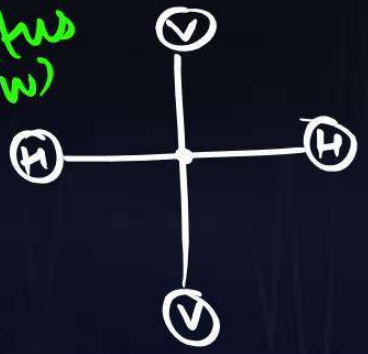
✗ ✓

R/S Configuration

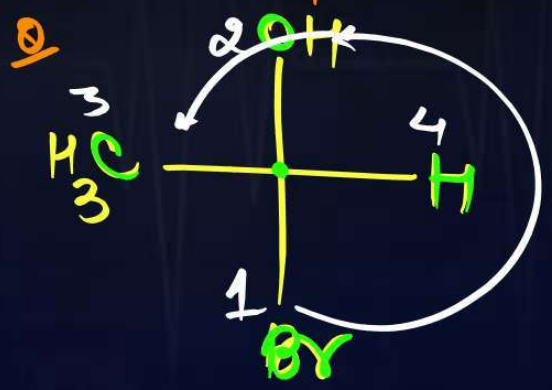
Sinister (ACW)

Rectus (CW)

Case 01: In Fischer Projection Formula

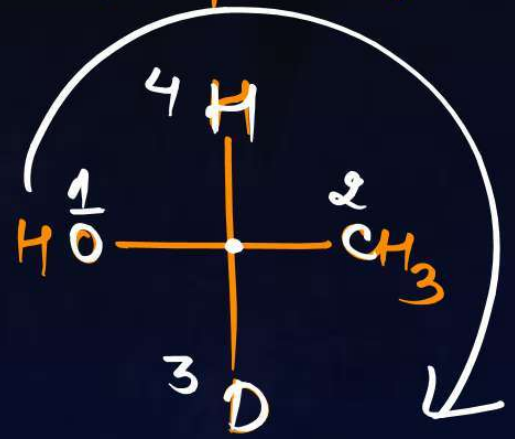


① if No. 4 is on Horizontal position flip the answer



S

R



R

C. Q. 28

CIP

The priority of groups -OH, -COOH, -CHO, $-OCH_3$ attached to a chiral carbon is in order

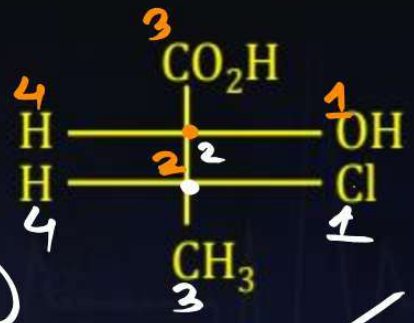
A $-\underline{O}H > -\underline{C}OOH > -\underline{C}HO > -\underline{O}CH_3$

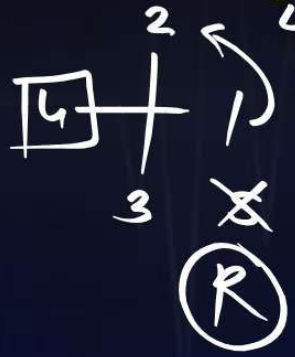
B $-\underline{O}CH_3 > -\underline{O}H > -\underline{C}HO > -\underline{C}OOH$

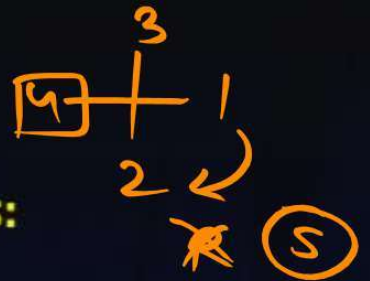
C $-OCH_3 > -OH > -COOH > -CHO$

D $-OCH_3 > -COOH > -CHO > -OH$

C. Q. 29 [JEE Main 2016]

The absolute configuration of  is:





(A) (2R, 3S)

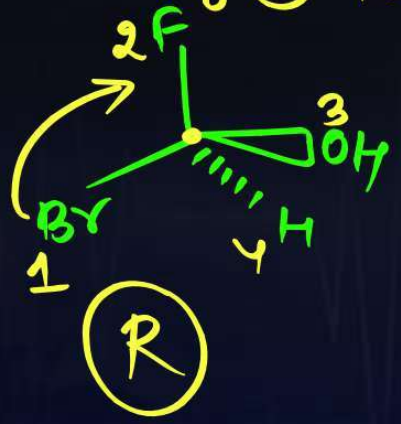
(B) (2S, 3R)

(C) (2S, 3S)

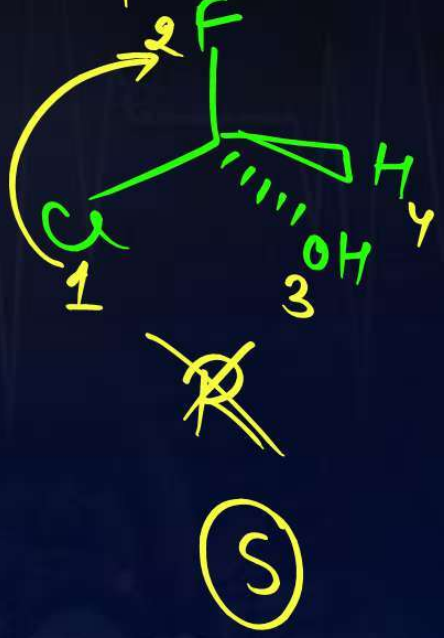
(D) (2R, 3R)

Case 02: In Solid dash wedge

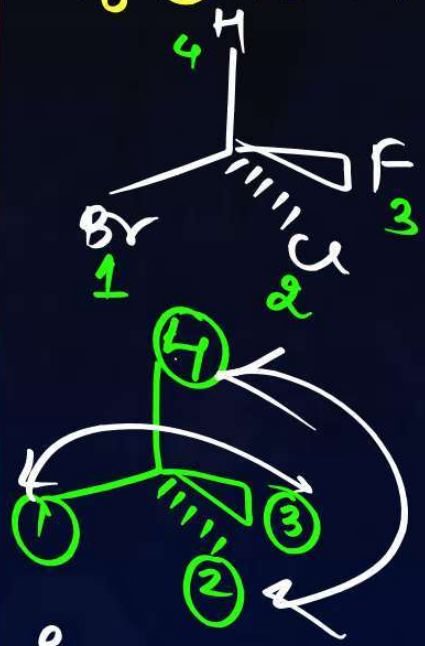
If ④ is on dash



If ④ is on solid flip the answer



If ④ is on line



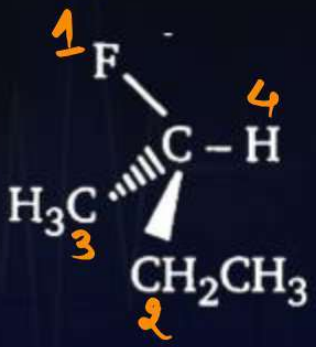
Even no of interchange

C. Q. 30

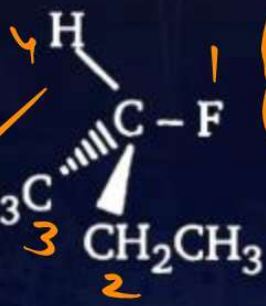
The structure of (S)-2-fluorobutane is best represented by:

A

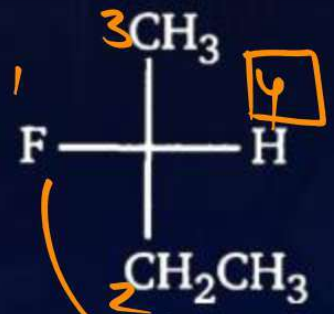
B



C



D



Relation b/w compounds when only one chiral carbon is present

Answer: Either Enantiomers or Identical

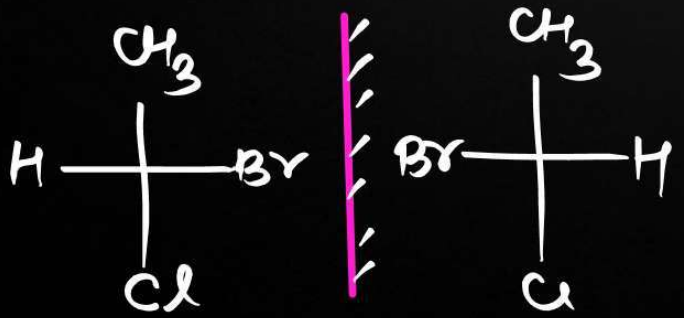
Enantiomers: Non superimposable mirror image.

P & 9 are Enantiomer

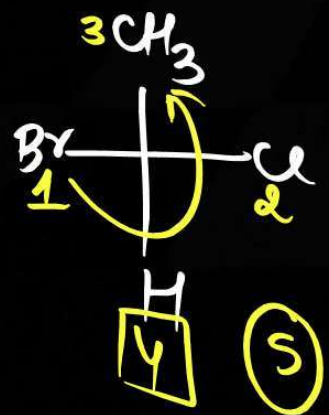
Non superimposable

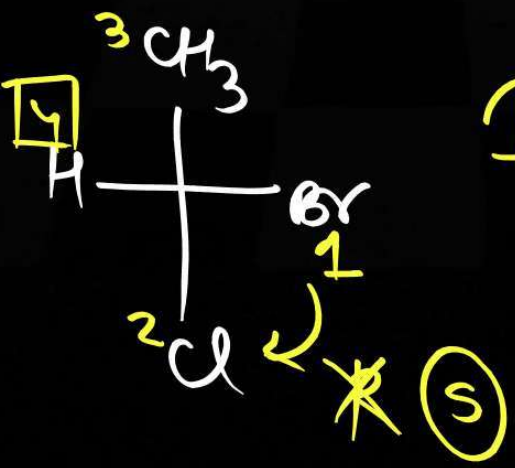
Comp ①	Comp ②	
R	R	Iden
S	S	Iden
R	S	Enan
S	R	Enan

Q find relation

① 

Enan

② 

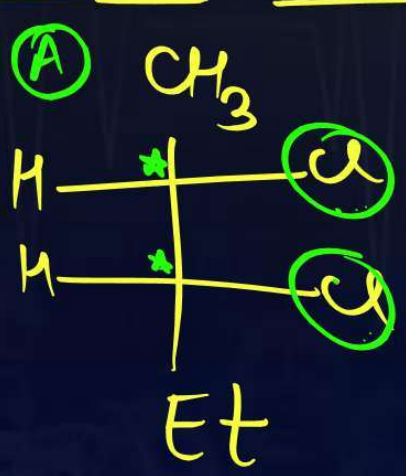


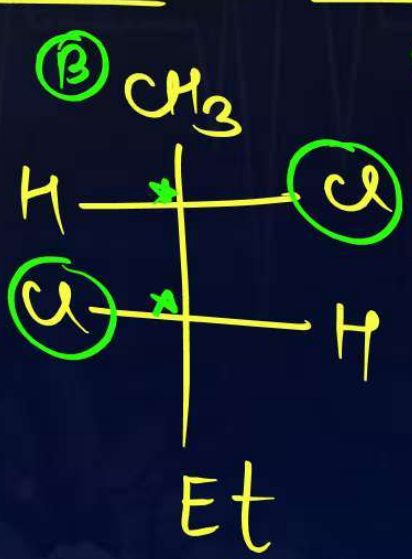
Iden

Relation b/w compounds when only two or more chiral carbons are present

Answer: Enantiomers or Identical or Diastereomers

Diastereomers: Non superimposable & not mirror image.





A & B are not Mirror image

Diastereo

Comp 1 Comp 2

dono
chiral
Carbon
config

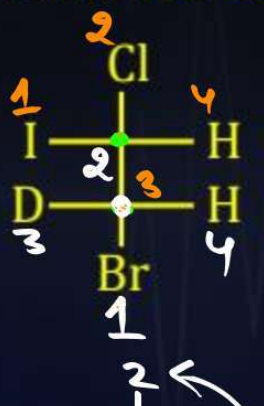
Same iden

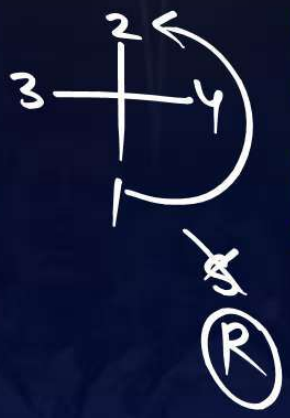
Switch Enan

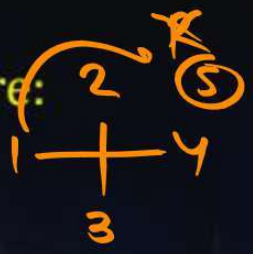
1 same
1 switch Dia

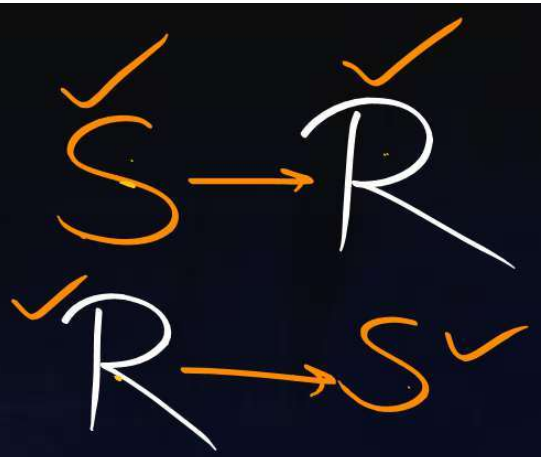
C. Q. 31

The two compounds given below are:









(A) enantiomers

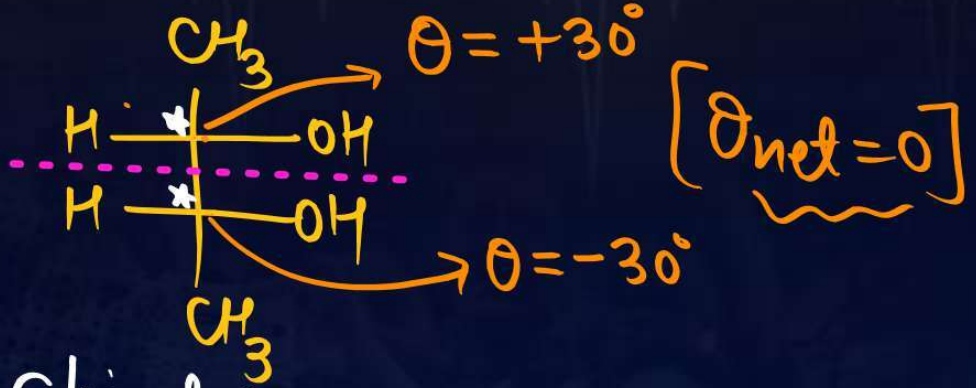
(B) identical

(C) optically inactive

(D) diastereosmers

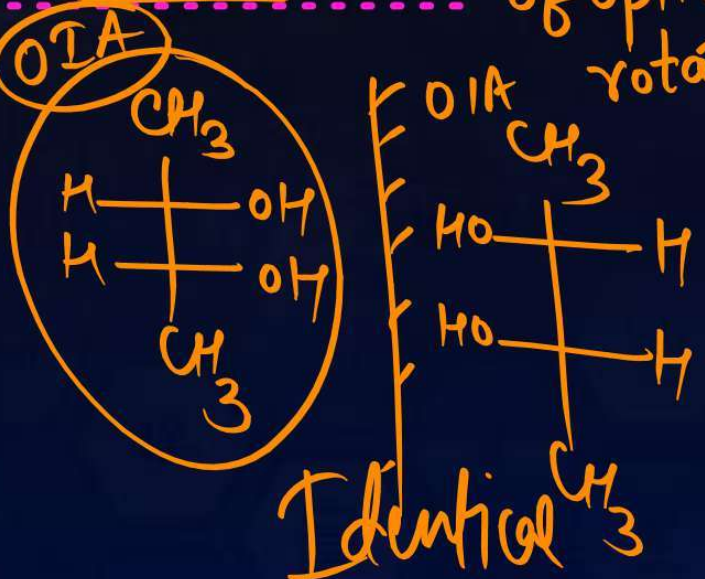
Meso Compounds:

1. Optical isomers having chiral center more than one with POS/COS.
2. Meso compounds are optically inactive due to internal compensation.
   → Cancellation of optical rotation
3. Mirror image of meso compounds represent its identical molecule.
4. Meso compounds cannot have enantiomers.

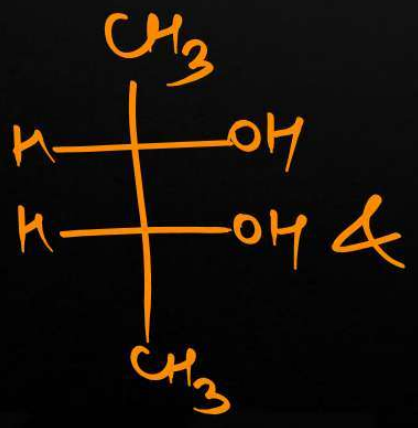


Chiral Cor = 2

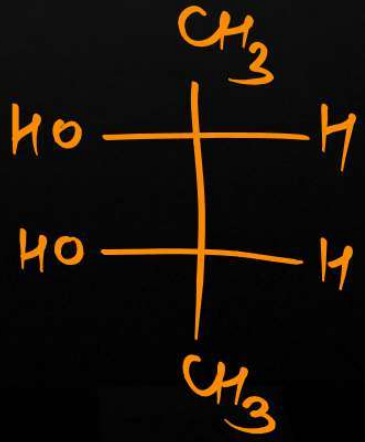
POS(✓) Meso(✓)



Identical



&



are identical

C. Q. 32

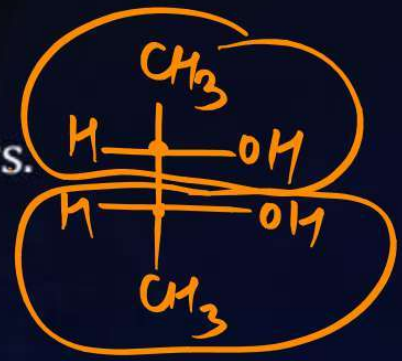
Which of the following statements for a meso compound is incorrect ?

A The meso compound has either a plane or a point of symmetry.

B The meso compound has at least one pair of similar stereocenters.

C The meso compound is achiral.

D The meso compound is formed when equal amounts of two enantiomers are mixed.



C. Q. 33

(1 pair of similar chiral carbon ~~Stereocenter~~)

Among the following which one can have meso form?

A $CH_3CH(OH)CH(Cl)C_2H_5$

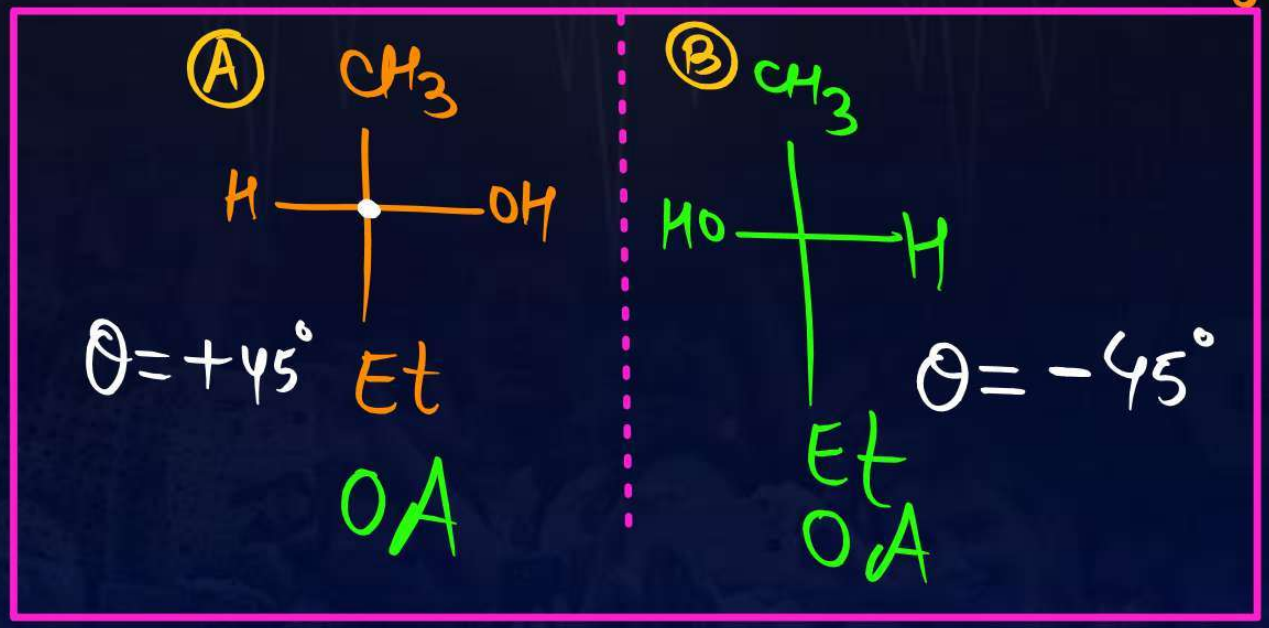
B $CH_3CH(OH)CH(OH)CH_3$

C $C_2H_5CH(OH)CH(OH)CH_3$

D $HOCH_2CH(Cl)CH_3$

Racemic Mixture:

1. Equimolar mixture of two enantiomers.
2. RM is optically inactive due to external compensation.
   ↳ Cancellation of optical rotation
3. Each enantiomer is optically active.



$\theta_{net} = 0$

(A) OA
(B) OA

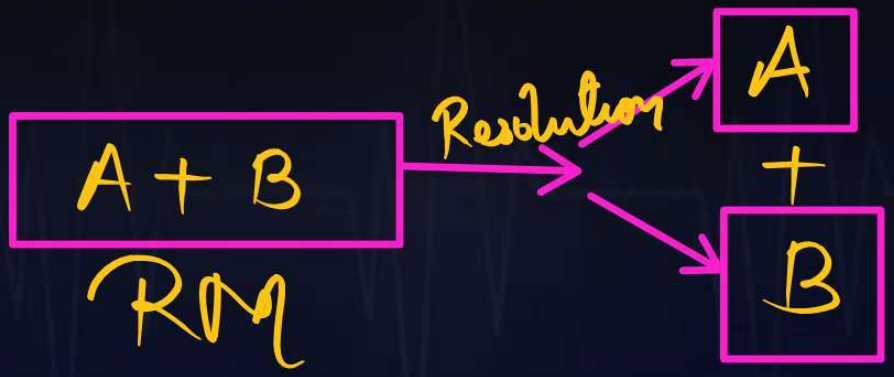
A & B Enantio

A+B

RM
θ = 0
OIA

Resolution:

Separation of Enantiomers from RM is called resolution.



C. Q. 34

The separation of a racemic mixture into pure enantiomers is termed as:

A Racemization

B Isomerization

C Resolution

D Equilibration

Question

Identify which compound is resolvable & Non-resolvable?

O.A — Chiral comp

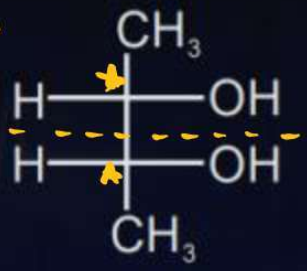
O.I.A or Achiral Comp

A

OA

Resolvable

B



Meso

OIA

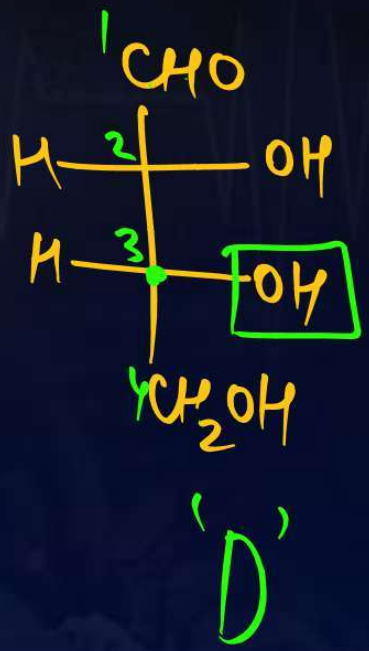
Non resol

D/L Configuration: (IUPAC) (OA se koi lena dena nahi hai)

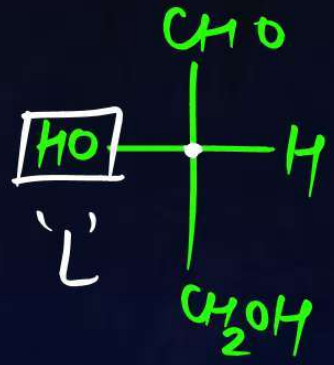
1. Highest priority group should be on top position.
2. Carbon should lie on vertical line.
3. Check the last chiral carbon.

   If OH/NH_2 right then "D"

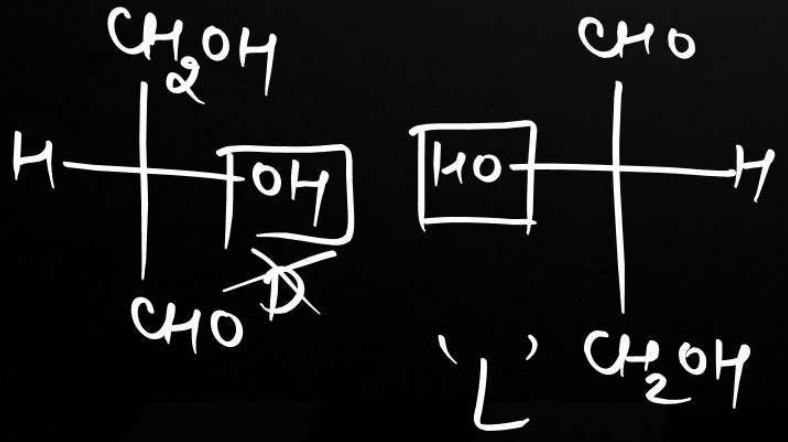
   If OH/NH_2 left then "L"



'D'

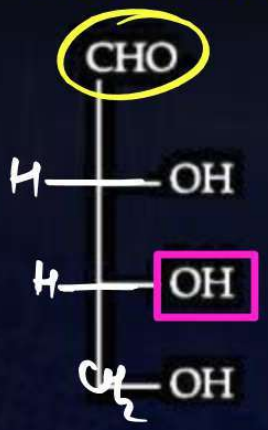


'L'

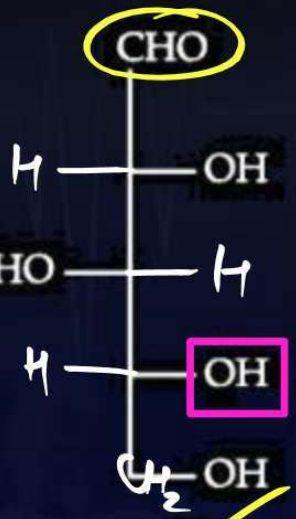

CH2OH
H
OH
CHO
CHO
HO
H
'L'
CH2OH

C. Q. 35 (JEE Mains 2025, 22 January Shift-2)

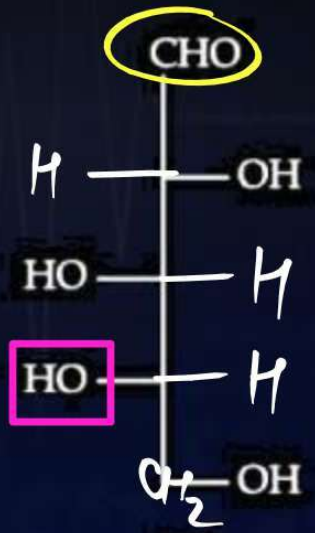
Identify the number of structure/s from the following which can be correlated to D-glyceraldehyde



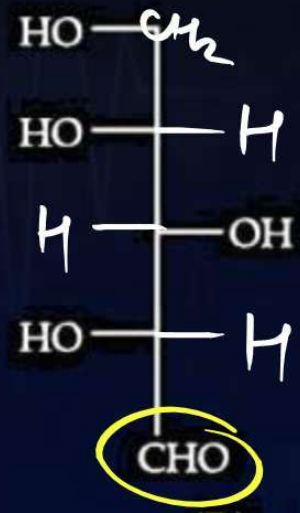
(A)



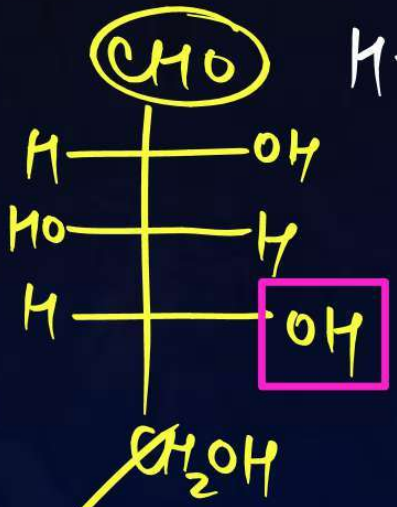
(B)

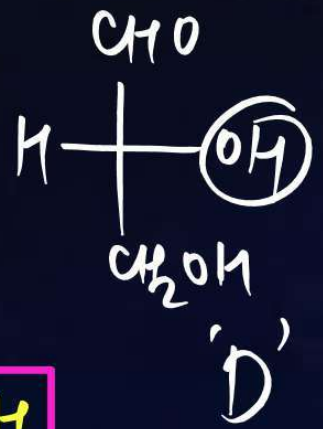


(C)



(D)





A two

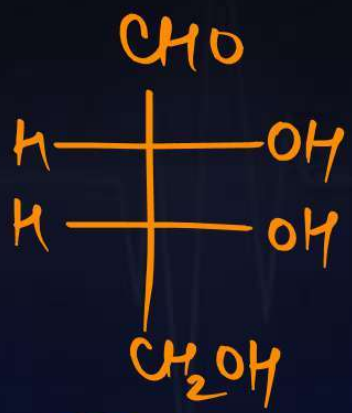
B four

C one

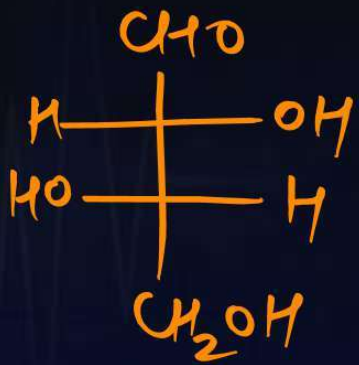
D three

Erythro/Threo:

- Similar groups are on the same side
- opp side



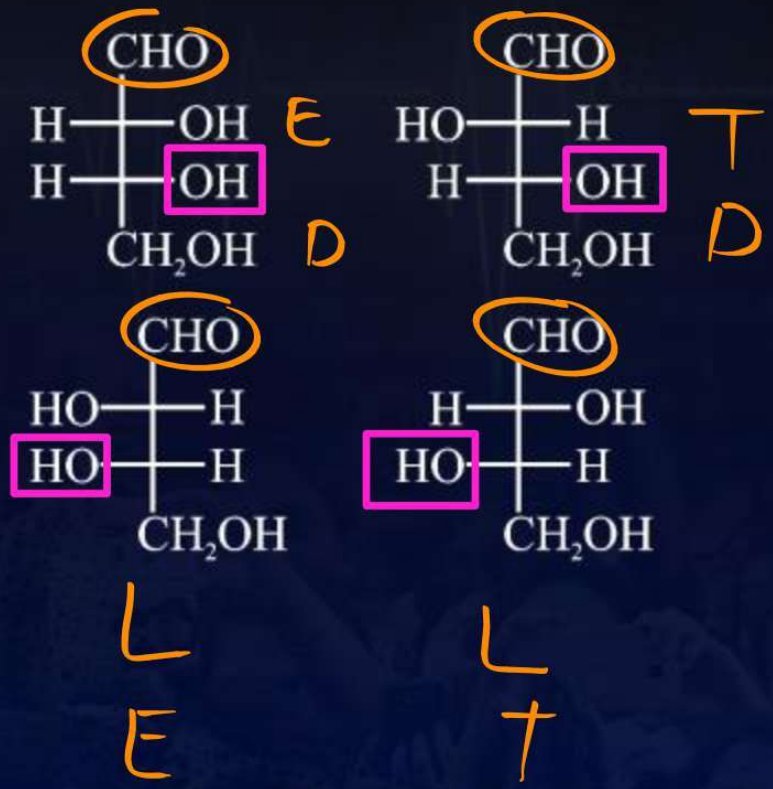
Erythro



Threo

C. Q. 36 (NEET 2016)

The correct corresponding order of names of four aldoses with configuration given below:



A L-erythrose, L-threose, L-erythrose, D-threose

B D-threose, D-erythrose, L-threose, L-erythrose

C L-erythrose, L-threose, D-erythrose, D-threose

D D-erythrose, D-threose, L-erythrose, L-threose

Epimer & Anomers:

[In Biomolecule]

Calculation of Optical Isomerism:

Case 1. If molecule is unsymmetrical.

$$\text{Total O.I} = 2^n \quad n = \text{chiral Carbon}$$

$$\text{O.A} = 2^n$$

$$\text{meso} = 0$$

$$RM = \frac{\text{O.A}}{2}$$

$n = 2$

$\text{Total O.I} = 2^2 = 4$

$\text{O A} = 4$

$\text{meso} = 0$

$RM = \frac{4}{2} = 2$

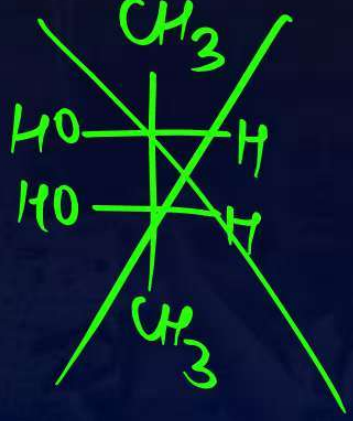
Case 2. If molecule is symmetrical (n = even)

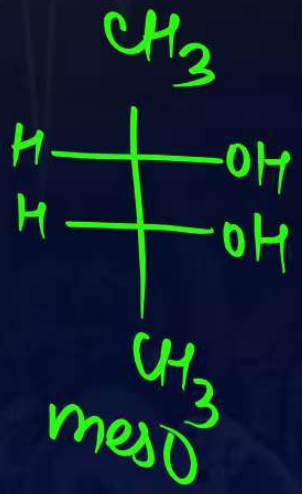
$$\text{Total O.I} = 2^{n-1} + 2^{\frac{n}{2}-1}$$

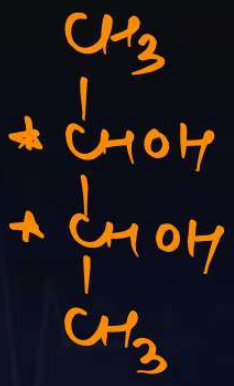
→ OA

→ meso

$$RM = \frac{OA}{2}$$







$n = 2$

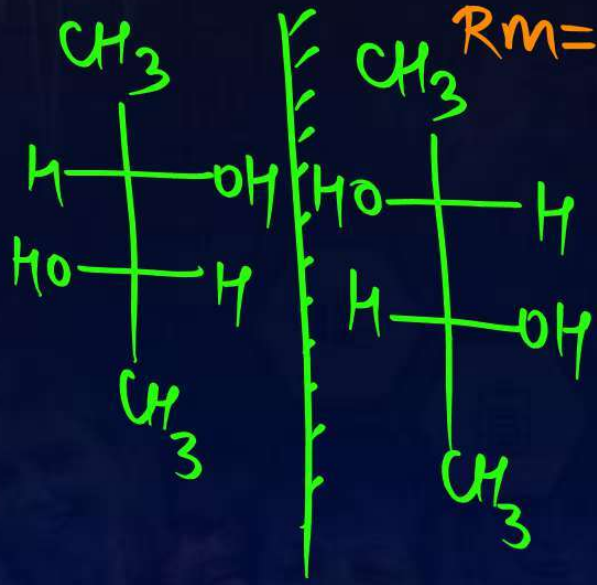
$$\text{Total O.I} = 2^{2-1} + 2^{\frac{2}{2}-1}$$

$$= 2 + 1$$

→ OA

→ meso

$$RM = \frac{2}{2} = 1$$



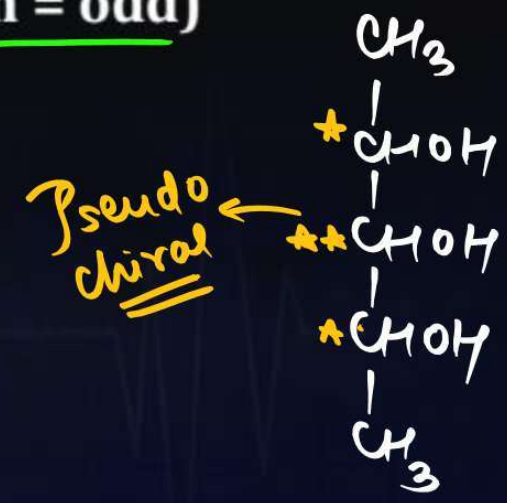
Case 3. If molecule is symmetrical (n = odd)

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

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

$$\text{O.A} = \text{O.I} - \text{Meso}$$

$$\text{RM} = \frac{\text{OA}}{2}$$



$n = 3$

$\text{Total OI} = 2^{3-1} = 4$

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

$\text{OA} = 4 - 2 = 2$

$\text{RM} = \frac{2}{2} = 1$

C. Q. 37 (JEE Mains 1st Feb 2024, Morning Shift)

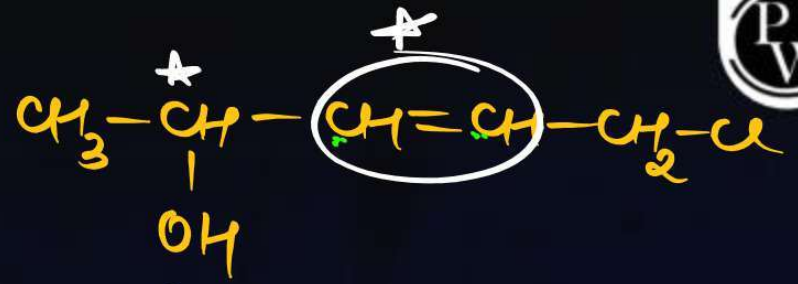
Number of optical isomers possible for 2-chlorobutane .....2.....

$n=1$

$2^1 = 2$

Calculation of Stereoisomers:

Case 1. If molecule is unsymmetrical.



Total S.I $= 2^n$

n = chiral cau + Geometrical area

$n = 2$

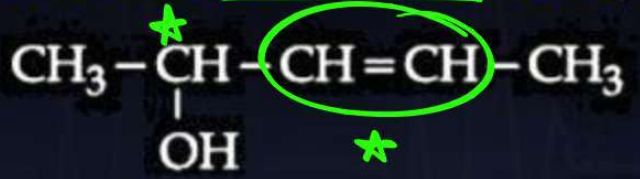
Total SI $= 2^2 = 4$

Stereo center = Chiral Carbon + Geometrical Cent

$1 + 2 = 3$

C. Q. 38 (JEE Mains 2025, 22 January Shift-1)

How many different stereoisomers are possible for the given molecule?



(A) 3

(B) 2

(C) 1

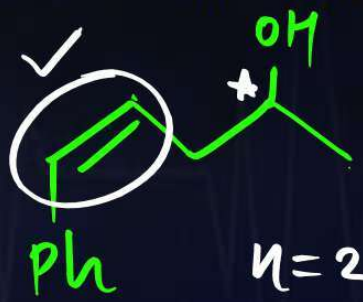
(D) 4

$n = 2$

$2^2 = 4$

C. Q. 39 (JEE Mains 2025, 24 January Shift-2)

The possible number of stereoisomers for 5-phenylpent-4-en-2-ol is 4 .



$n = 2$

$2^2 = 4$

C. Q. 40 (JEE Mains 9th April 2024, Evening Shift)

Total number of stereo isomers possible for the given structure:

$n = 2$

$2^2 = 4$

A 8

B 2

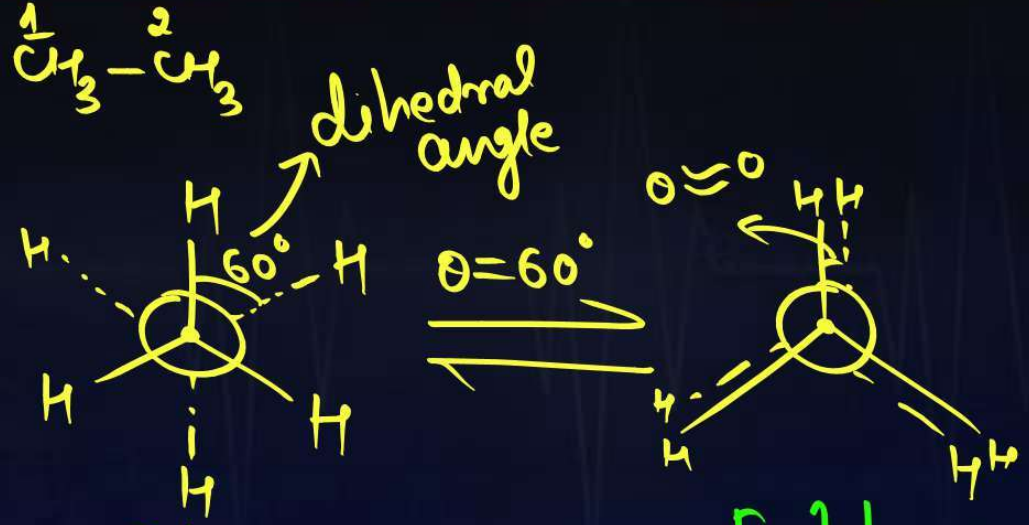
C 4

D 3

Conformational Isomerism

1. Arises due to free rotation around C–C sigma bond.
2. There are infinite conformers.
3. The energy for rotation (Rotational Energy) around sigma bond is available at room temperature.
4. Total conformer of methane is zero. CH_4
5. Also known as Rotamers.
6. Conformers are not true isomers.
7. Interconvertible.

Conformation Isomerism in Ethane



Skew form

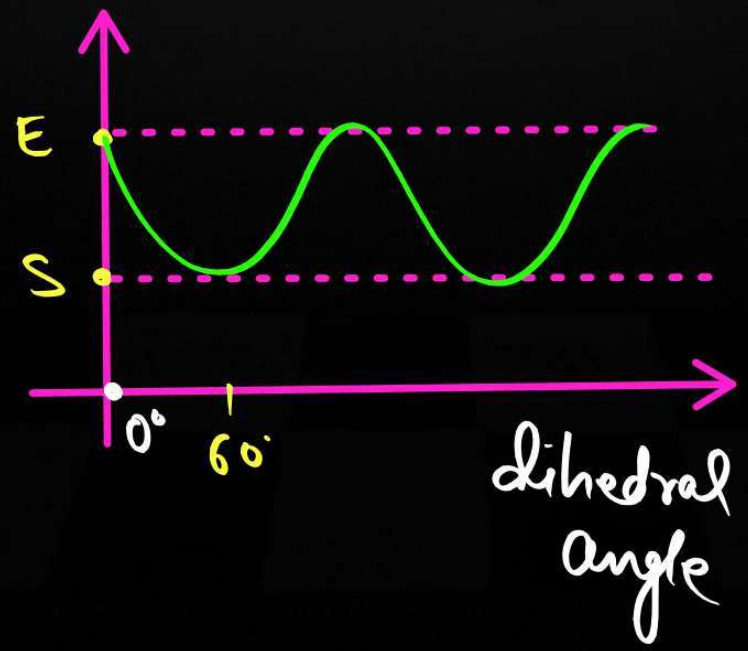
all conformer b/w

S & E

Stability S > E

Energy S < E

Energy profile diagram



C. Q. 41 (NEET 2017)

With respect to the conformers of ethane, which of the following statements is true?

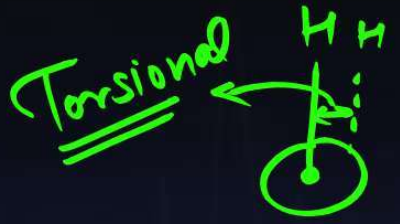
A Bond angle changes but bond length remains same.

B Both bond angle and bond length change.

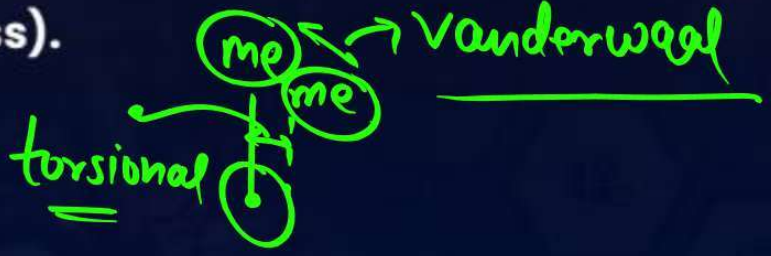
C Both bond angles and bond length remains same.

D Bond angle remains same but bond length changes.

Torsional Strain: The strain arises due to repulsion b/w bond pair electrons.



Vander Waal Strain: The strain arises due to repulsion of front & back atoms or group due to steric factor (bulkiness).



C. Q. 42 (NEET 2016)

The correct statement regarding the comparison of staggered and eclipsed conformation of ethane is:

A The staggered conformation of ethane is less stable than eclipsed conformation, because staggered conformation has torsional strain.

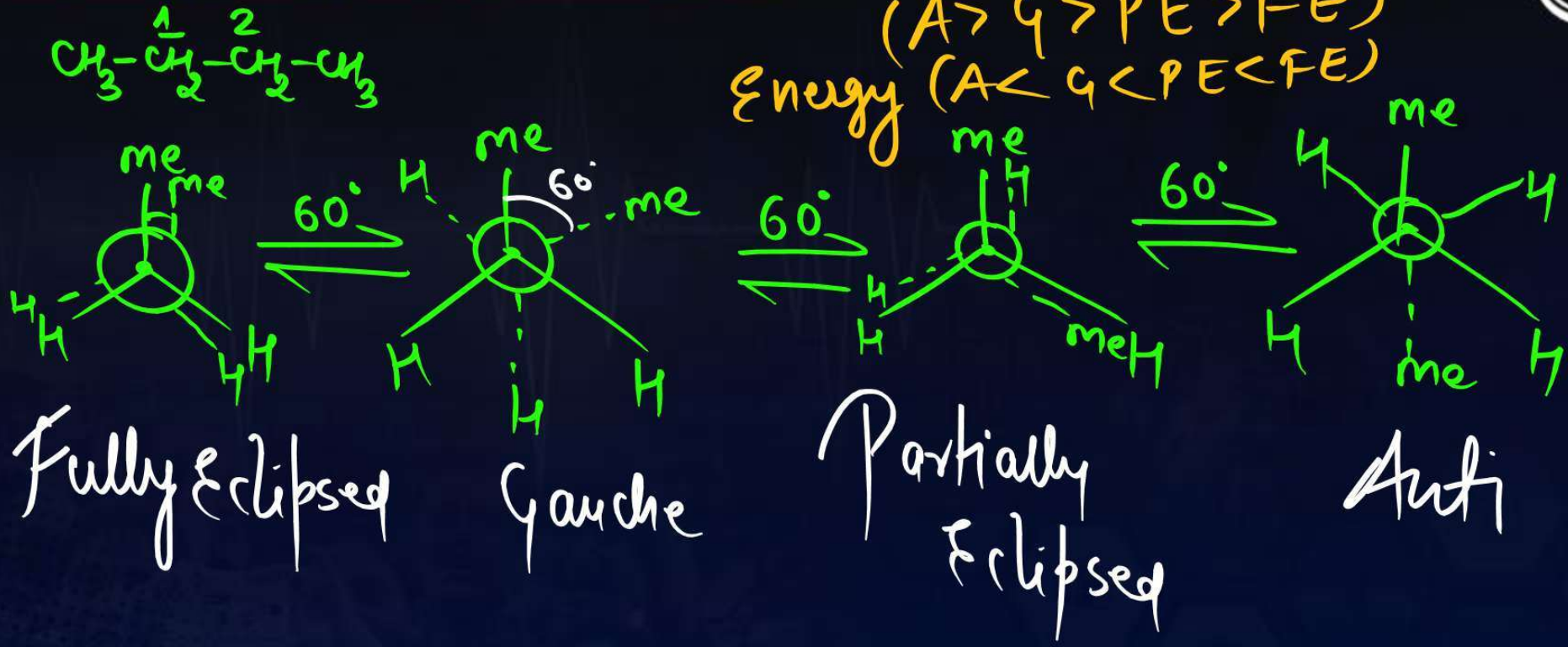
B The eclipsed conformation of ethane is more stable than staggered conformation, because eclipsed conformation has no torsional strain.

C The eclipsed conformation of ethane is more stable than staggered conformation even through the eclipsed conformation has torsional strain.

D The staggered conformation of ethane is more stable than eclipsed conformation, because staggered conformation has no torsional strain.

Conformation Isomerism in Butane

Stability
(A > G > PE > FE)
Energy (A < G < PE < FE)



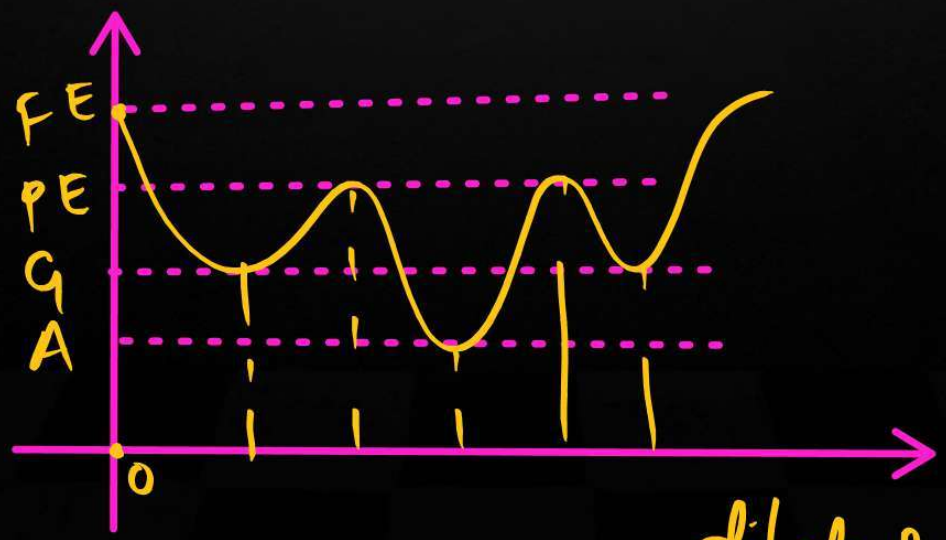
Fully Eclipsed

Gauche

Partially Eclipsed

Anti

Energy profile dia



C. Q. 43

Which of the following conformations of butane has the lowest energy?

most stable

A Anti

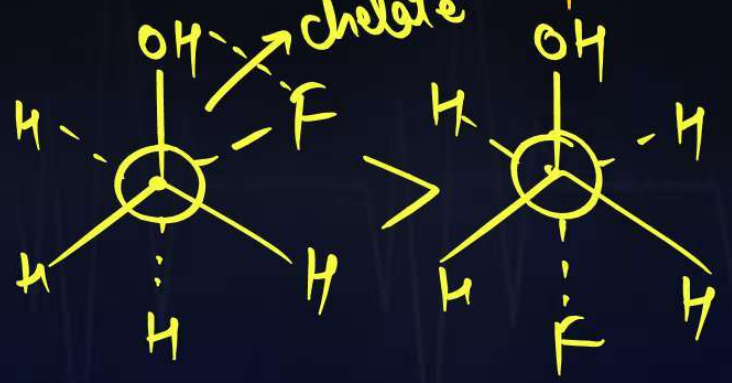
B Gauche

C Staggered

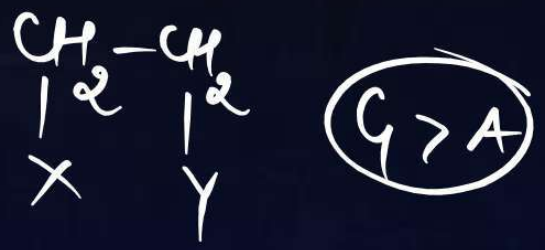
D Eclipsed

Gauche effect

Stability G > A when H-bond is present

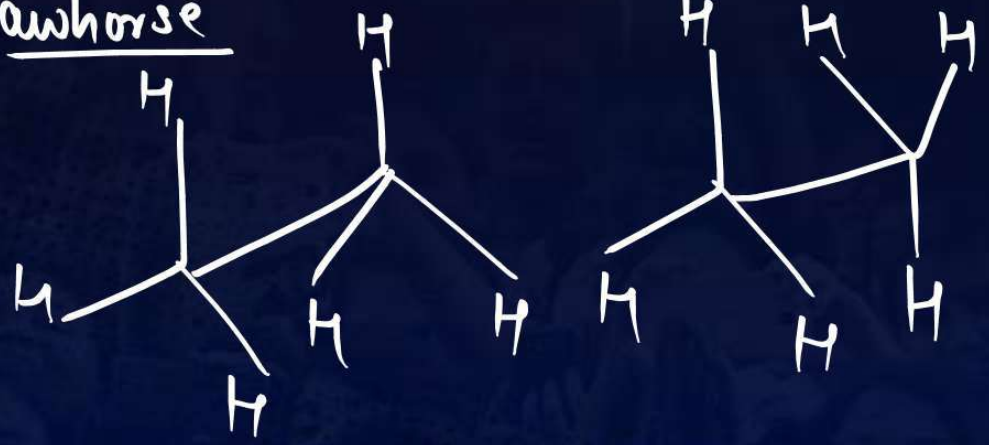


Stability (G > A > PE > FE)



X, Y F O N

Sawhorse



Conformation Isomerism in Cyclohexane

Chair

Twist boat

Boat

Half chair

Stability

[Chair > TB > B > HC]

C. Q. 44

Most stable form of cyclohexane is:

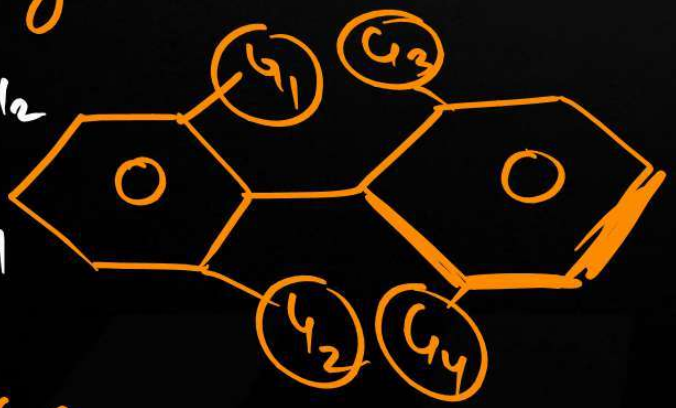
A Boat

B Chair

C Skew

D Eclipsed

O·I in Biphenyl



$C_1 \neq C_2$

$C_3 \neq C_4$

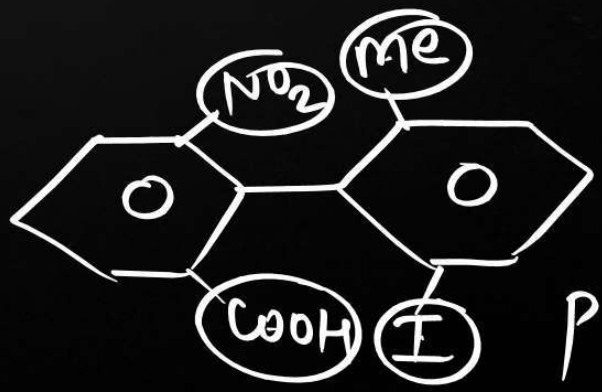
$C_1 C_2 C_3 C_4$

Bulky

R, NO_2, SO_3H

$CH_3, I, COOH$

CHO etc



Pos(x)

OA

Practice Problems

QUESTION-1

The number of isomeric structures possible for a molecule having molecular formula C_5H_{12} is:

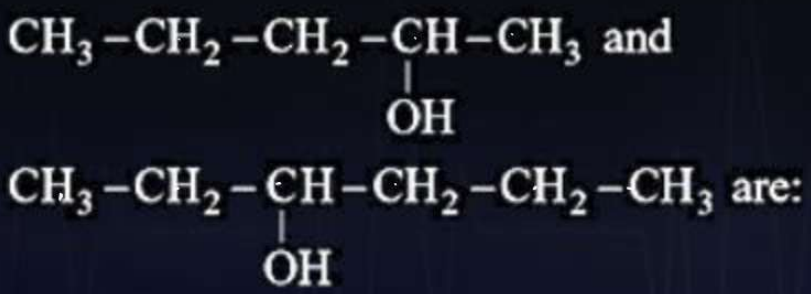
A 2

B 3

C 4

D 5

QUESTION-2



MF diff

A Functional isomers

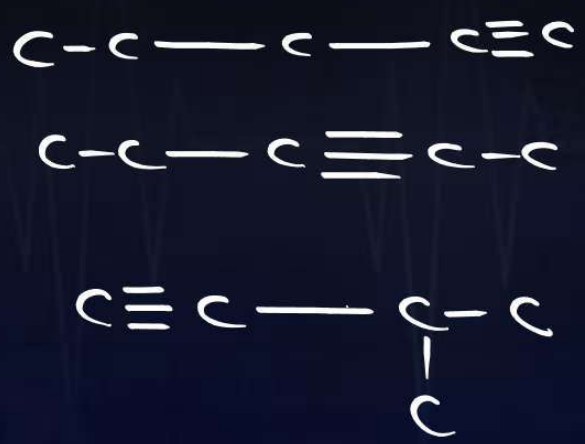
B Position isomers

C Chain isomers

D These are not isomers

QUESTION-3

The number of alkynes possible with molecular formula C_5H_8 is:



$$DU = (5+1) - \left(\frac{8+0-0}{2}\right)$$
$$= 6 - 4 = 2$$

A 2

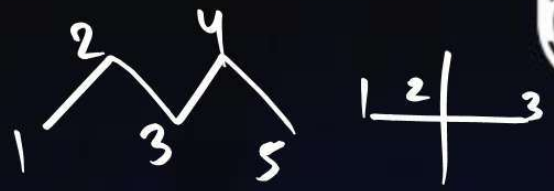
B 3

C 4

D 5

QUESTION-4

n-pentane and neopentane are:



A Functional isomers

B Geometrical isomers

C Chain isomers

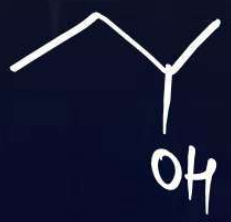
D Position isomers

QUESTION-5

Which of the following compounds will exhibit cis-trans isomerism?

A 2-butene 

B 2-butyne 

C 2-butanol 

D butanal 

QUESTION-6

Total number of stereoisomers of compound is:

$2^2 = 4$

A 2

B 4

C 6

D 3

QUESTION-7

Match List-I with List-II.

List-I		List-II	
(A)	CH_3CH_2OH & CH_3-O-CH_3 (IV)	(I)	Chain Isomers
(B)	$CH_3-\underset{\displaystyle NH_2}{\underset{|}{CH}}-CH_3$ & $CH_3-CH_2-CH_2-NH_2$ (II)	(II)	Position isomers
(C)	$CH_3CH_2CH_2CH_3$ & $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$ (I)	(III)	Metamers
(D)	$CH_3CH_2-O-CH_2CH_3$ & $CH_3-O-CH_2CH_2CH_3$ (III)	(IV)	Functional isomers

Choose the correct answer from the options given below:

A A-II, B-IV, C-III, D-I

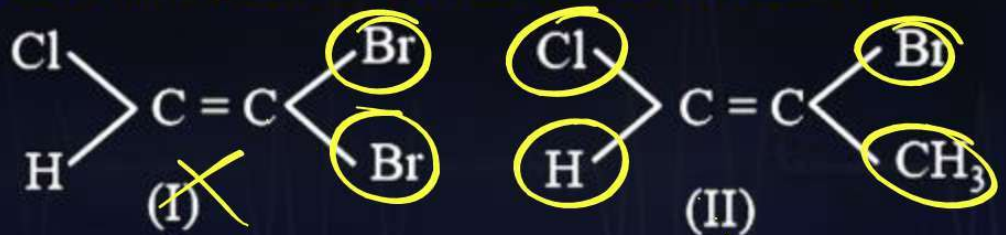
B A-II, B-IV, C-I, D-III

C A-IV, B-II, C-I, D-III

D A-IV, B-II, C-III, D-I

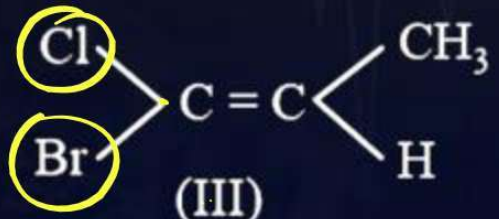
QUESTION-8

Which is a pair of geometrical isomer?

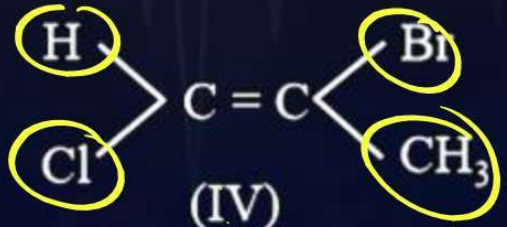


(I)

(II)



(III)



(IV)

A I and II

B I and III

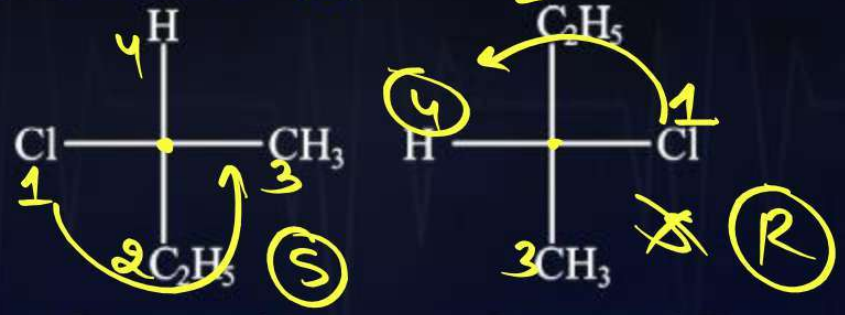
C II and IV

D III and IV

QUESTION-9

Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R):

Assertion (A):



Compound-I Compound-II

Compound-I and II are enantiomers.

Reason (R): Non superimposable mirror images are enantiomers.

In the light of the above statements, choose the correct answer from the options given below:

A Assertion (A) is true and Reason (R) is false.

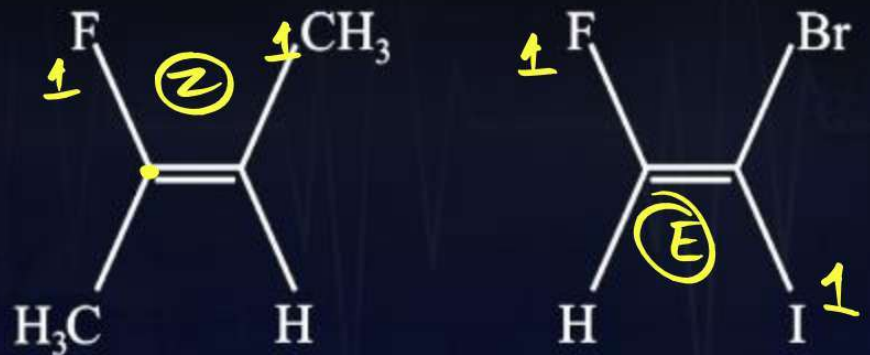
B Assertion (A) is false and Reason (R) is true.

C Both Assertion (A) and Reason (R) are true and Reason (R) is a correct explanation of Assertion (A).

D Both Assertion (A) and Reason (R) are true but Reason (R) is not a correct explanation of Assertion (A).

QUESTION-10

Identify E and Z configuration in the following compounds



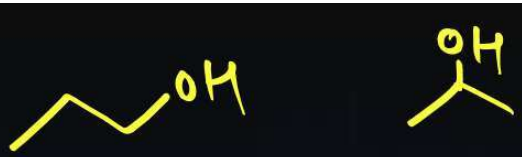
A E, E

B Z, Z

C E, Z

D Z, E

QUESTION-11



n-Propyl alcohol and isopropyl alcohols are examples of:

A position isomerism

B chain isomerism

C tautomerism

D geometrical isomerism

QUESTION-12

Compounds (A) and (B) are:

A Chain isomers

B Positional isomers

C Metamers

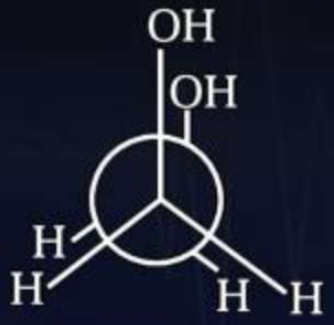
D Functional isomers

QUESTION-13

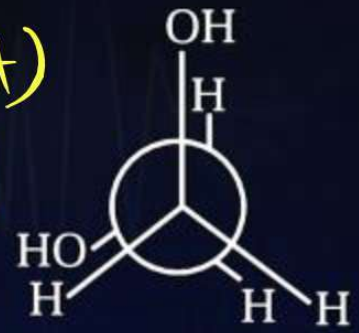
Which of the following conformers for ethylene glycol is most stable:

(C > D > B > A)

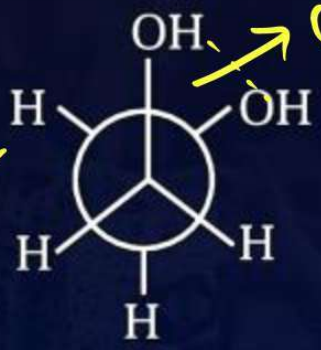
A



B

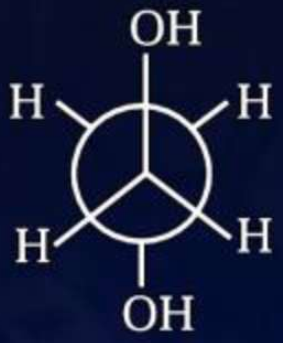


C



chelate

D



QUESTION-14

A functional isomer of but-1-yne is:

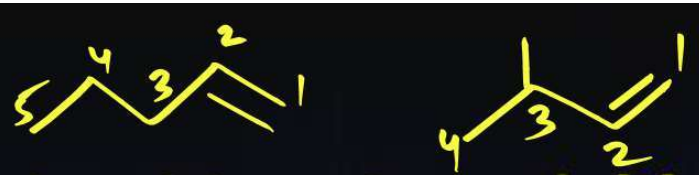
A but-2-yne

B but-1-ene

C but-2-ene

D buta-1, 3-diene DU=2

QUESTION-15



Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R):

Assertion (A): Pent-1-ene and 3-Methylbut-1-ene are chain isomers.

Reason (R): When two or more compounds have similar molecular formula but different carbon skeletons, they are referred to as chain isomers.

In the light of the above statements, choose the correct answer from the options given below:

A Assertion (A) is true and Reason (R) is false.

B Assertion (A) is false and Reason (R) is true.

C Both Assertion (A) and Reason (R) are true and Reason (R) is a correct explanation of Assertion (A).

D Both Assertion (A) and Reason (R) are true but Reason (R) is not a correct explanation of Assertion (A).

QUESTION-16

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: Alkanes having more than three carbon atoms exhibit chain isomerism.

Reason R: All carbon atoms in alkanes are sp hybridized.

In the light of the above statements, choose the correct answer from the options given below.

A Assertion (A) is true and Reason (R) is false.

B Assertion (A) is false and Reason (R) is true.

C Both Assertion (A) and Reason (R) are true and Reason (R) is a correct explanation of Assertion (A).

D Both Assertion (A) and Reason (R) are true but Reason (R) is not a correct explanation of Assertion (A).

QUESTION-17

The most stable configuration of n-butane will be:

A skew

B gauche

C eclipsed

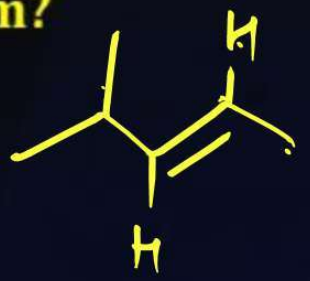
D anti

QUESTION-18

Which of the following compounds shows geometrical isomerism?

A 2-methylpent-2-ene

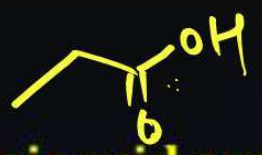
B 4-methylpent-2-ene



C 4-methylpent-1-ene

D 2-methylpent-1-ene

QUESTION-19



Isomers of propionic acid are:

A $HCOOC_2H_5$ and CH_3COOCH_3

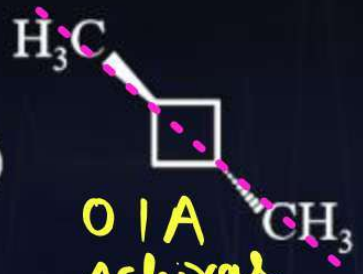
B $HCOOC_2H_5$ and C_3H_7COOH

C CH_3COOCH_3 and C_3H_7OH

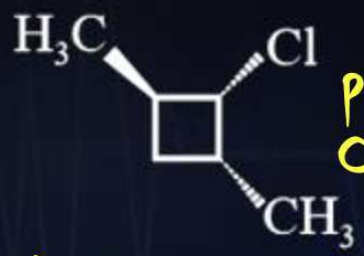
D C_3H_7OH and CH_3COCH_3

QUESTION-20

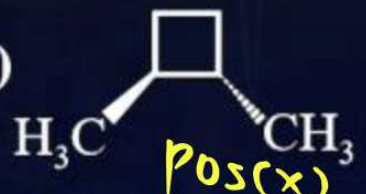
Out of the following, which are chiral?

(I) 

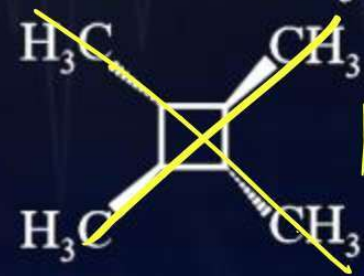
OIA
Achiral

(II) 

Pos(x)
Cos(x)
OA

(III) 

Pos(x)
Cos(x)
OA

(IV) 

Pos(v)
OIA

A I, II, III

B I, III, IV

C II, III

D II, III, IV