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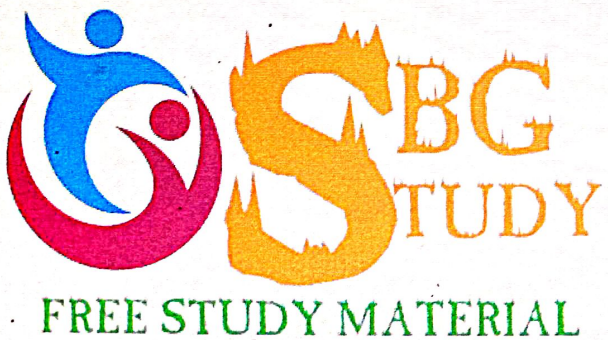
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Isomerism

Compds which have same M.F. but different property (atleast one) is c/a isomer & phenomena is c/a isomerism.

C_2H_6O CH_3-CH_2-OH liq. H-bonding $76^\circ C$ acidic H Reac ⁿ with Na $\rightarrow H_2$ Reac ⁿ with HI CH_3-CH_2-I	C_2H_6O CH_3-O-CH_3 gas X $17^\circ C$ X X CH_3-I
--	--

Classification

Structural / Constitutional Isomerism

→ structural is diff.

- C.I.
- P.I.
- F.I.
- R.C.I.
- Metamerism
- Tautomerism

Stereoisomerism

→ spatial arrangement is diff.

Configuration isomerism

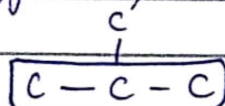
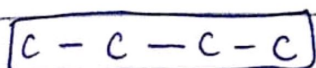
G.I.

O.I.

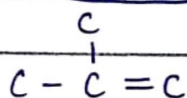
Conformational isomerism

Chain Isomerism :- compds which have same M.F but diff. size of Principal carbon chain or side chain.

Note : Nature of fg / Mb / Sb must remain same.



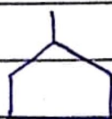
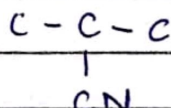
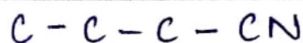
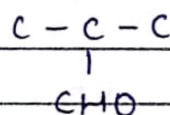
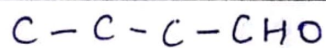
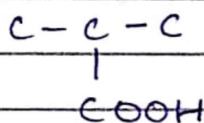
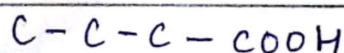
C.I. ✓



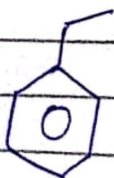
C.I. ✓



C.I. ✓



C.I.



Min. no. of C-atom req^d to show C.I.

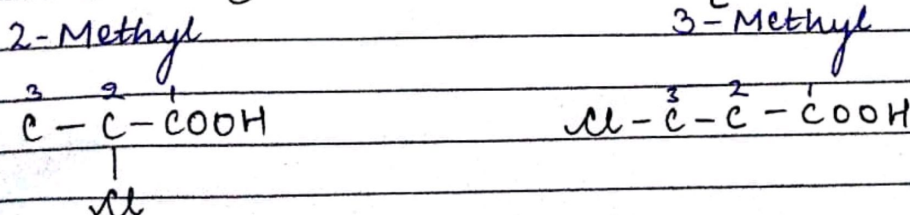
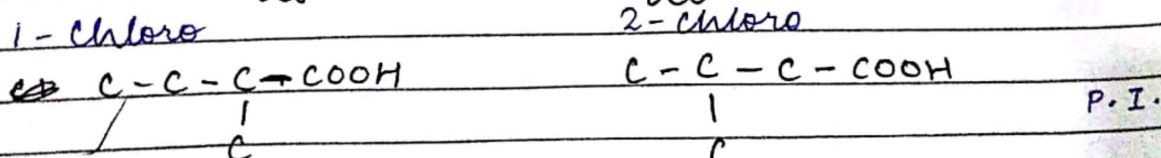
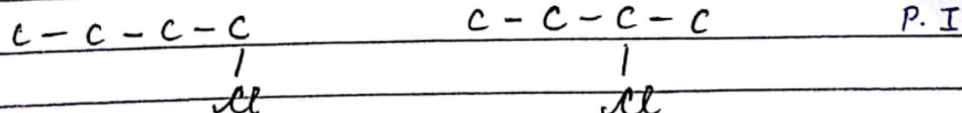
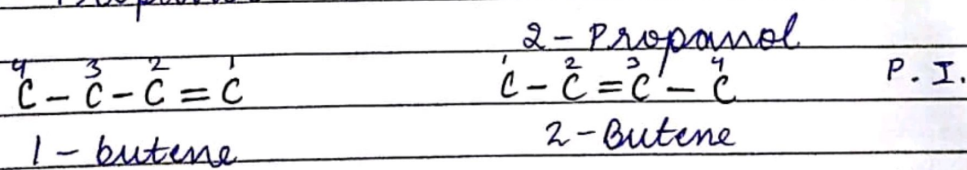
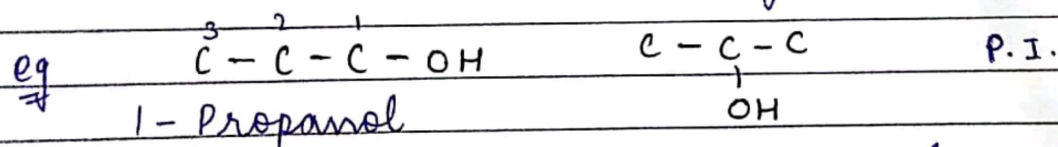
1. Alkane	4C	C-C-C-C	C-C-C-C
2. alkene	4C	C-C-C=C	C-C=C-C
3. Alkyne	5C	C-C-C-C≡C	C-C-C≡C-C
4. Alkadiene	5C	C=C-C-C=C	C=C-C=C
5. Alkenyne	5C	C=C-C-C≡C	C=C-C≡C-C
6. Alcohol	4C	C-C-C-C-OH	C-C-C-OH

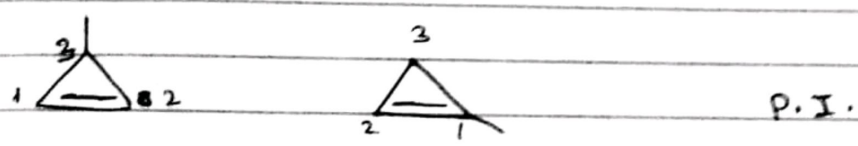
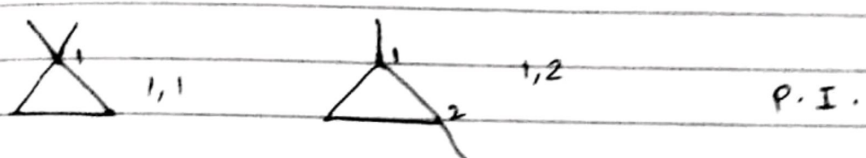
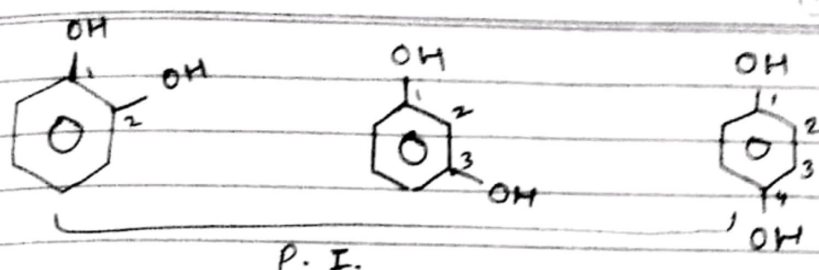
Position Isomerism: Compds which have same M.F. but diff. posⁿ of Fg / mb / sb. c/a P.I.

Note: ① Nature of Fg / mb / sb must remain same

- ② Size of PC / SC must be same

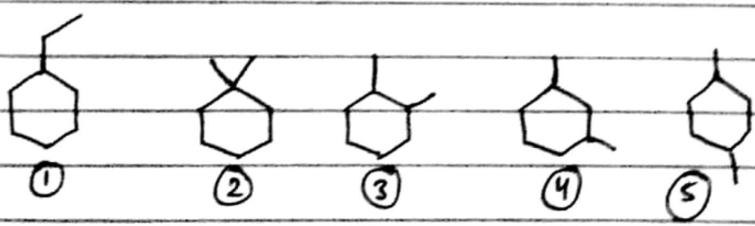
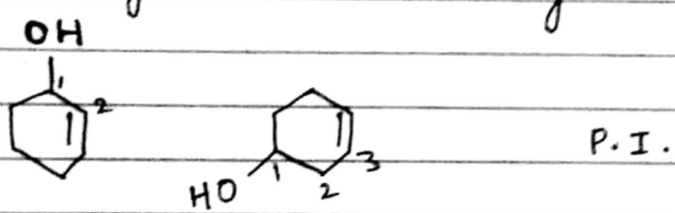
Note: C.I. & P.I. never exist together





3 - Methyl

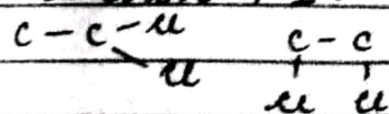
1 - Methyl



1 → is C. I. for all
2, 3
3, 4
4, 5 } P. I.

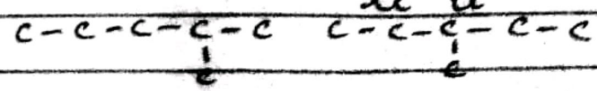
min. no. of C req^d to show P. I.

① any compd



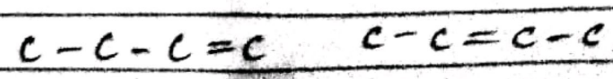
② alkane

6 C



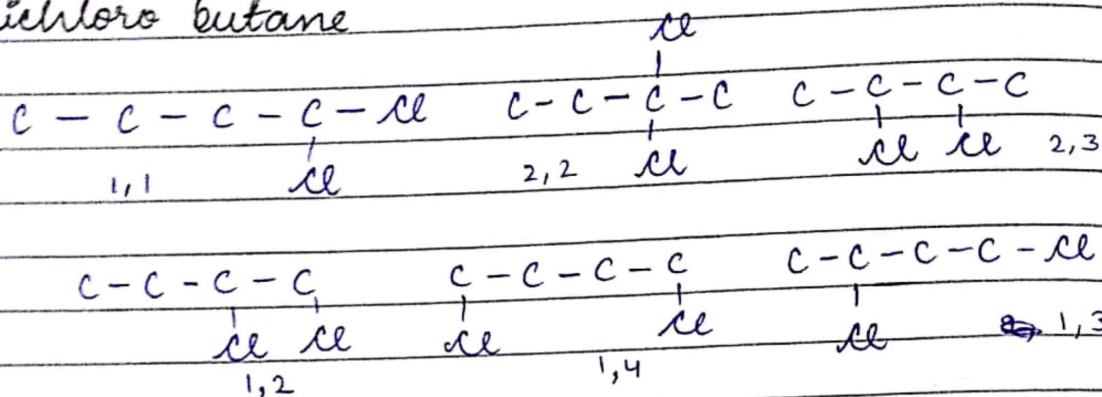
③ alkene

4 C

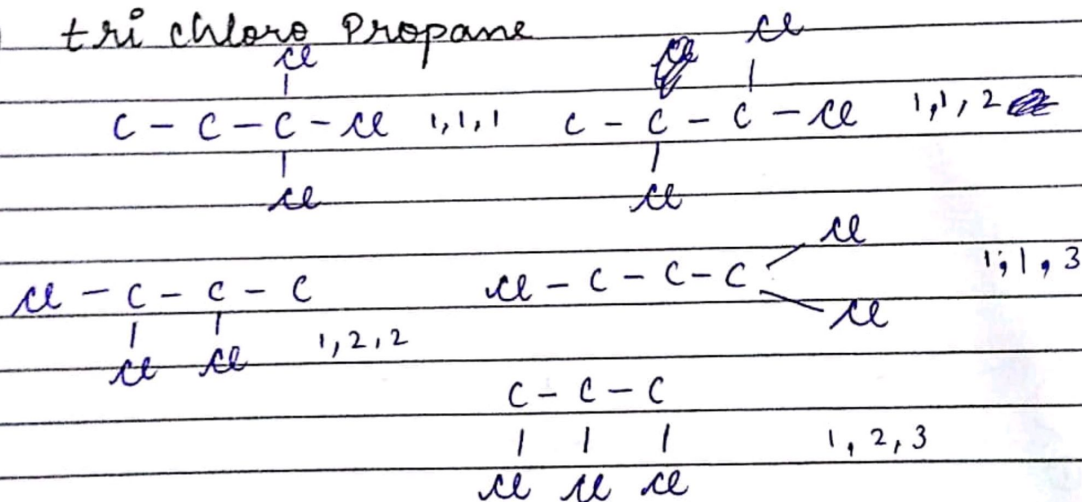


Ques Write all possible P.I. for following

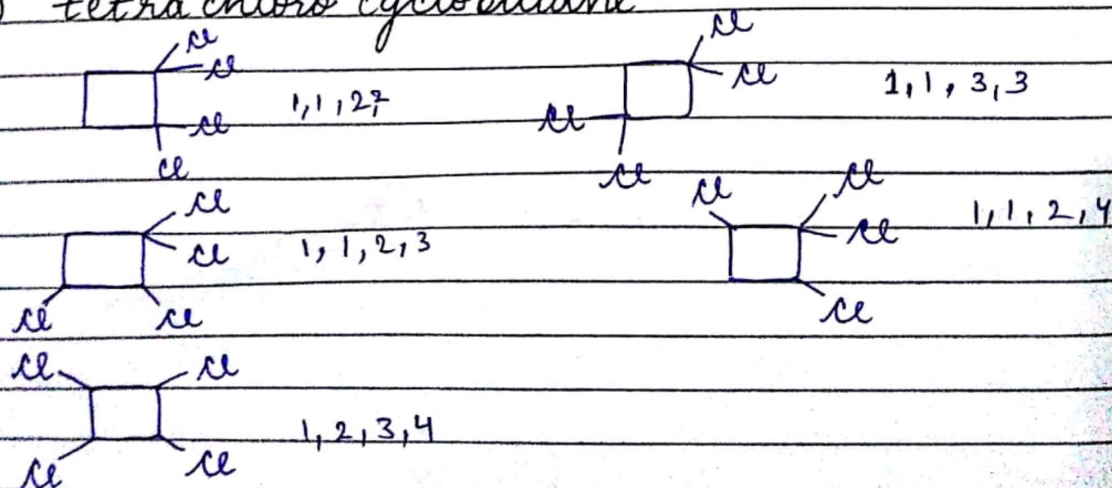
① dichloro butane



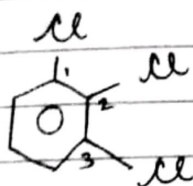
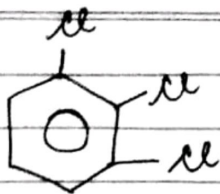
② tri chloro Propane



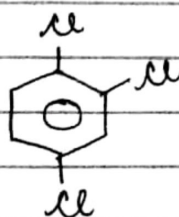
③ tetrachloro cyclobutane



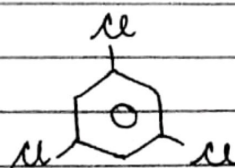
(4)



1, 2, 3



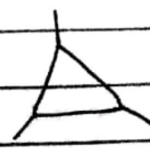
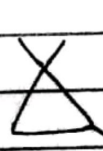
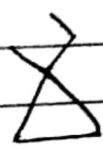
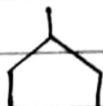
1, 2, 4



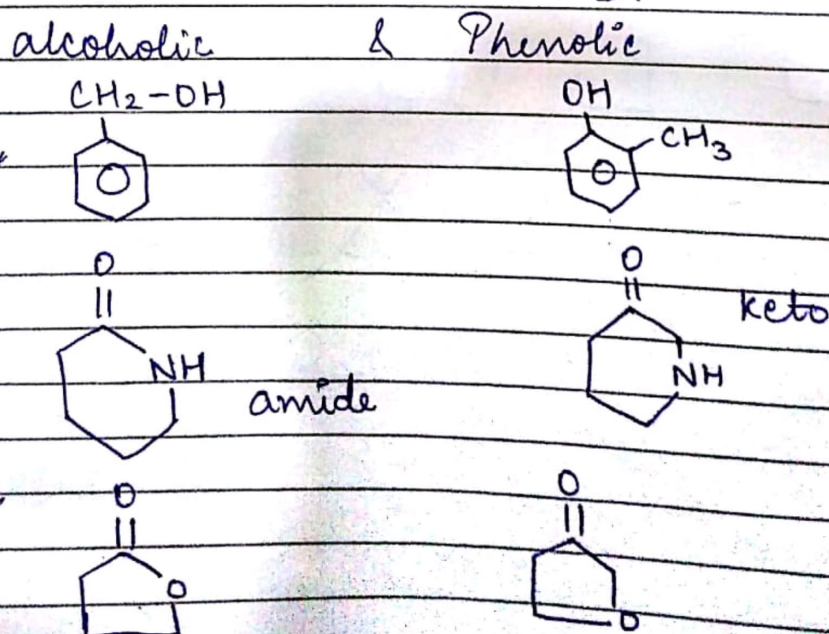
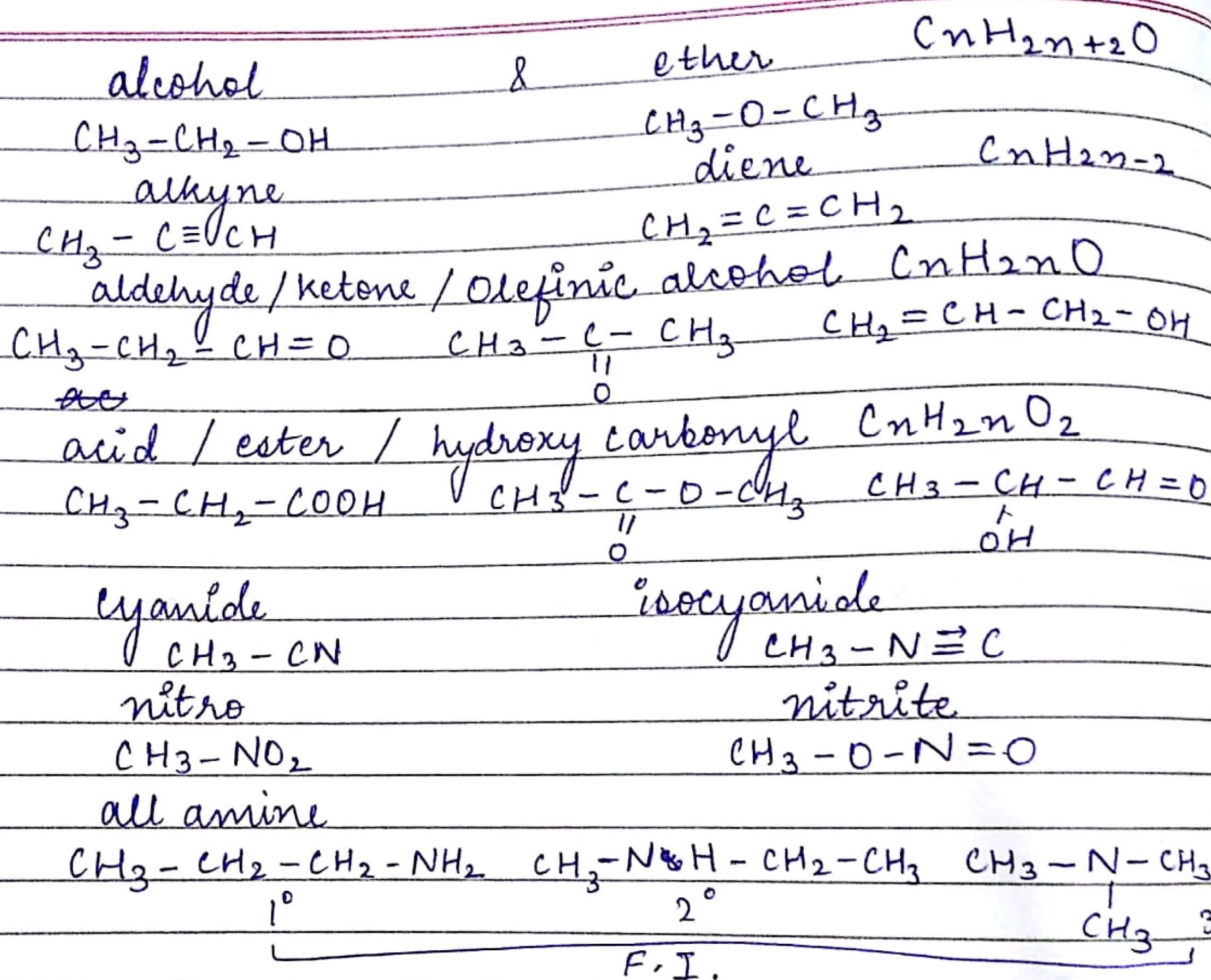
1, 3, 5

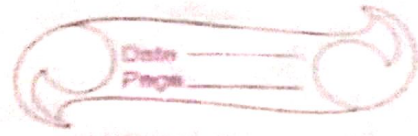
3 isomer

Ques Write all possible cyclic isomers of compd
having M.F. $\rightarrow C_6H_{12}$?



Functional Isomerism :- Compd which have same M.F.
but different functional gp.





for free

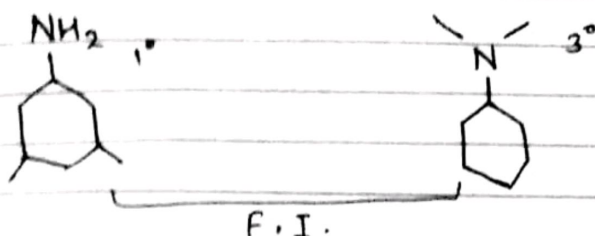
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Practice Paper, Sample Paper

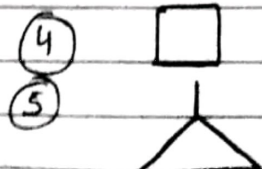
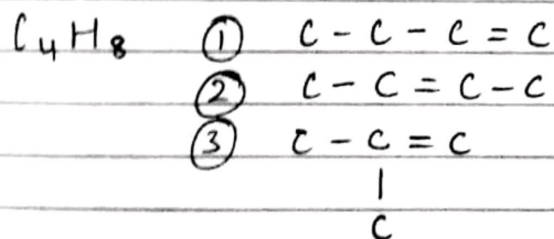
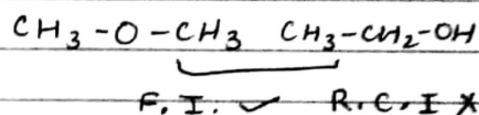
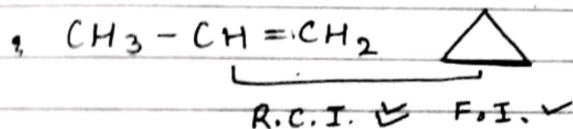


Ring chain Isomerism:- Compds which have same M.F. but exist as open chain as well as closed chain.

Note: all R.C.I. is F.I. but vice versa not true.
• Priority is given to R.C.I.

Type-I

alkene / cycloalkane C_nH_{2n}



①, ② P.I.

①, ③ C.I.

②, ③ C.I.

4 $\rightarrow$ ①, ②, ③ R.C.I.

5 $\rightarrow$ 1, 2, 3 R.C.I.

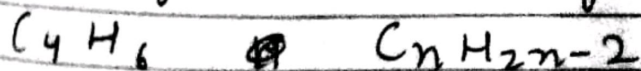
4, 5 C.I.

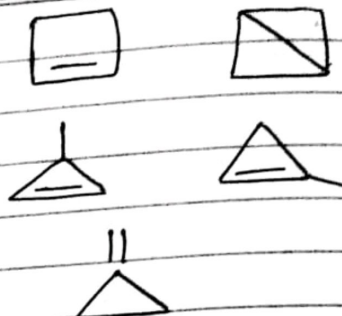
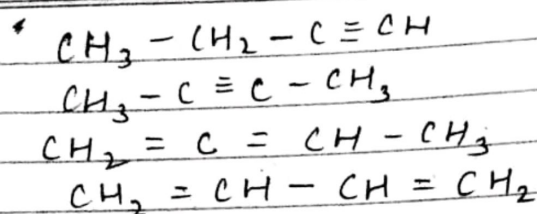
Type-2

C_nH_{2n-2}

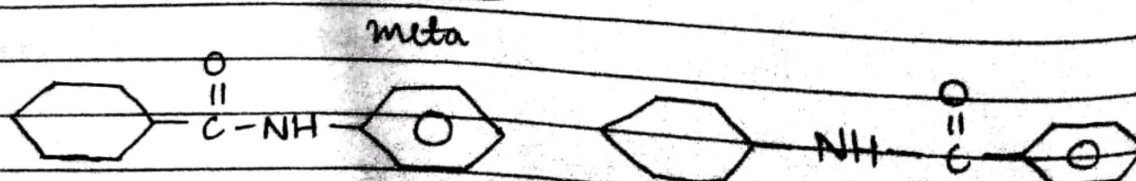
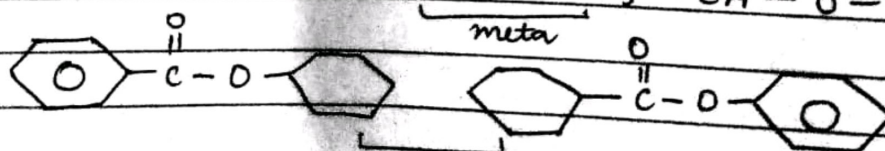
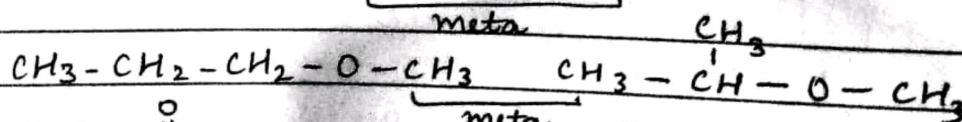
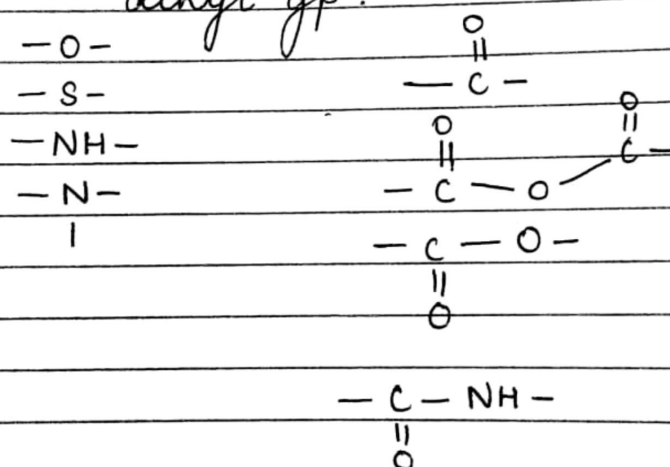
alkyne / ~~alkene~~ / cycloalkene / bicyclo / spiro

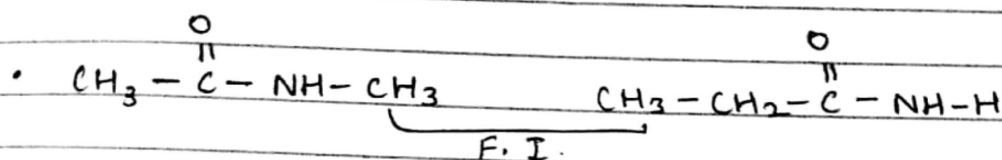
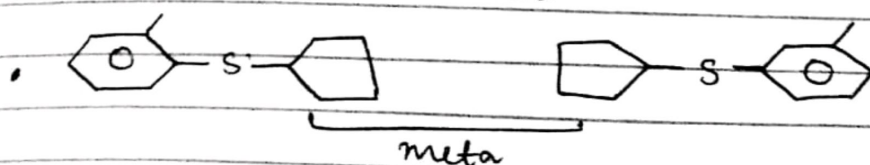
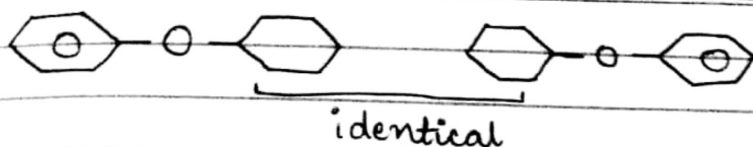
min 4c min 5c





Metamerism :- compds which have ^{same} M.F.
same polyvalent func gp but diff.
alkyl gp.



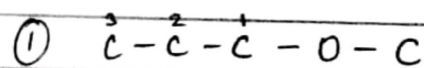


Note : F. I. & metamers do not exist together

Priority Order :

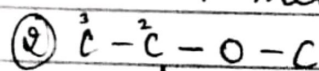
R. C. I. > tauto > F > M > C > P

Note : C. I. / P. I. can exist with metamers if no. of C-atom remain same both side



1-methoxy propane

① ② meta P.I

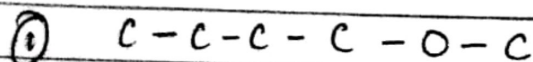
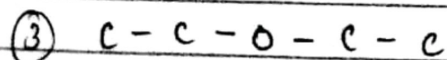


1

2-methoxy propane

2 3 Meta only

1 3 Meta only



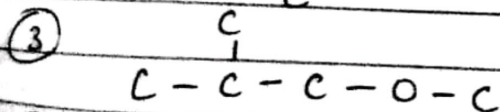
1 2 Meta P. I



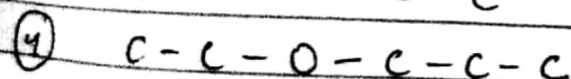
1 3 Meta & C. I

1

1, 4 Meta only



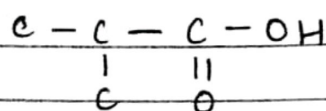
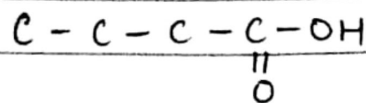
2, 3 Meta & C. I.



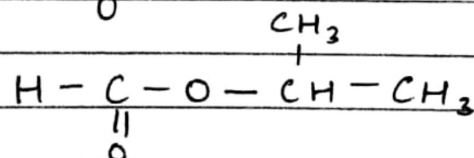
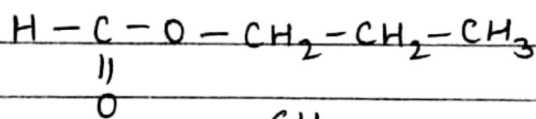
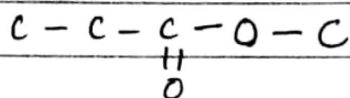
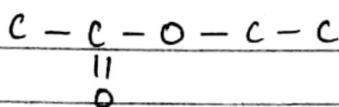
2, 4 Meta only

3, 4 Meta only

Ques Write all acid & ester isomers of comp
having M.F. $C_4H_8O_2$



acid = 2



ester = 4

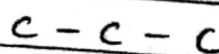
Formation of Isomers :-

Alkane: 1C $\rightarrow$ X

2C $\rightarrow$ C-C X

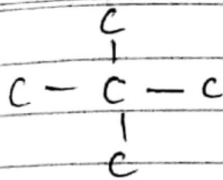
3C $\rightarrow$ C-C-C X

4C $\rightarrow$ C-C-C-C

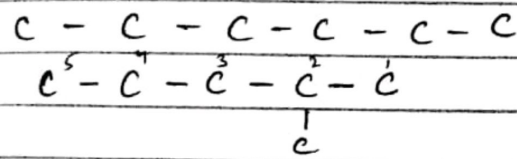


5C C-C-C-C-C



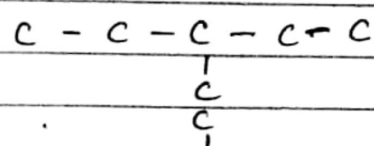


6C → 5

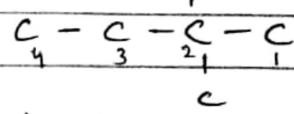


hexane

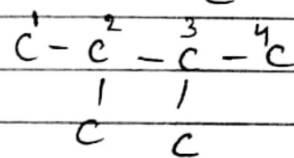
2-Methyl Pentane



3-Methyl Pentane

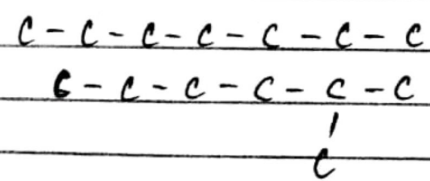


2, 2-dimethyl Pentane Butane



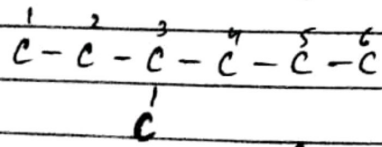
2, 3-dimethyl Butane

7C → 9

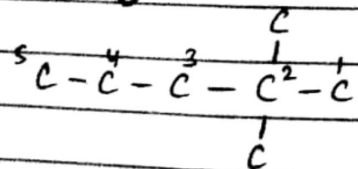


heptane

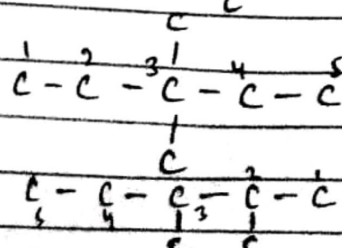
2-methyl hexane



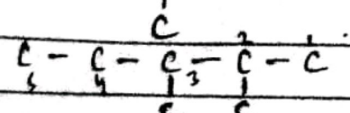
3-methyl hexane



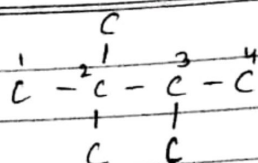
2, 2-dimethyl hexane Pentane



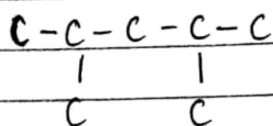
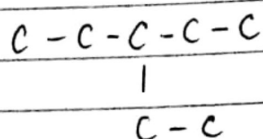
3, 3-dimethyl Pentane



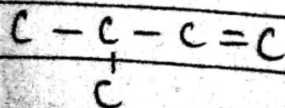
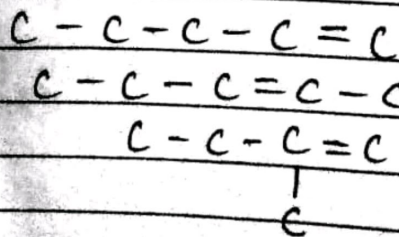
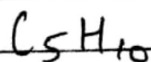
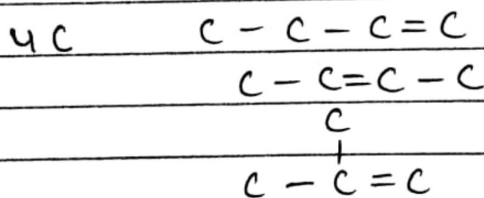
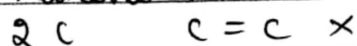
2, 3-dimethyl Pentane

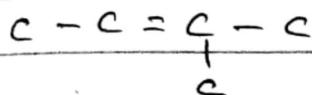


2, 2, 3 - trimethyl
Butane



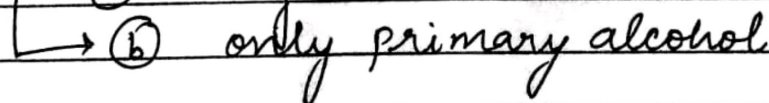
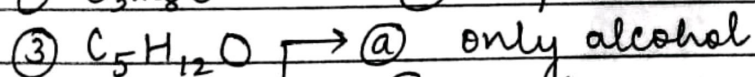
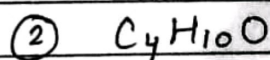
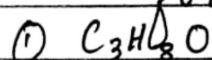
Alkene : $C_nH_{2n} \rightarrow$ cycloalkane



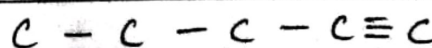
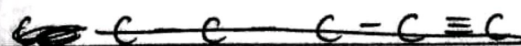
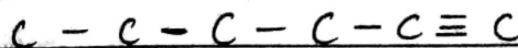


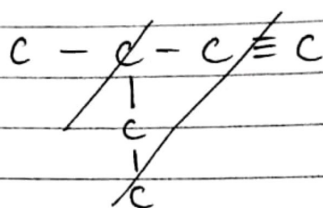
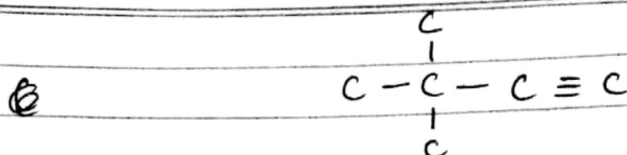
Ques write all terminal alkynes of compd having
M.F. $\rightarrow \text{C}_6\text{H}_{10}$

Ques write all possible isomer of comp. having
formula.

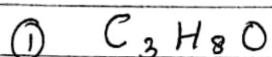


Ans 1

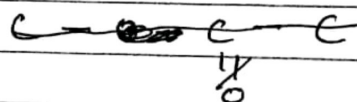
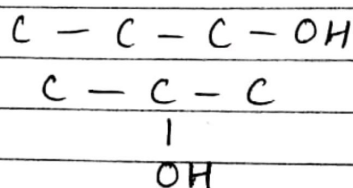




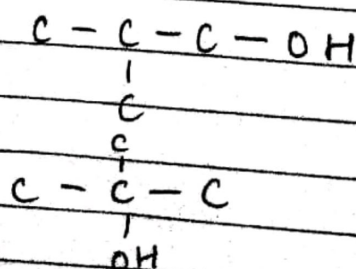
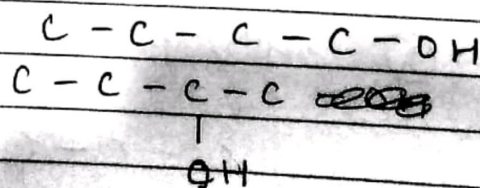
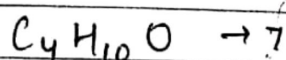
Ans 2

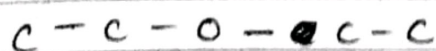
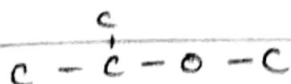
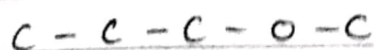


Ans

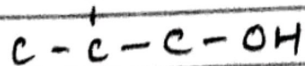
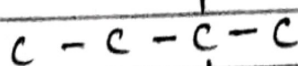
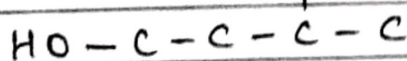
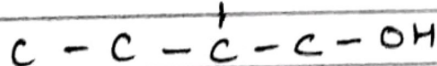
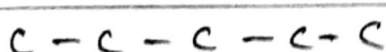
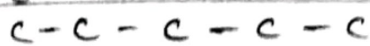


②





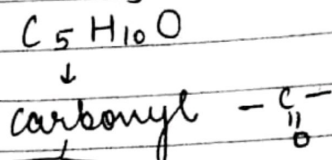
(3) $C_5H_{12}O$



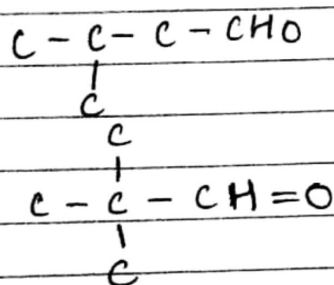
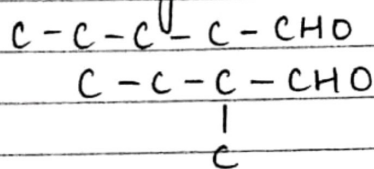
(a) $\rightarrow 8$

(b) 1° alcohol (4)

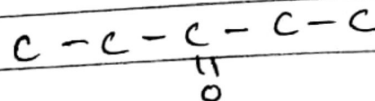
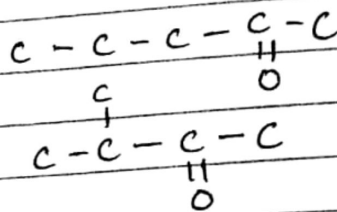
Ques Write all possible carbonyl isomers of compd
having MF $\rightarrow C_5H_{10}O$



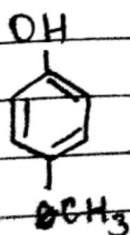
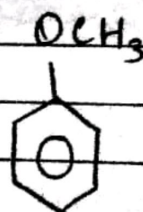
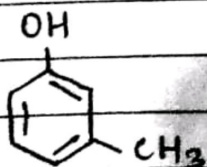
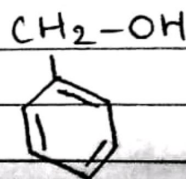
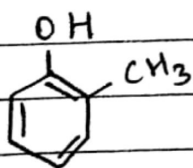
aldehyde



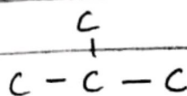
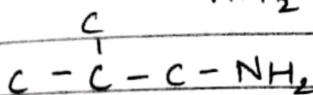
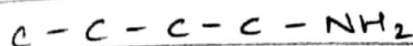
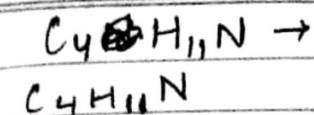
Ketone



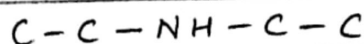
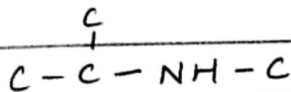
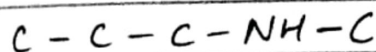
Ques



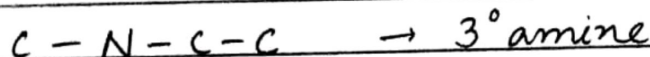
Ques



1° amine

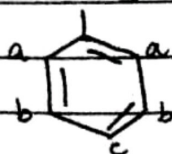
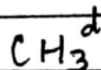


2° amine



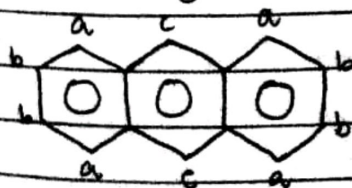
Ques How many monochloro product can be formed from following.

①



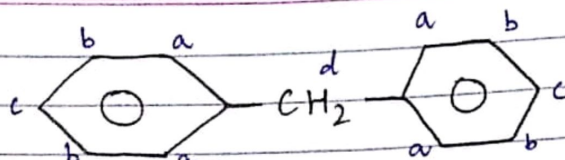
4

②



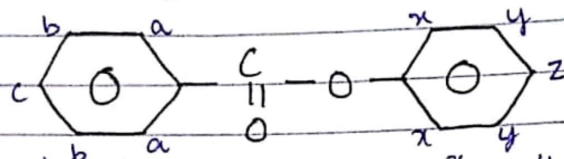
3

(3)



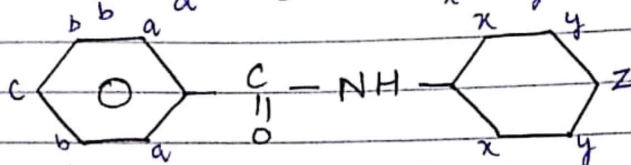
4

(4)



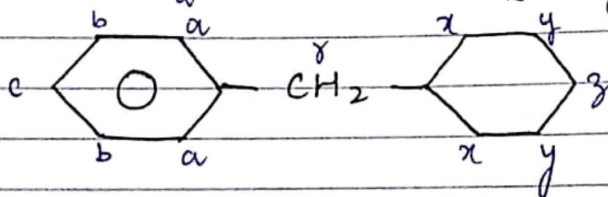
6

(5)



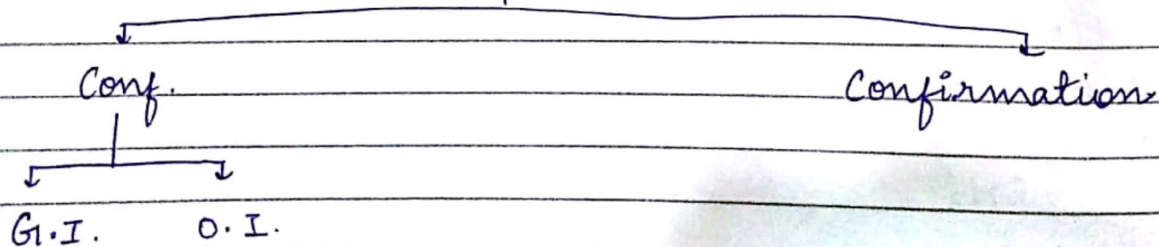
6

(6)

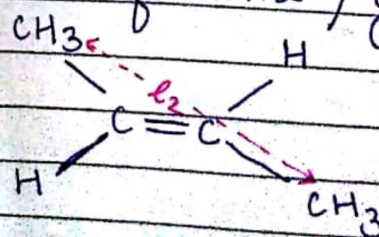
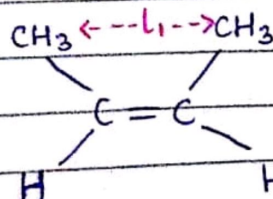


7

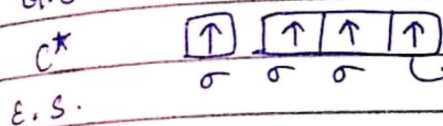
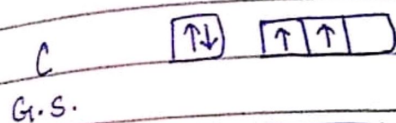
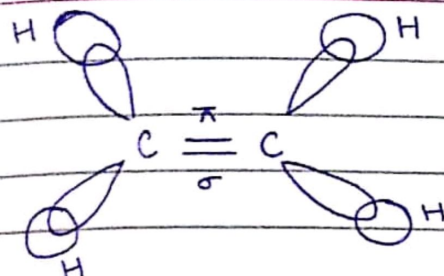
Stereoisomerism :- Compound which have same M.F., same structural formula but differ due to spatial arrangement k/n as stereoisomers & phenomena is k/n as stereoisomerism.



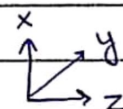
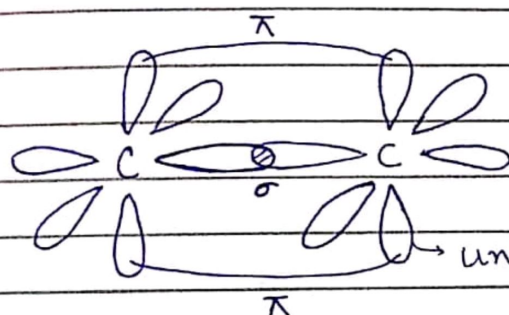
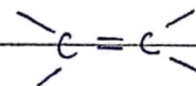
G.I. : Compds which have ^{same} M.F., same S.F. but differ due to Restricted Rotation of atoms / gps.



$l_1 \neq l_2$
diff. spatial arrangement
G.I.



unhybrid orbital

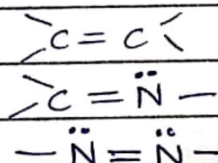


unhybrid orbital

R.R. due to π -bond

Type R.R.S.

① db



② cyclo alkane

③ cyclo alkene

④ allene

⑤ spiro

⑥ biphenyls

Condⁿ for G.I. : ① Restricted Rotation system

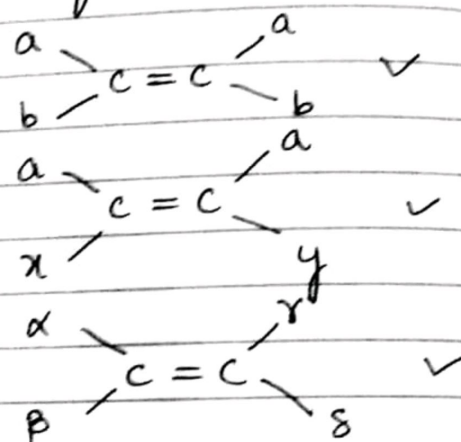
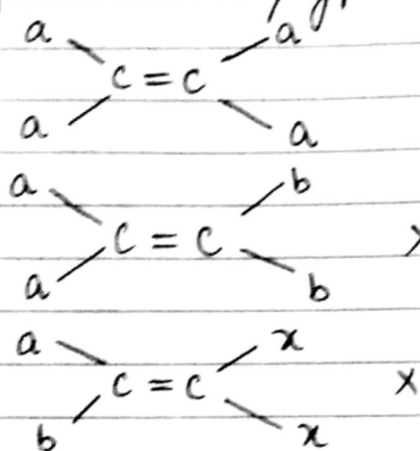
② Square Planar

③ C- attached to db must have 2 diff- gp/atoms

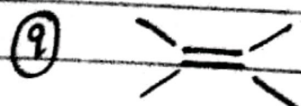
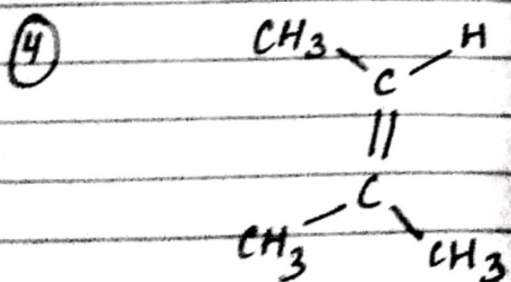
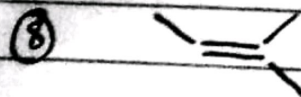
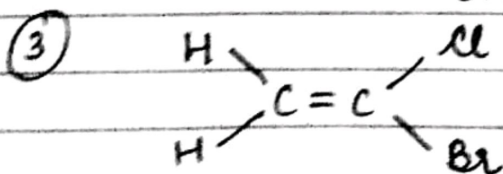
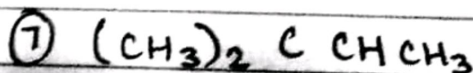
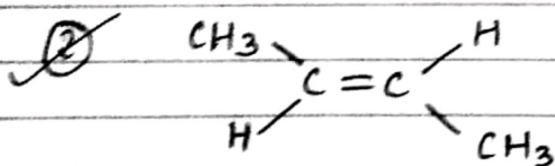
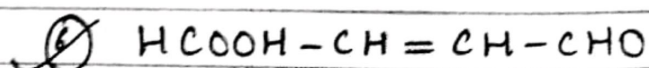
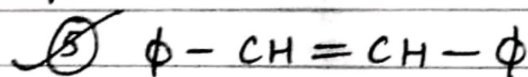
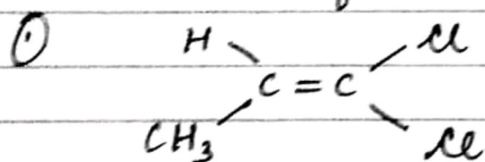
① double bond

② Alkene :-

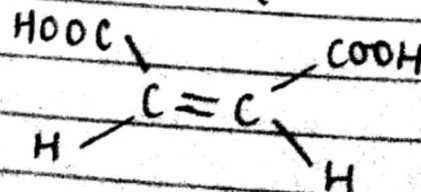
Condⁿ : Such alkene will show G.I. in which each doubled bonded C-atom is attached to different atom/gp individually.



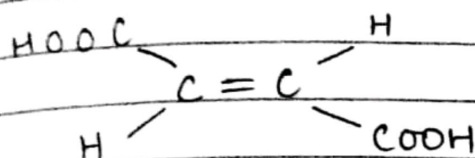
Ques which of the following will show G.I. :-



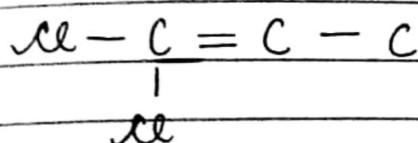
⑩ Maleic acid



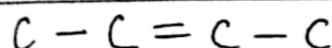
(11) Fumaric acid



(12) 1,1-dichloro propene



(13) 2-butene

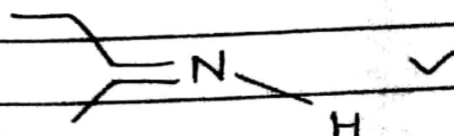
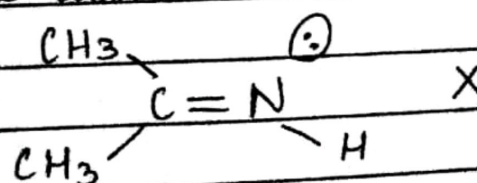
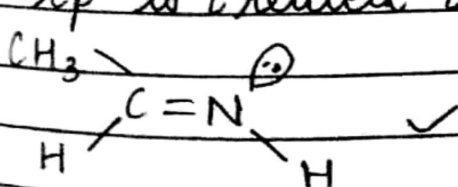


(14) 2-Propenal

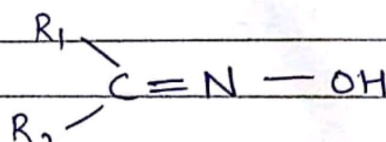
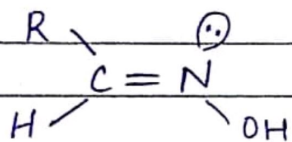
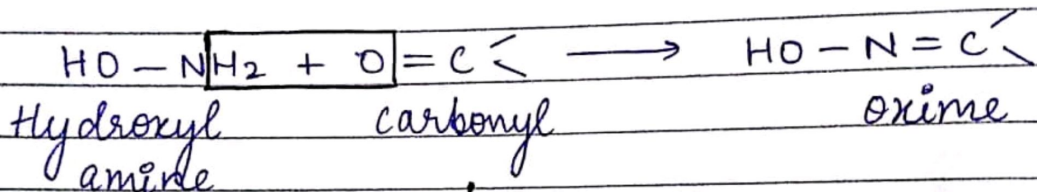
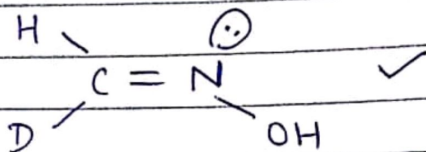
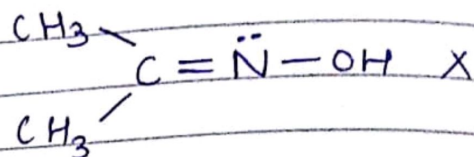
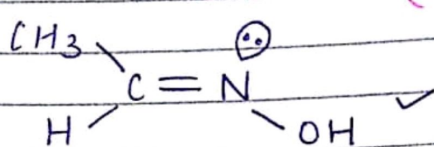


(b) imine system : $\left(\text{>C} = \ddot{\text{N}} - \text{H} \right)$

lp is treated as pseudo atom

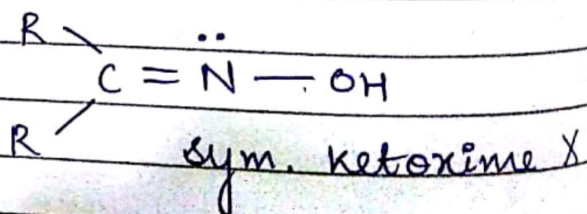
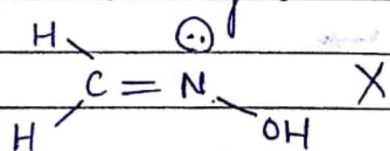


c. Oxime ($>C=N-OH$)

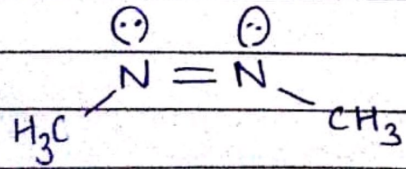
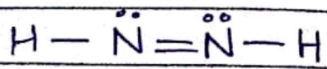


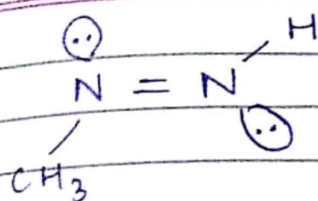
all ald oxime
will show G.I
except oxime of
formaldehyde

all unsymm. ketoxime
will show G.I.

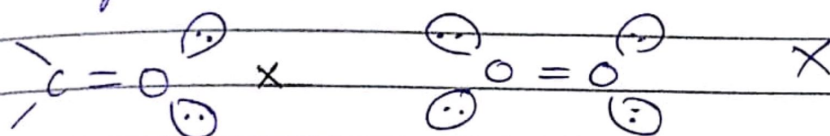


Azo compound :- ($-N=N-$)



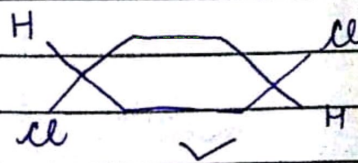
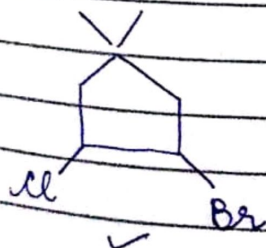
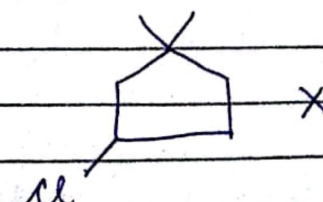
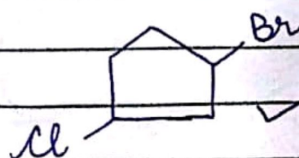
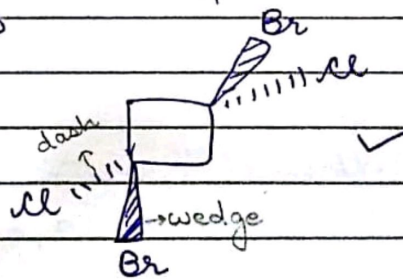
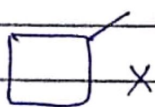
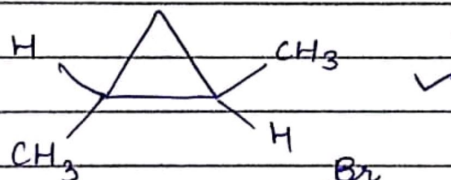
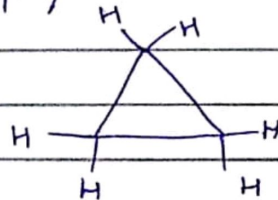


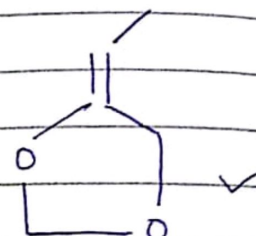
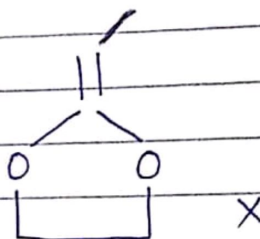
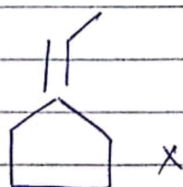
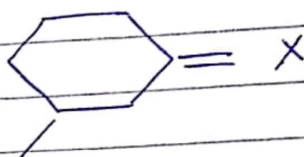
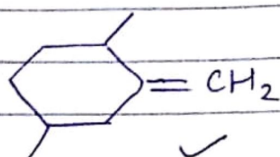
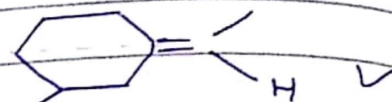
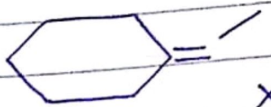
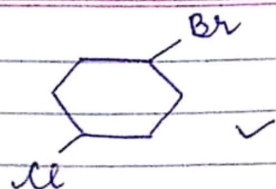
All azo compd will show G.I.



2. Cyclo Alkane :-

Condⁿ : Such cyclo alkane will show G.I. in which at least 2 C-atom have different gp / atom attached.

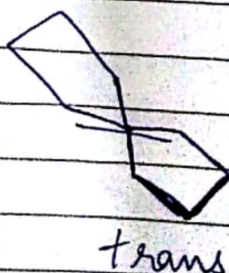
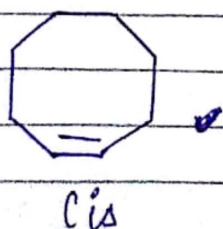
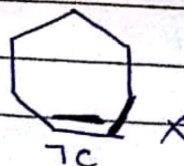
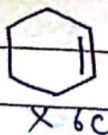
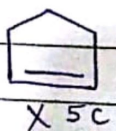
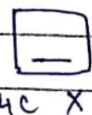
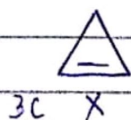


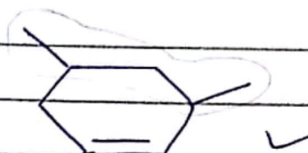
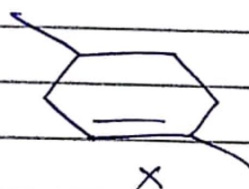
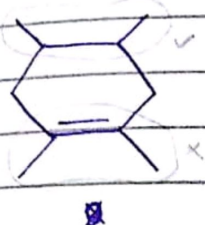
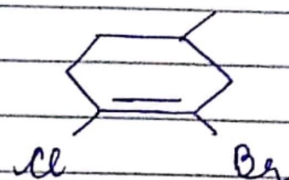
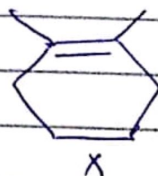


(c) Cyclo alkene :-

upto 7C member cyclo alkene do not show G.I. around db.

Cyclo alkene having more than 7C will show G.I. around db



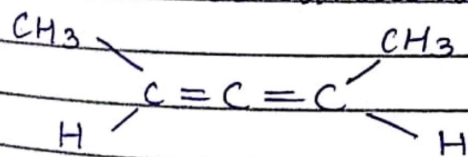


8-11 C ring cis > trans
> 11 C ring trans > cis

Note :- $R_1 - C \equiv C - R_2$
alkyne do not show G.I.
Reason → linear

Allene System :-

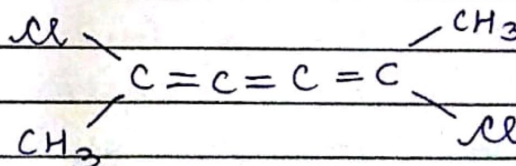
allene = continuous db + nt.



db = 2

G.I. X

Planar X



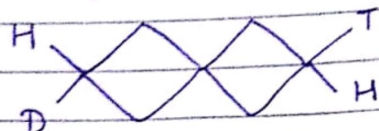
G.I. ✓

db = 3

Note : Even no. db containing allene will not show G.I.

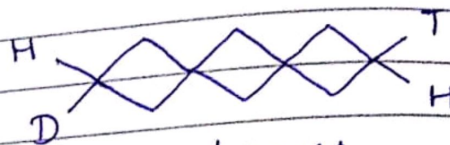
• Only odd no. db containing allene will not show G.I.

Spiro :



G.I. X

even no. ring containing
spiro comp. will not show
G.I.

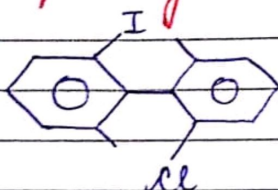


trans

G.I. ✓

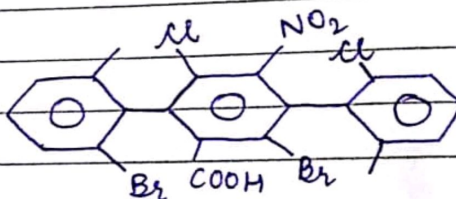
→ Odd no. ring
containing spiro
compd. will show G.I.

Biphenyls :



G.I. X

even no. benzene
ring containing
biphenyl will not
show G.I.



G.I. ✓

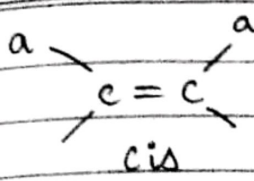
Odd no. benzene ring
containing biphenyl
will show G.I.

Nomenclature of G.I. :-

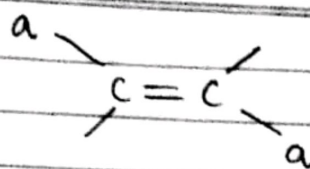
1. Cis-trans system
2. Syn-anti system
3. E-Z system

1. Cis-trans system :

Applicable when at least 2 atom/gp are +nt
in on R.R.S.

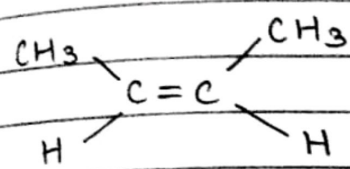


same gp on same side

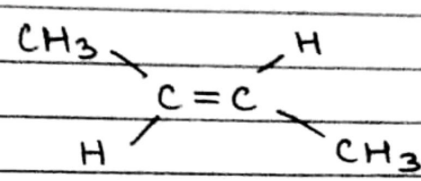


trans

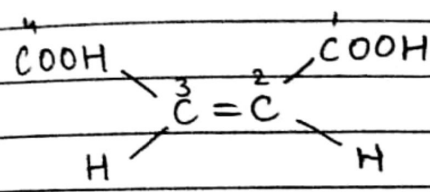
same gp on opp. side



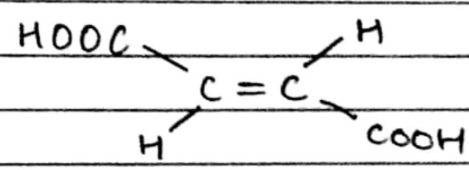
cis - 2 - butene



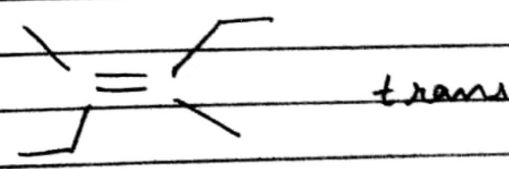
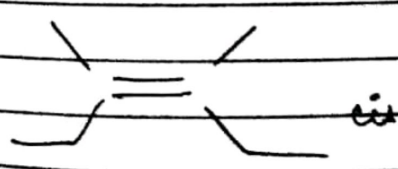
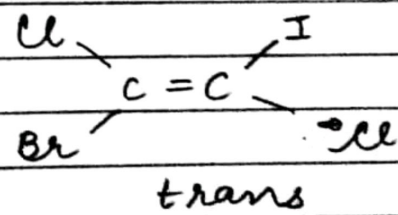
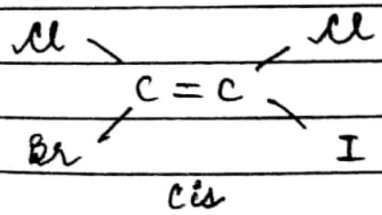
trans - 2 - butene



cis - 2 - butendioic acid
OR Maleic Acid



trans - 2 - butendioic acid
OR Fumaric Acid

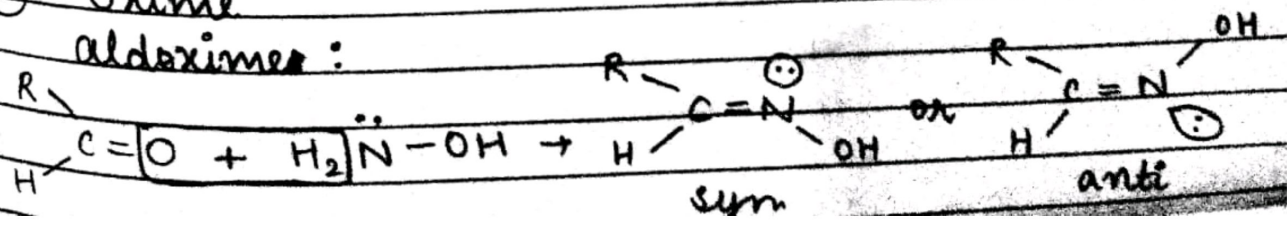


2. Syn - Anti System

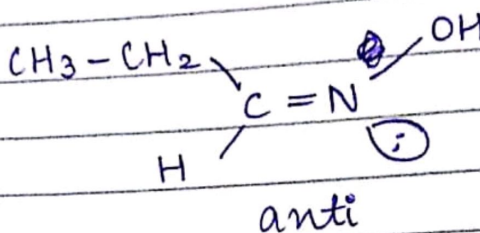
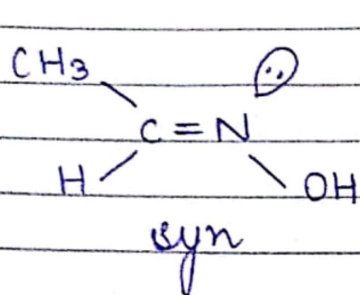
Applicable when at least one lp is +nt on RRS.

(a) Oxime

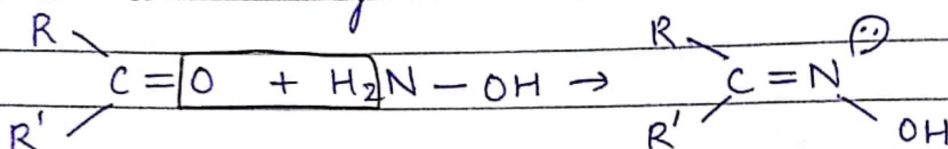
aldoximes :



Syn $\rightarrow$ when H & OH are on same side of R.R.S.
Anti $\rightarrow$ when H & OH are on opposite side of R.R.S.

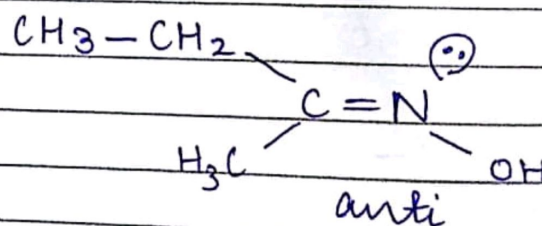
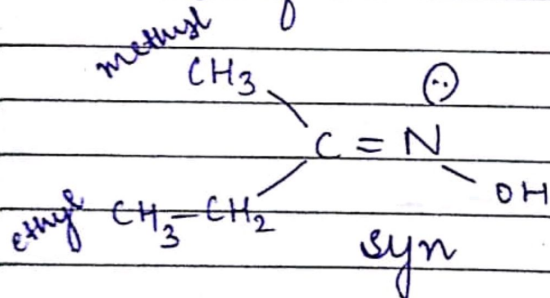


Ketoxime : Unsymm. Ketoxime will show G.I.

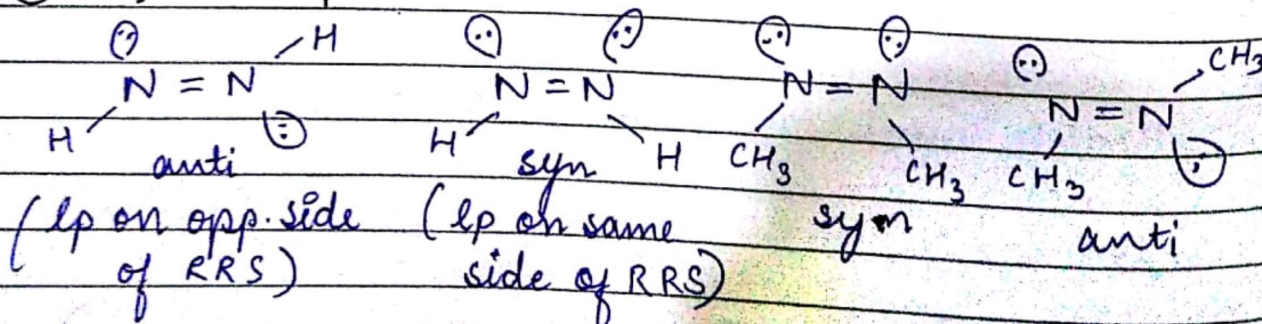


If alphabetically preferred gp & OH gp are on same side of R.R.S. $\rightarrow$ syn

If alphabetically preferred gp & OH gp are on opposite side of R.R.S. $\rightarrow$ anti



(b) Azo compound :-



3. E-Z System :- Latest Rule

Applicable when all 4 different atom/gp are attached to R.R.S.

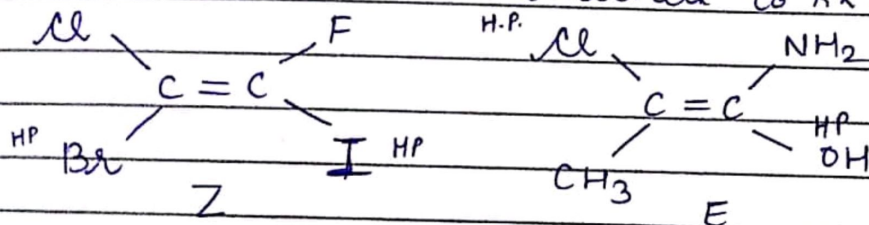
CIP Rule :- Chann. Ingold. Prelong
Zusammen $\rightarrow$ Z

Entgegen $\rightarrow$ E

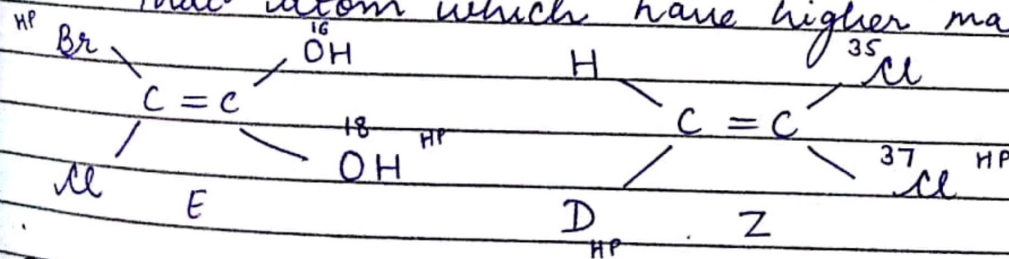
When Higher Priority (H.P.) gp/atom are on same side of RRS $\rightarrow$ Z

When Higher Priority (H.P.) gp/atom are on opp. side of RRS $\rightarrow$ E

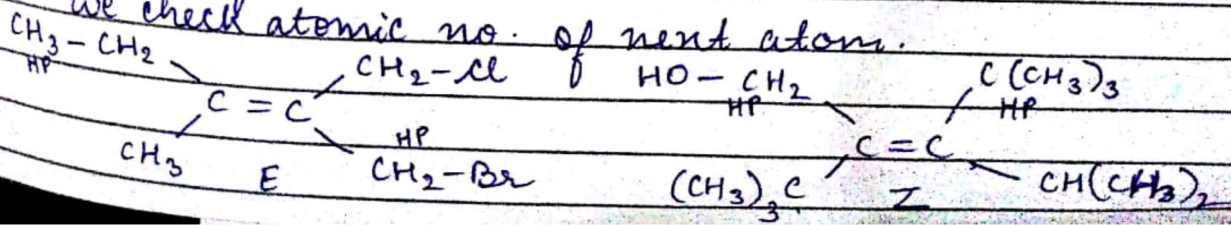
Rule-I Priority Order $\propto$ atomic no. of atom directly attached to RRS.

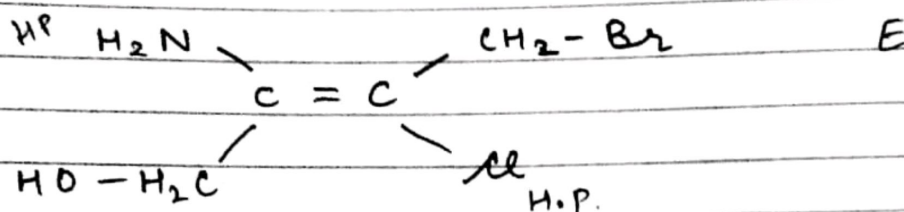
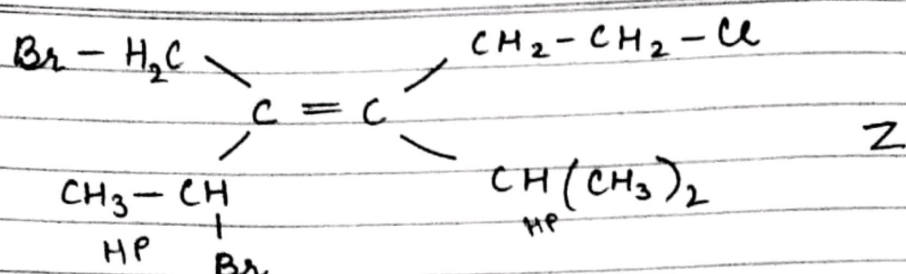


Rule-II If atomic no. is same then priority is given that atom which have higher mass no.

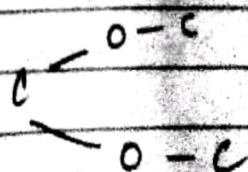
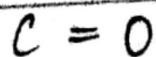
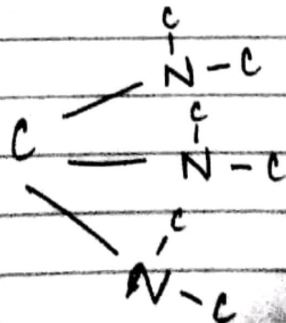
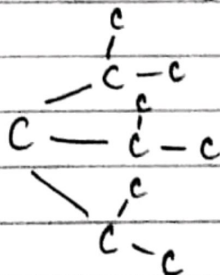
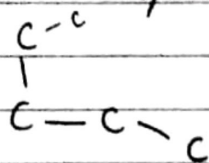
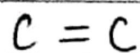


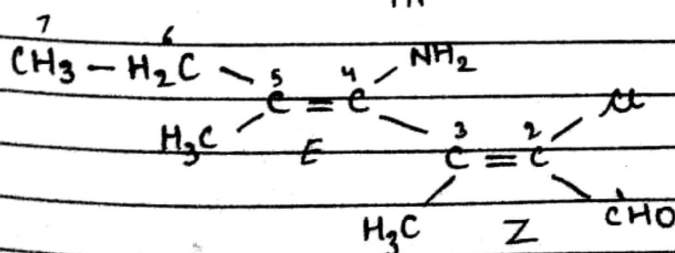
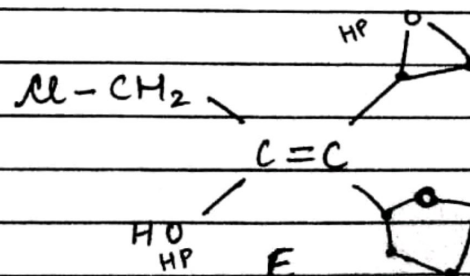
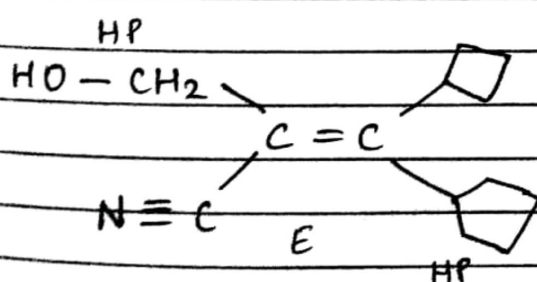
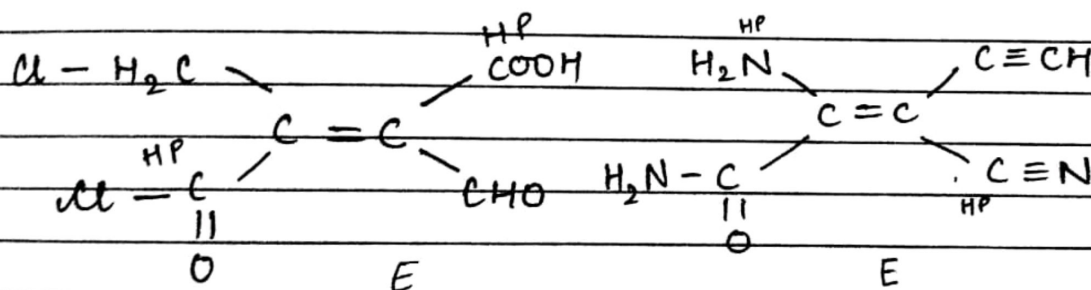
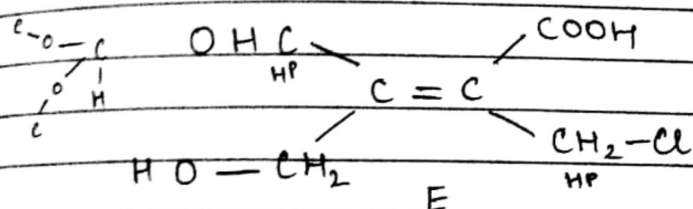
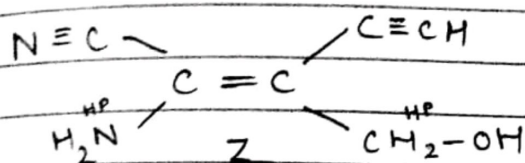
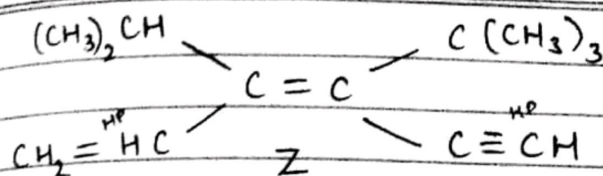
Rule-III If atomic no. & mass no. are same then we check atomic no. of next atom.





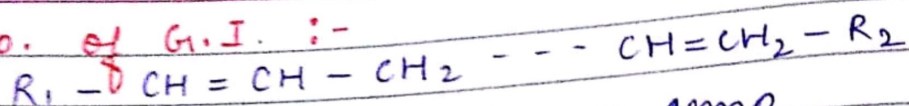
Rule-IV If multiple bond is +nt





(2Z, 4E) - 4 amine - 2-chloro - 3, 5-dimethyl hepta - 2, 4 dienal

No. of G.I. :-



If $R_1 \neq R_2$ unsymm. comp

$$\text{no. of G.I.} = 2^n$$

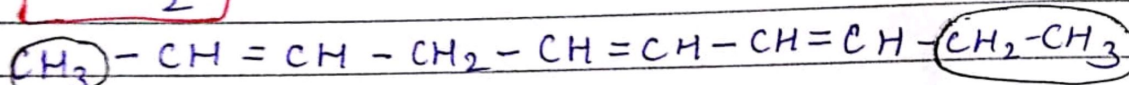
$n \rightarrow$ no. of site which show G.I.

If $R_1 = R_2$ sym. comp.

$$\text{no. of G.I.} = 2^{n-1} + 2^{p-1}$$

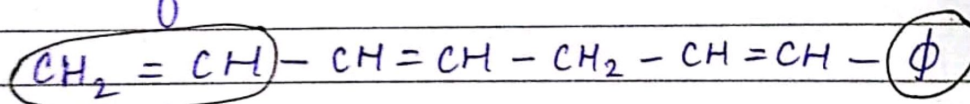
$$P = \frac{n}{2} \quad \text{when } n \text{ is even}$$

$$P = \frac{n+1}{2} \quad \text{when } n \text{ is odd}$$

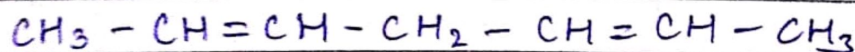


$R_1 \neq R_2$ unsym

$$\text{no. of G.I.} = 2^3 = 8$$



$$R_1 \neq R_2 \quad \text{no. of G.I.} = 2^2 = 4$$



$R_1 = R_2$ sym. $n = 2$ even

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

$$\text{G.I.} = 2^{2-1} + 2^{1-1} = 2^1 + 2^0 = 3$$

For free

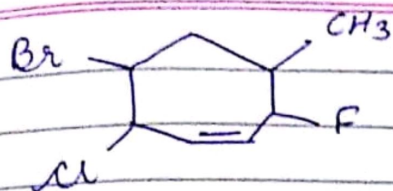
study material.

Visit :- www.sbgstudy.com

SBGStudy.com

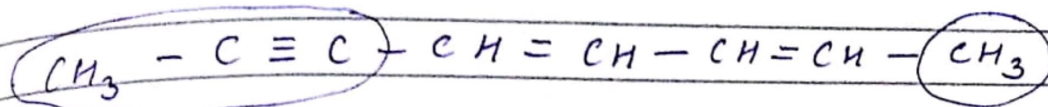
Notes, Papers, Syllabus

Practice Paper, Sample Paper

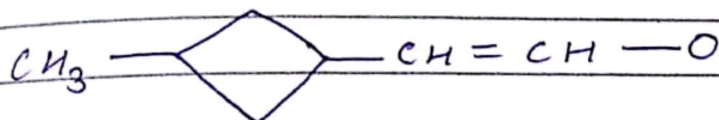


unsym

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



$$2^2 = 4$$



$$n = 2$$

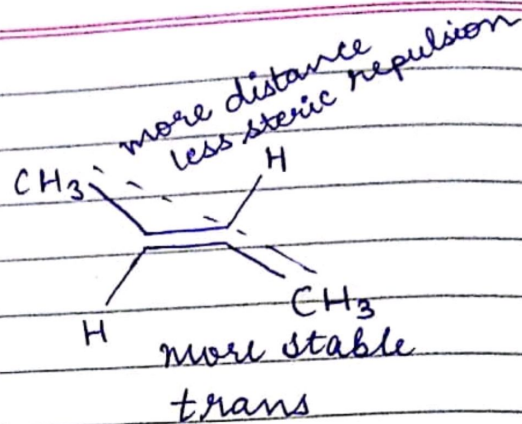
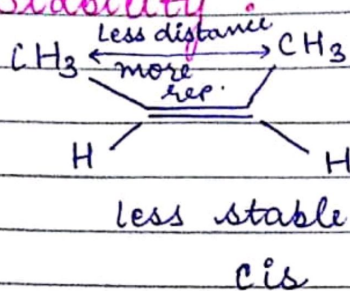
unsym

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

$$G.I. = 2^{2-1} + 2^{1-1} = 3$$

Properties of G.I. :-

1. Stability :-



2. Dipole moment (μ) :-

$$\mu = q \cdot d$$

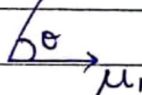
Unit : Debye or C.m

$q \rightarrow$ Charge on ion

$d \rightarrow$ dist. b/w cations & anion

$\mu \rightarrow$ dipole moment (vector quantity)

μ_1
 μ_2



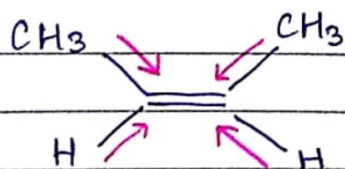
$$\mu_R = \sqrt{\mu_1^2 + \mu_2^2 + 2\mu_1\mu_2\cos\theta}$$

$$\theta = 0^\circ \quad \cos\theta = 1$$

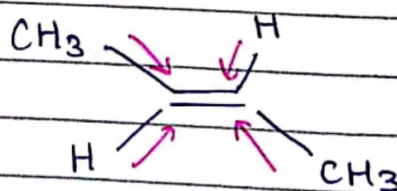
$$(\mu_R)_{\max} = \mu_1 + \mu_2$$

$$\theta = 180^\circ \quad \cos\theta = -1$$

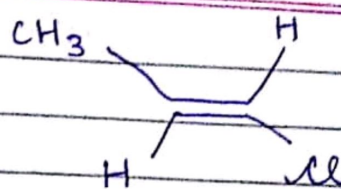
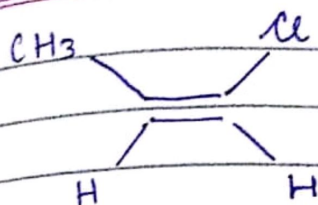
$$(\mu_R)_{\min} = \mu_1 - \mu_2$$



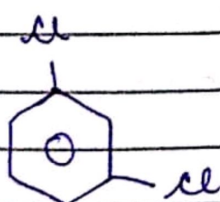
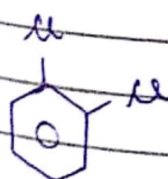
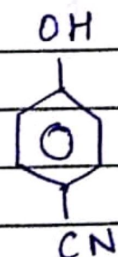
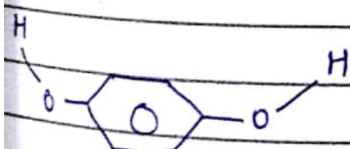
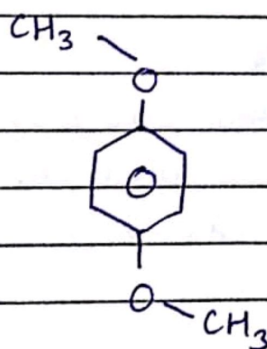
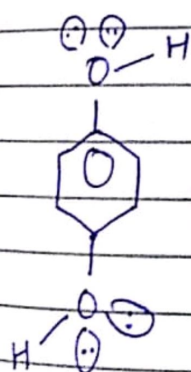
generally

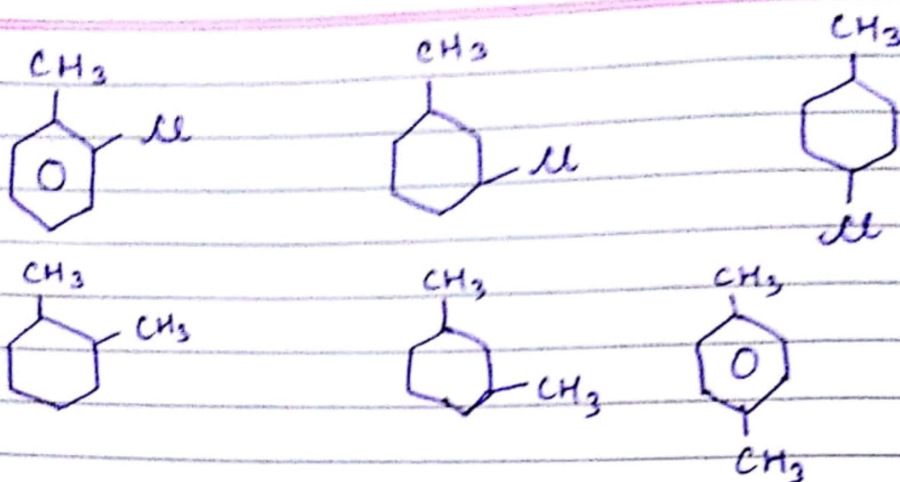


cis > trans



Cis < trans





Solubility
 $\text{Solubility} \propto \text{Polarity} \propto \mu$
 $\mu_{\text{cis}} > \mu_{\text{trans}}$
 $\text{Solubility cis} > \text{trans}$

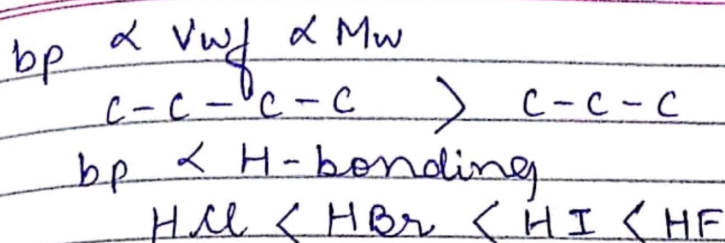
"Like dissolve like"
 cis isomers are more soluble in polar solvent like water & trans isomer are more soluble in non polar solvent like benzene, CCl_4 , CS_2

M.P.

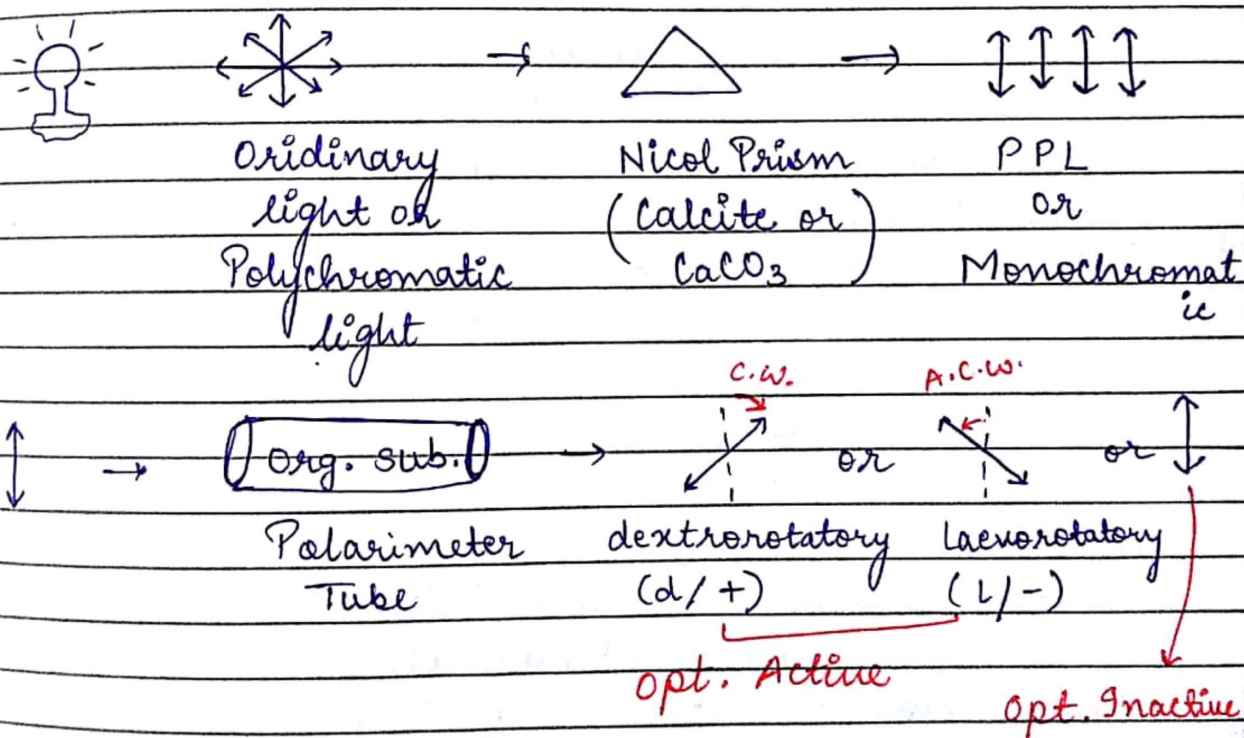
M.P. $\propto$ Symmetry of molecule
 $\text{trans} > \text{cis}$
 $\text{Cl-Cl} < \text{H-Cl}$

B.P.

B.P. $\propto$ Polarity $\propto \mu$
 generally bp $\rightarrow$ cis $>$ trans



Optical Isomerism: Those compd. which have same M.F. & same structure but different behaviour towards plane polarised light (PPL)
e/a Optical Isomers & phenomena is e/a optical Isomerism.



Magnitude of Rotation of PPL depends upon :-

- ① Nature of org. Sub.
- ② Conc. of org. sub. in solⁿ
- ③ Nature of solvent

- ④ Length & cross-section of polarimeter tube.
- ⑤ Wavelength of light.
- ⑥ Exp. temp.

Some imp. definitions

1. **Optical Activity** :- Tendency to rotate P.P.L.
2. **Opt. Active compd.** :- Those compd which rotate P.P.L.
3. **Opt. Inactive compd.** :- Those compd which cannot rotate P.P.L.
4. **Chiral Molecule** :- Unsymmetrical compds. are c/a chiral molecule.
• Chiral Molecule have ^{non} superimposable ~~super~~ mirror image.

Note : Chiral Molecules are optically active molecule.

P	q
S	Z
B	8
E	3

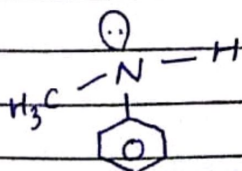
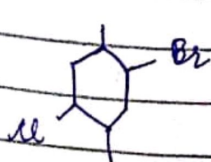
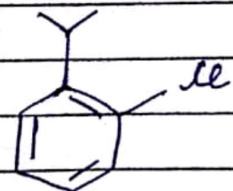
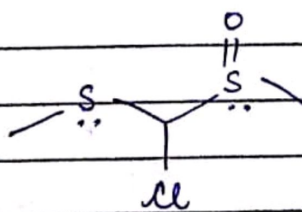
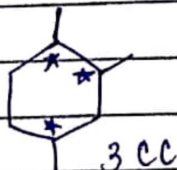
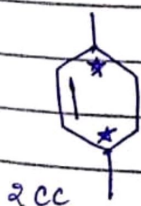
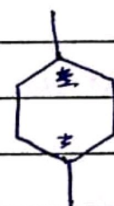
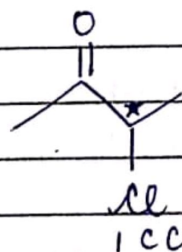
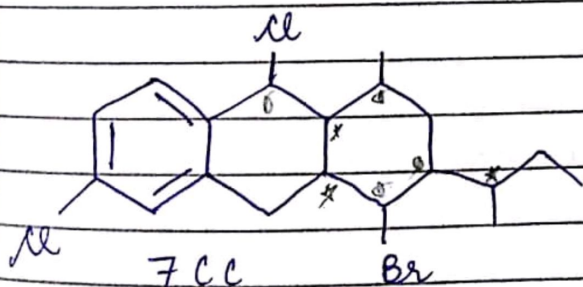
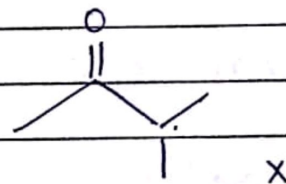
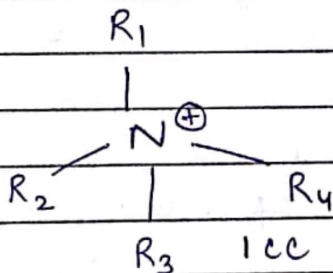
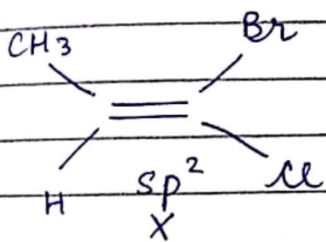
Achiral Molecule :- Symmetrical molecule are c/a achiral molecule.

- Achiral molecule have superimposable ~~mirror~~ mirror image

A	A
O	O
U	U
V	V

Note : Achiral molecules are optically inactive molecule.

Note: Chiral centre is ^{not} necessary condⁿ for optical activity.



18/12/17

PAGE NO.: 41
DATE: / /

Condⁿ for Optical Activity :-

1. A molecule is optically active if it is chiral or unsymmetrical.

OR

It has non-superimposable mirror image.

Ques which is a unsymmetrical molecule / compd?

① = A molecule in which element of symmetry is absent

Element of Symmetry :-

1. Centre of Symmetry (C.O.S.) ✓
2. Plane of Symmetry (P.O.S.) ✓
3. Axis of Symmetry (A.O.S.) ✗

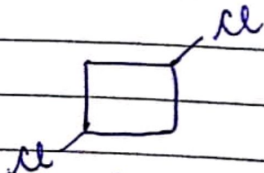
Note: A molecule to be optically Active does not have C.O.S. and P.O.S.

1. Centre of Symmetry (C.O.S.)

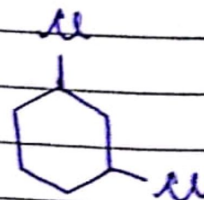
An imaginary point or centre from which at equal distances in opposite dirⁿ same atom or group is present.



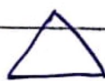
C.O.S. ✓



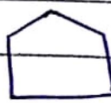
C.O.S. ✓



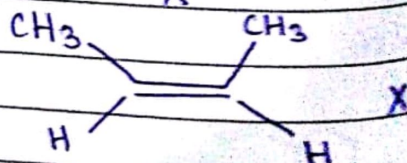
✗



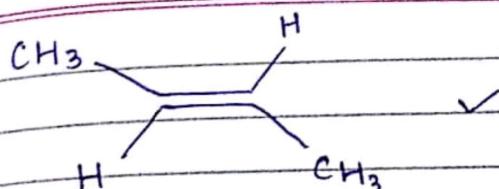
✗



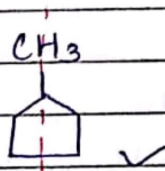
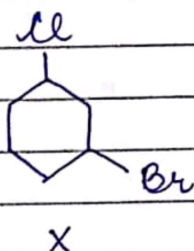
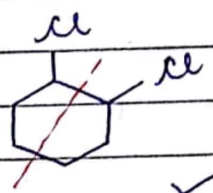
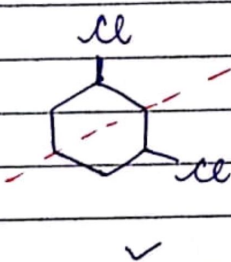
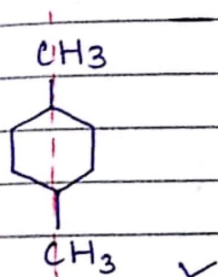
✗



✗



2. Plane of Symmetry (P.O.S.): An imaginary plane which divide molecule into 2 equal parts.



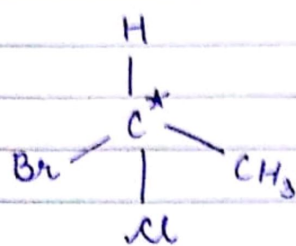
How to check optical Activity?
3 Possibility.

molecule having
1 C.C.
always opt.
active

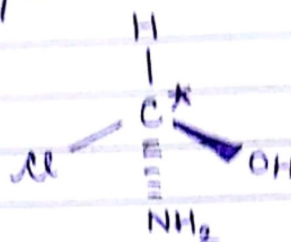
molecule having
more than 1 C.C.
→ may be opt.
active or not
→ molecule is opt.
active if it is
unsymm.

molecule having
no C.C.
→ may be opt. active
or not.
→ molecule is opt.
active if it is
unsymm.

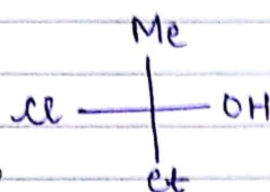
Type-1 Molecule having 1 C.C. ↳ always opt. active



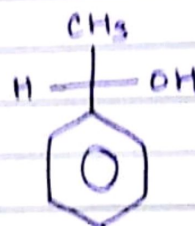
1 C.C.
O.A. ✓



1 C.C.
O.A. ✓



1 C.C.
O.A. ✓

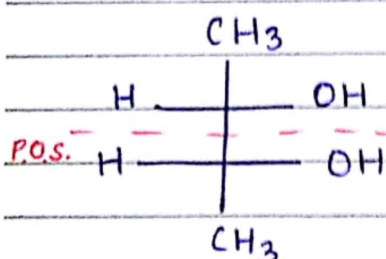


1 C.C.
O.A. ✓

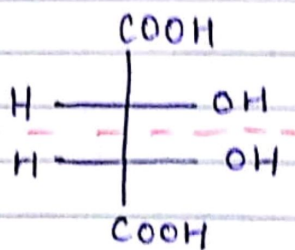
Type-2 Molecule having more than 1 C.C.

→ molecule may be opt. active or not.

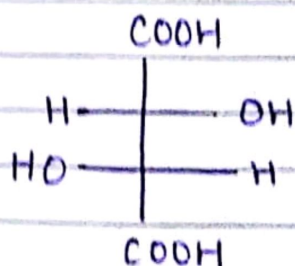
→ Molecule is opt. active if it is unsymm. i.e. C.O.S & P.O.S is absent.



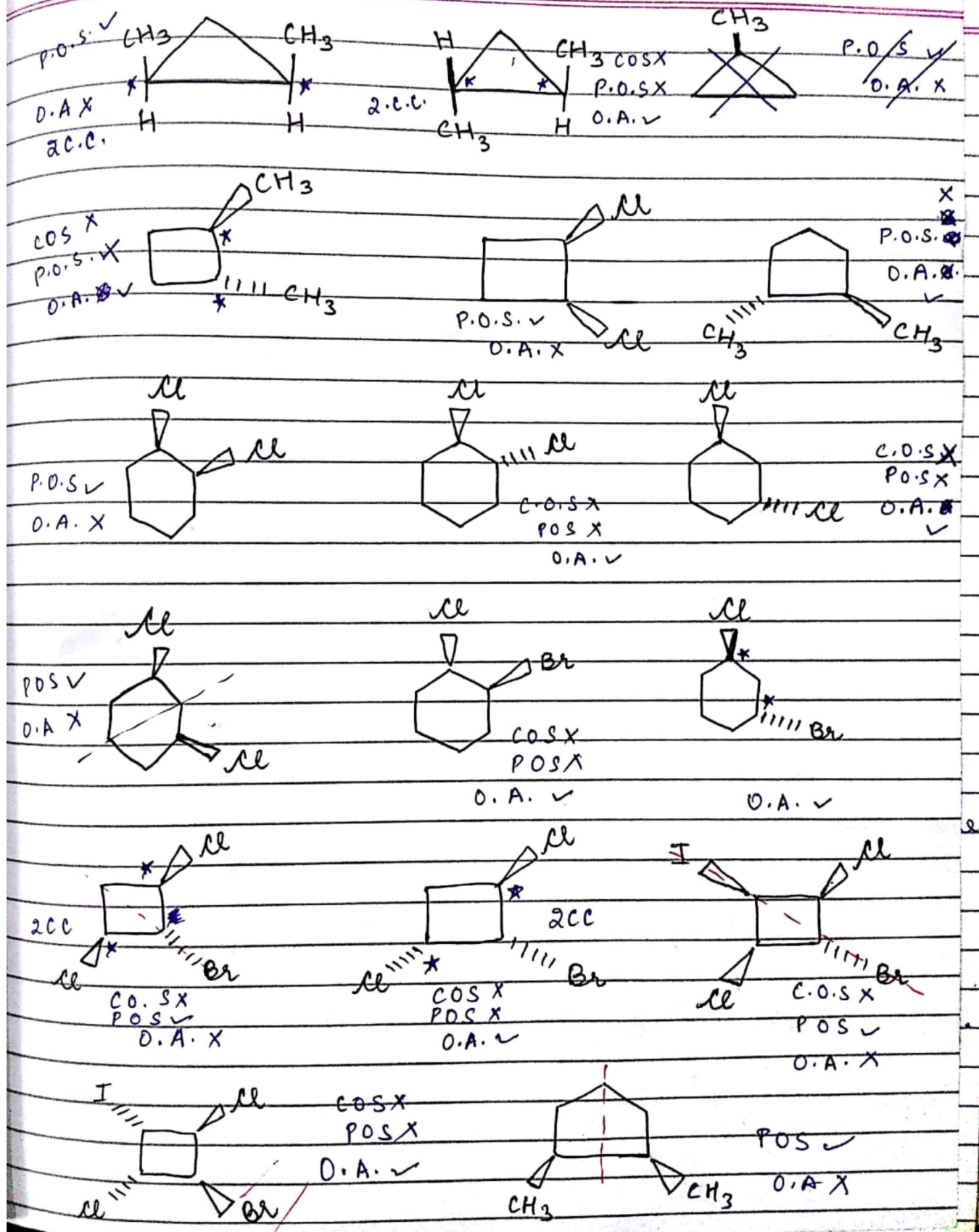
2 C.C. C.O.S X
P.O.S ✓
O.A. X



2 C.C. C.O.S X
P.O.S ✓
O.A. X

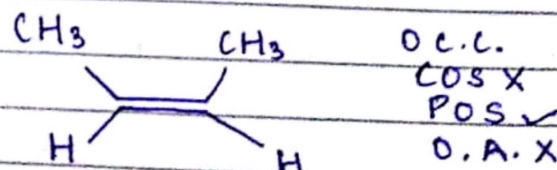
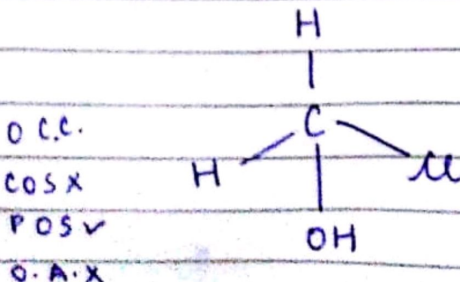
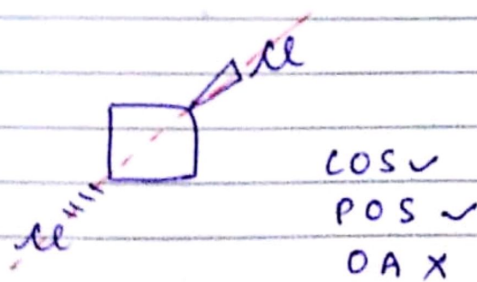
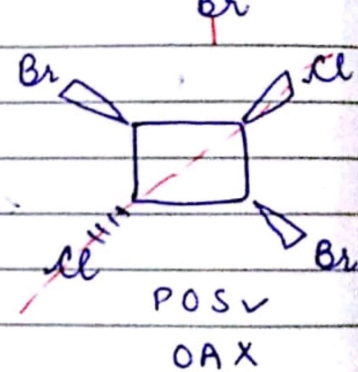
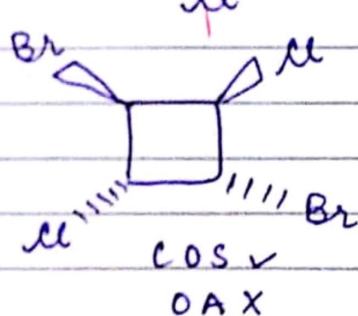
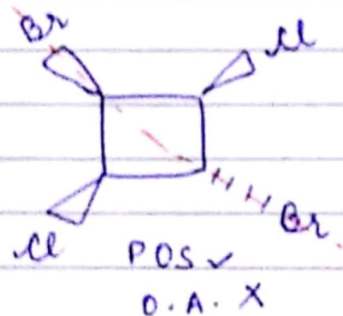
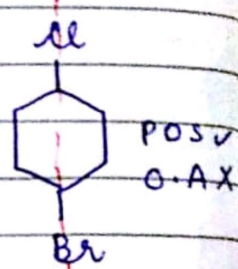
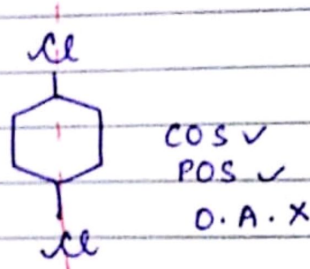
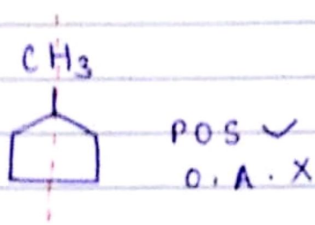


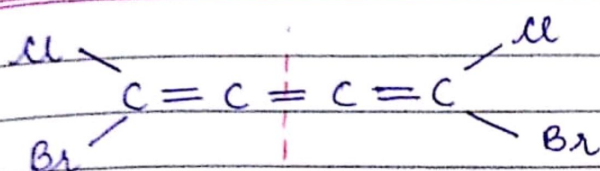
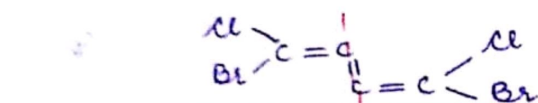
2 C.C. C.O.S } X
P.O.S }
O.A. ✓



Type-3 Molecule having no C.C. :-

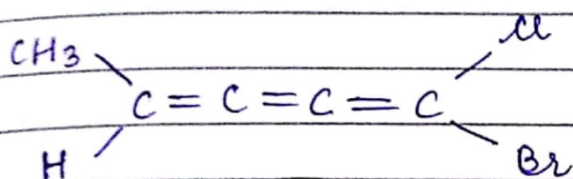
- molecule may be opt. active or not.
- Molecule is opt. active if it is unsymm. i.e. C.O.S. & P.O.S. is absent.





COS X
POS ✓
O.A. X

O.C.C.

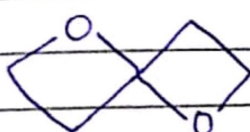


O.C.C.

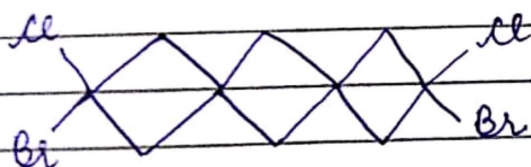
COS X
POS X
OA ✓



COS X
POS ✓
O.A. X



COS X
POS X
OA ✓



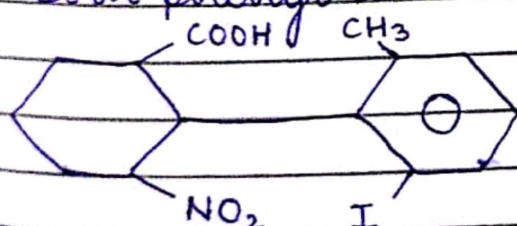
COS X
POS ✓
O.A. X

Biphenyls :- Ortho posⁿ must have bulky gp on same side of both phenyls so that there is steric repulsion.

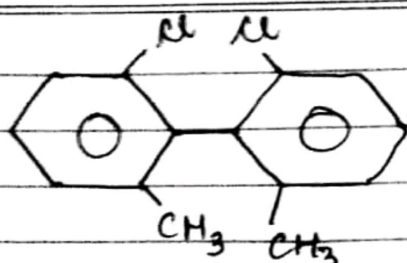
Condⁿ :- Biphenyls will show O. Isomerism if

① Bulky gp should be +nt on ortho posⁿ.
-COOH/-SO₃H/-NO₂/-R/-Cl/-Br/-I

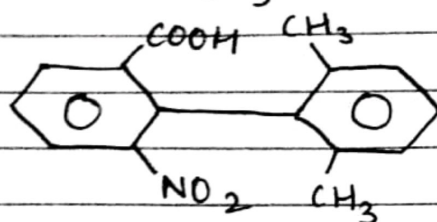
② Both phenyl should be unsymm. individually.



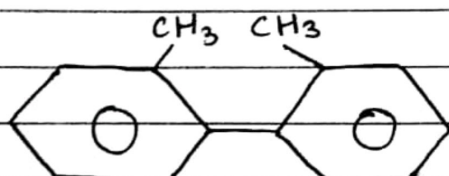
Ortho Posⁿ
bulky ✓
ring unsymm. ✓
O.A. ✓



O.A. ✓

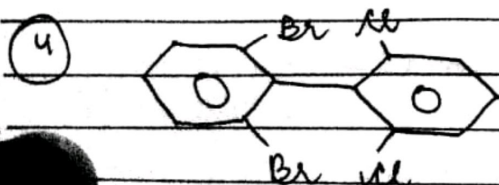
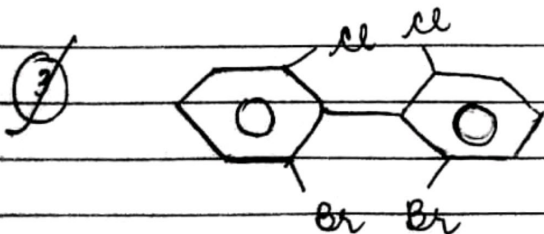
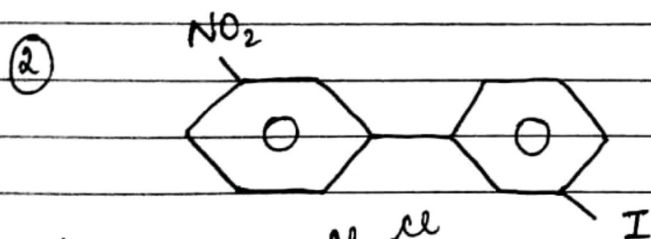
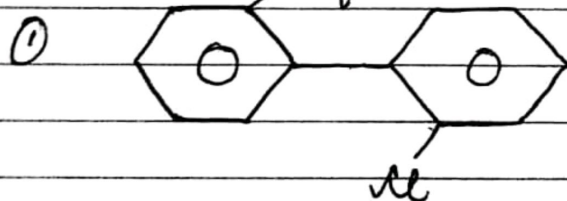


Ortho-bulky gp ✓
indirect - ring unsymm X
O.A. X



O.A. ✓

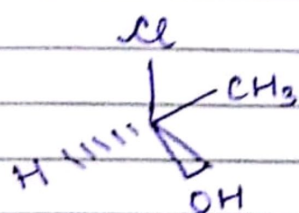
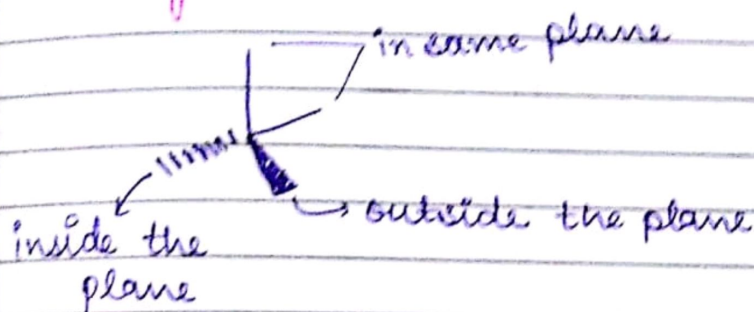
Ques which of the following biphenyls is O.A.



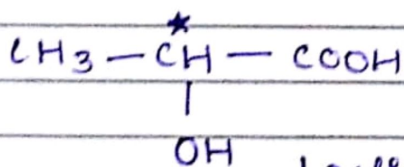
Representation of Optical Isomerism :-

1. Wedge Dash Formula $\rightarrow$ 3D
2. Fischer Projection $\rightarrow$ 2D

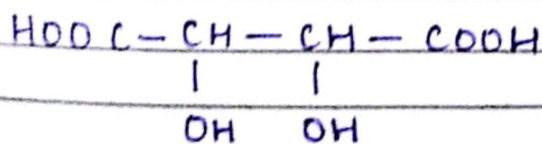
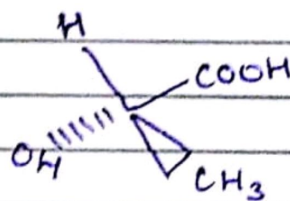
1. Wedge Dash Formula



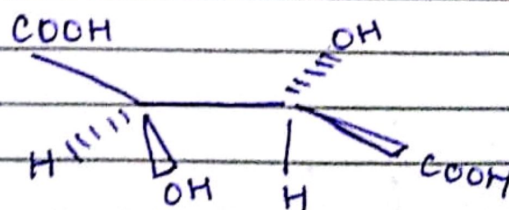
Cl & CH₃ $\rightarrow$ same plane
OH $\rightarrow$ Outside the Plane
H $\rightarrow$ inside the Plane



Lactic acid



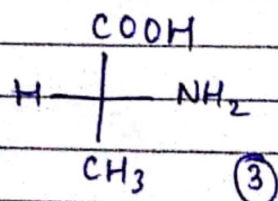
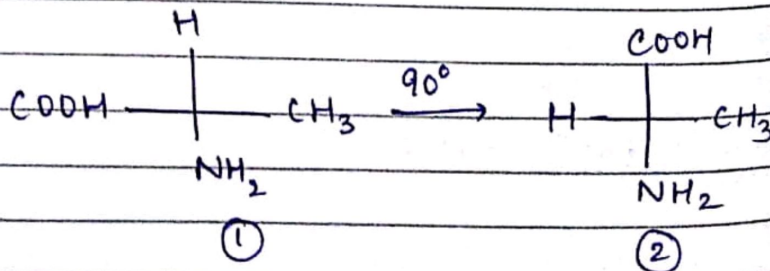
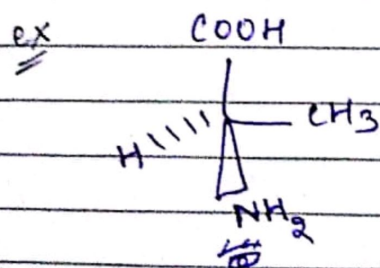
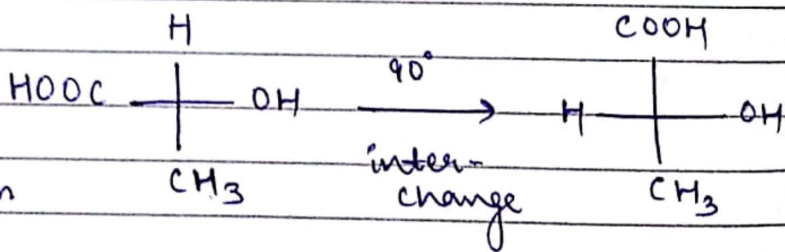
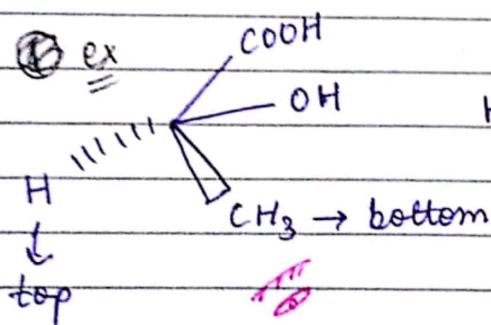
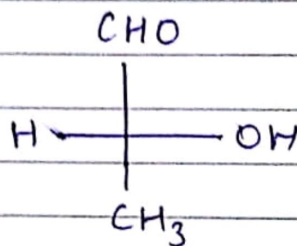
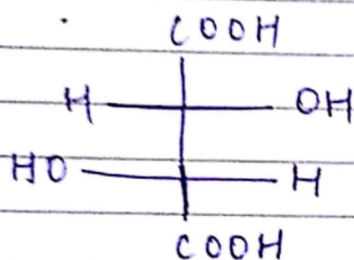
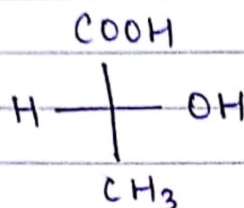
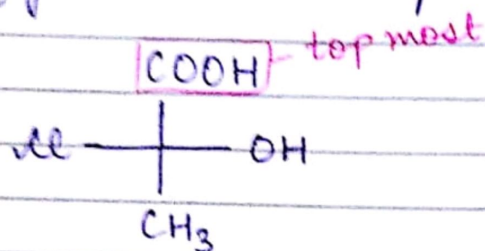
tartaric acid

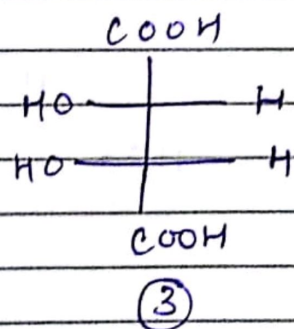
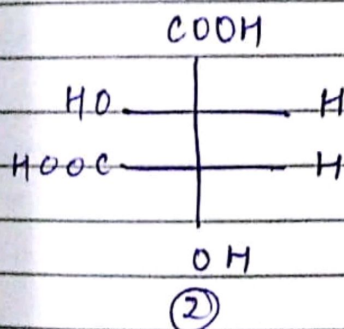
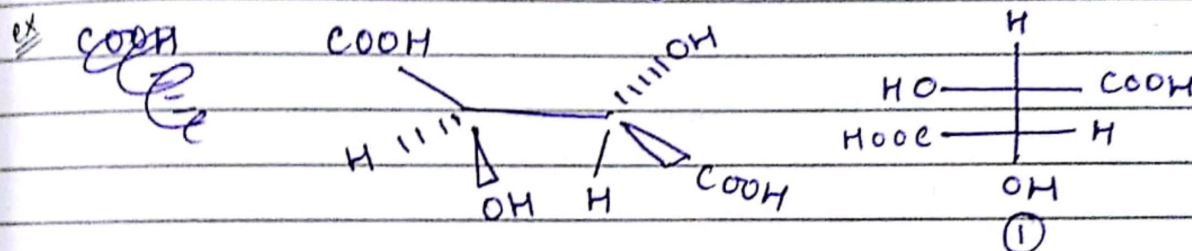
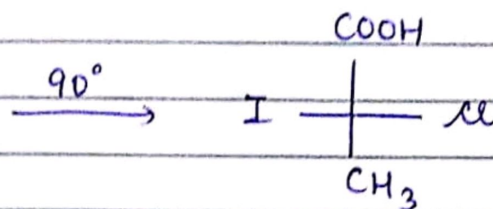
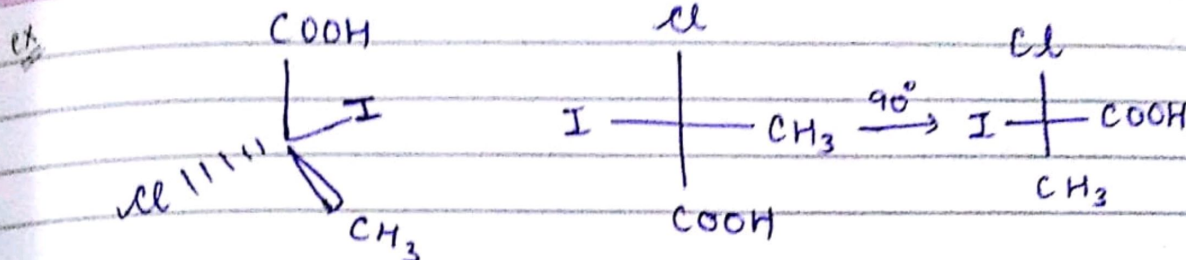


Fischer Projection - 2D

P.C.C. will be on Vt. line

Pfg will be at top most posⁿ





(1) & (3) same
(1) & (2) inverted

Note For one / 3 change $\rightarrow$ conf. inverted.
 90° 270°

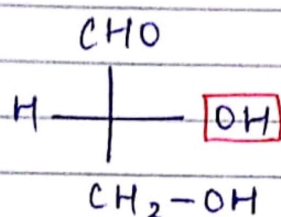
For 2 / 4 change $\rightarrow$ conf. same
 180° 360°

Configuration of O.I. :-

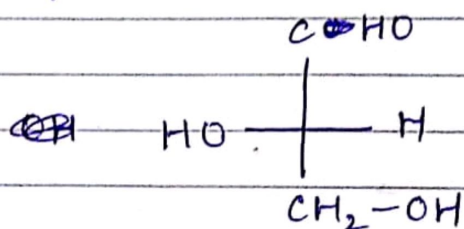
1. D-L conf.
2. R-S conf.

1. D-L Conf. :-

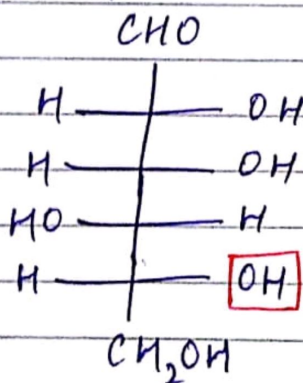
Carbohydrates : Compd having Polyhydroxy carbonyl gp & at least one chiral C is k/n as carbohydrates



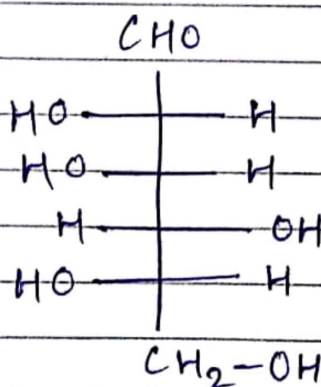
D-Glyceraldehyde



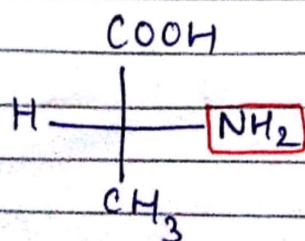
L



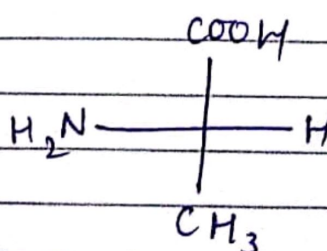
D-Glucose



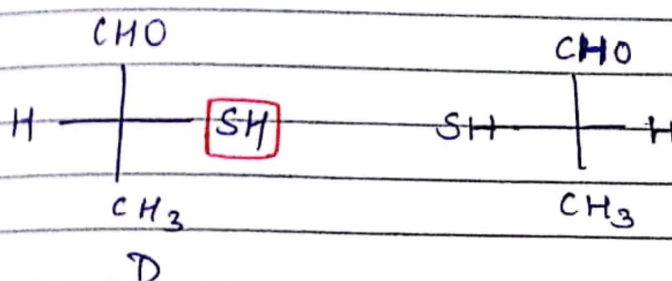
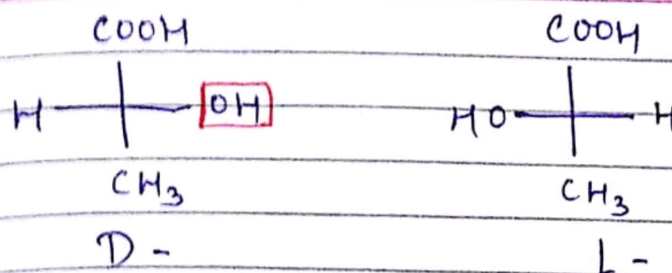
L-Glucose



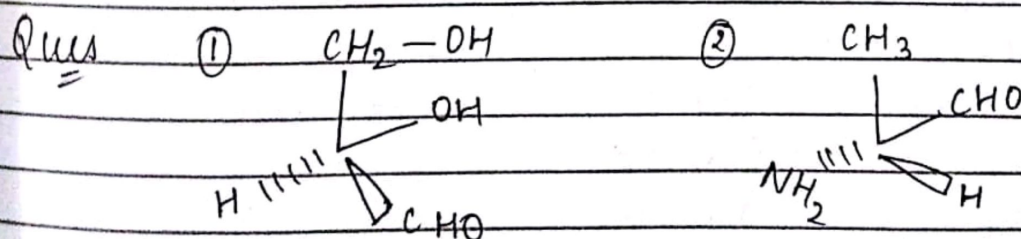
D



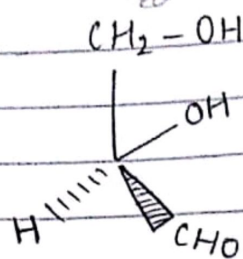
L



- If at last chiral ~~C~~ carbon OH gp is on right side → D
- If at last chiral carbon OH gp is on left side → L
- D & L conf. is not +nt in sym. compd.
- D & L are enantiomers.
- There is no direct relationship
b/w D & d → dextro
L & l → levo



①



HO

H

CHO

90°

HO

CHO

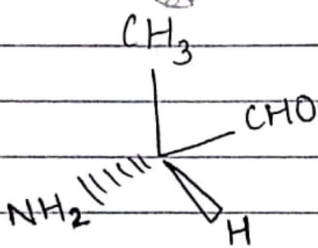
CH₂-OH

CH₂-OH

D

L

②



OH

NH₂

H

90°

H₂N

CHO

CH₃

D

L =

R - S configuration :-

→ Fischer

→ wedge - dash

R.S. in Fischer Projection:

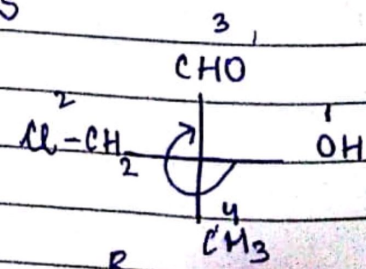
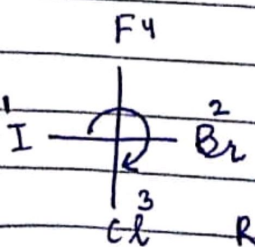
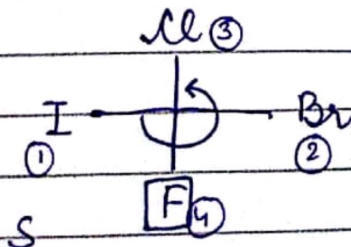
Step-I First of all assign priority to all 4 groups acc. to CIP Rule.

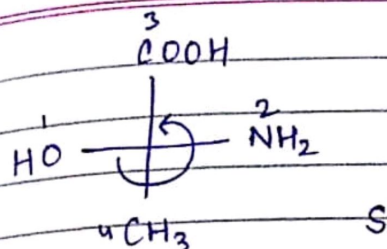
Case-I If least Priority gp is at vt. line we move

① → ② → ③

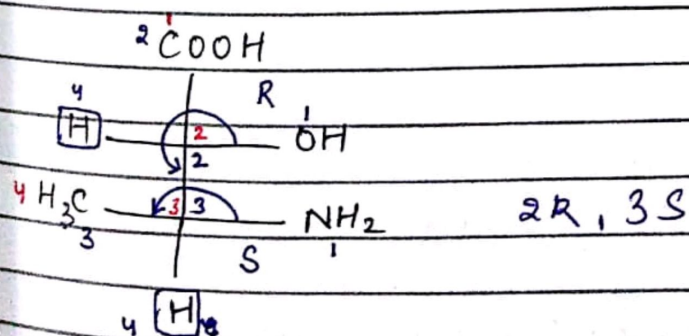
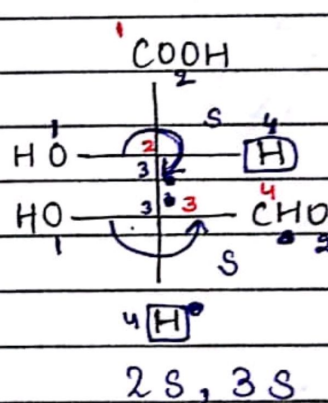
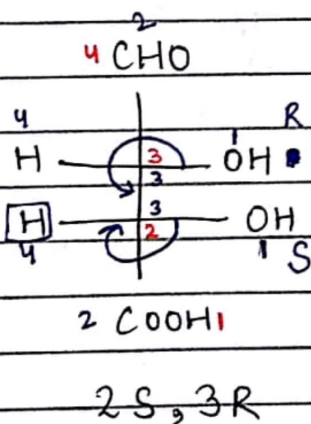
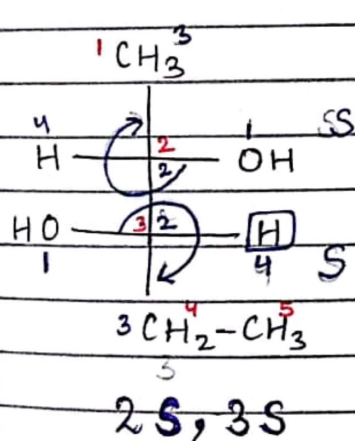
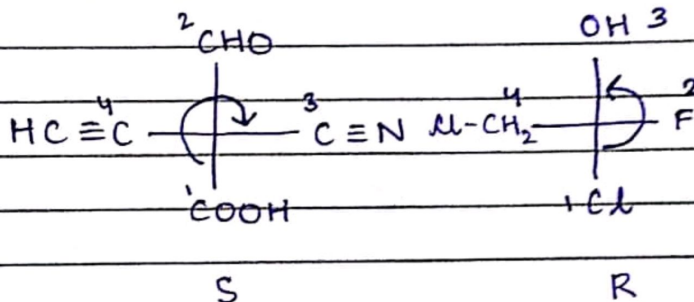
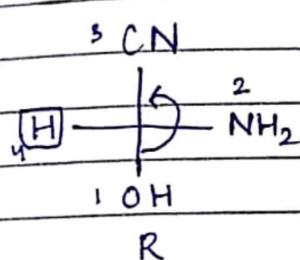
→ C.W. → R

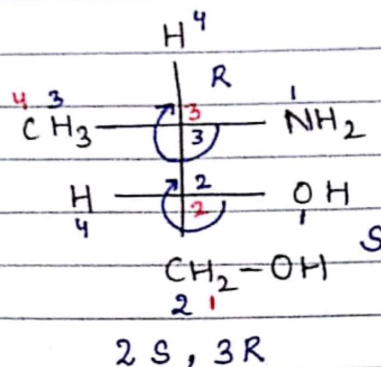
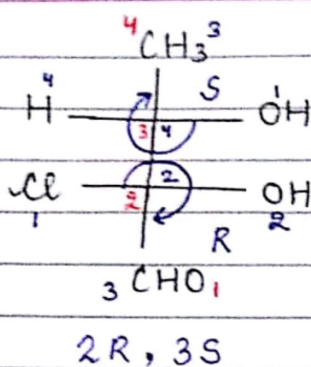
A.C.W. → S





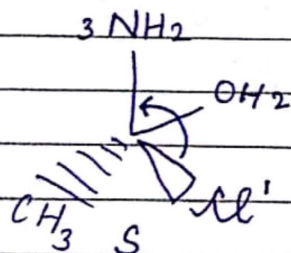
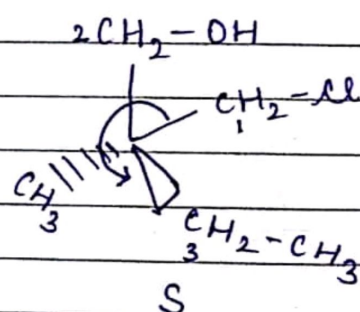
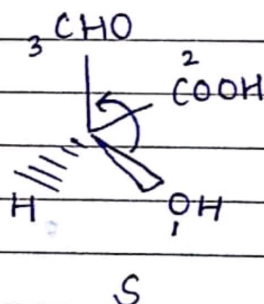
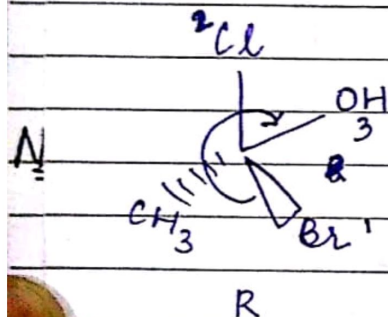
Case-II If least Priority gp is at Horizontal line we
move ① → ② → ③
 $\begin{cases} \text{C.W.} \rightarrow \text{S} \\ \text{A.C.W.} \rightarrow \text{R} \end{cases}$





Wedge Dash Formula :-

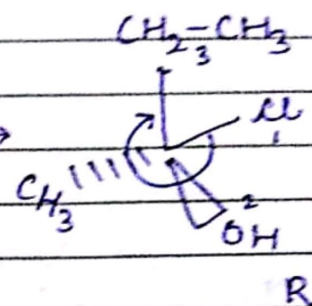
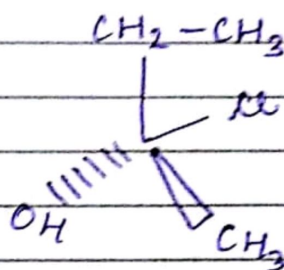
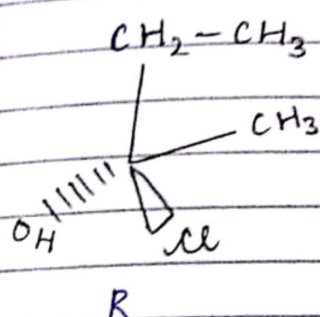
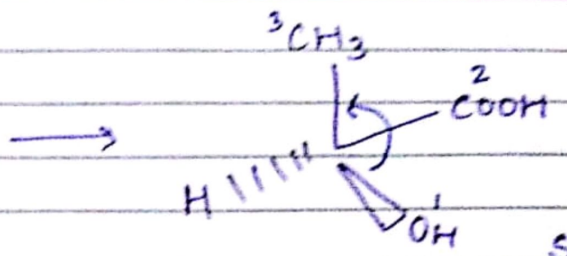
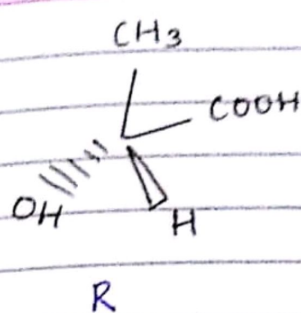
- 1st assign priority to all 4 gps.
- If least priority gp is not at Dash line we move ① → ② → ③
 - C.W. R
 - A.C.W. S



- If least priority gp is not at Dash line then we interchange gps to fix least priority gp at Dash line.

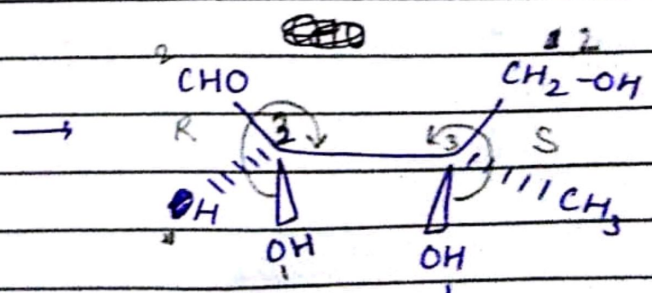
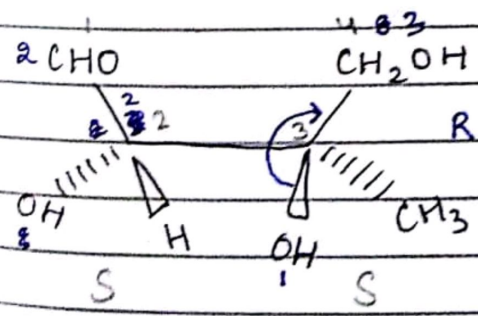
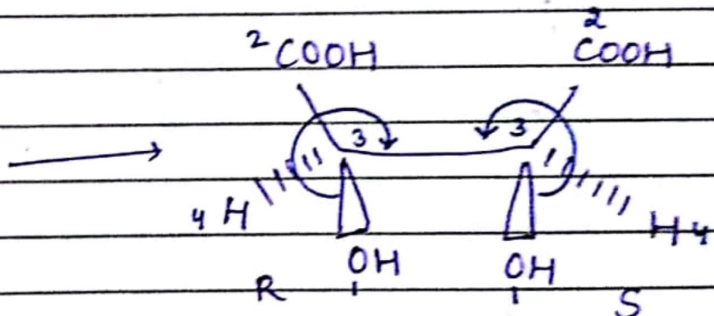
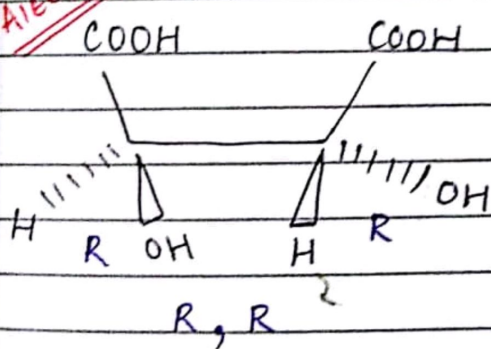
For 1/3 change → Conf. change

For 2/4 change → Conf. same.

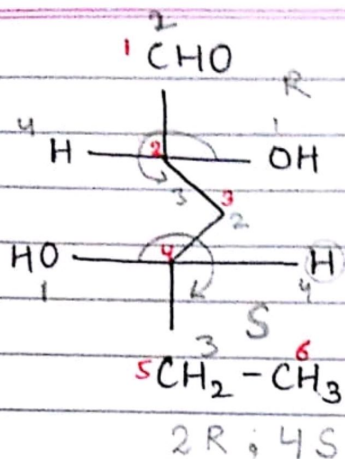


① & ③ identical $\rightarrow$ 2 change
 ① & ② inverted

AIIEE-08



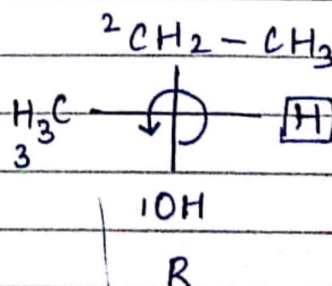
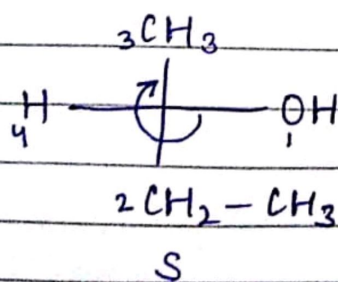
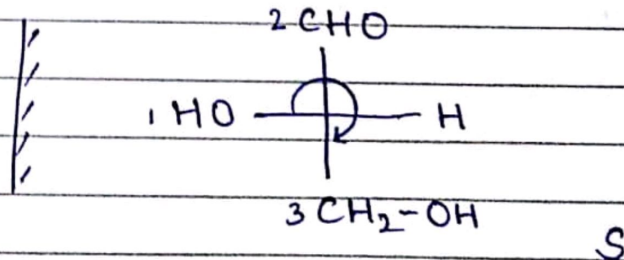
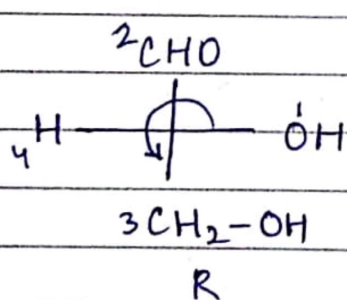
2S, 3S



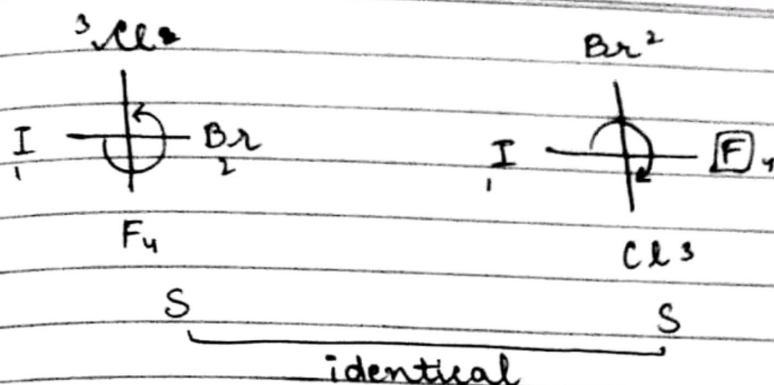
Relationship b/w Stereoisomers

Enantiomers :- Enantiomers are non-superimposable mirror image of each other.

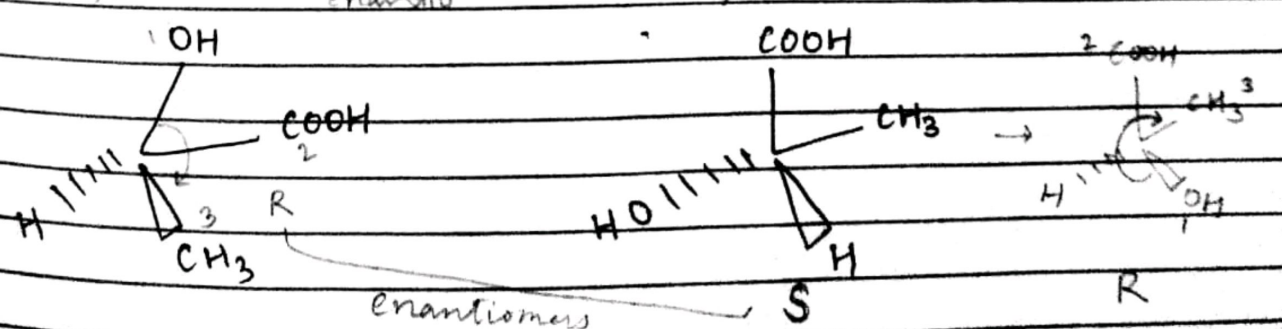
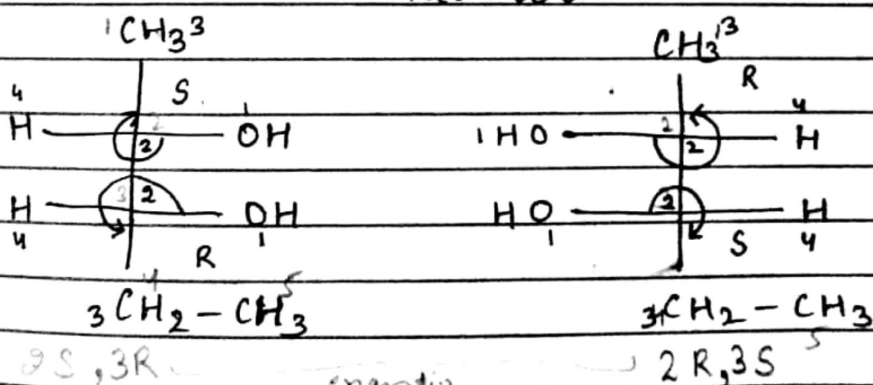
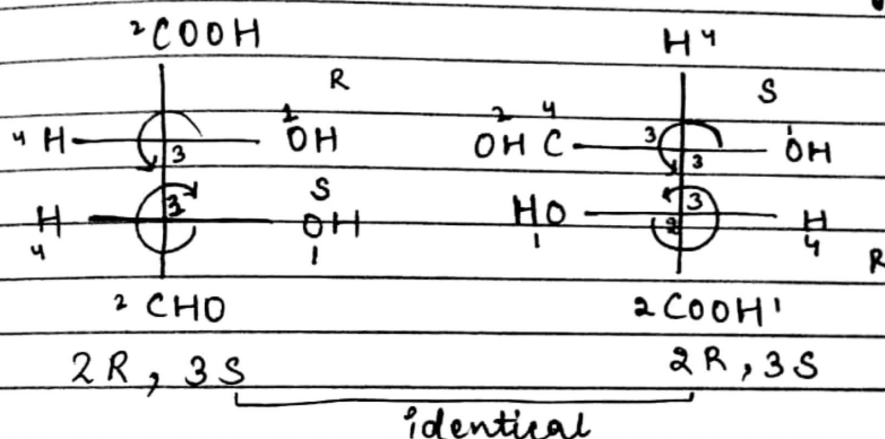
- Physical Property of Enantiomers is always same.
- Enantiomers show different behaviours towards PPL.



enantiomers

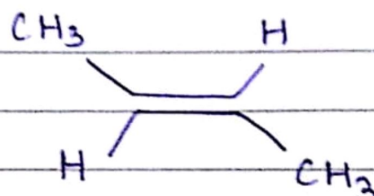
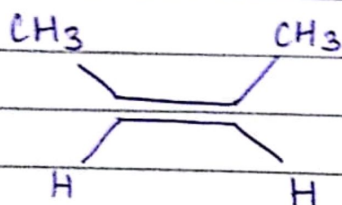


Note : If conf. is same then they are identical

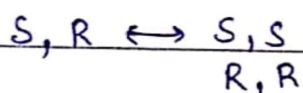
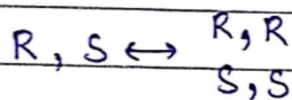


Diastereomers :- They are not mirror image of each other.

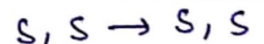
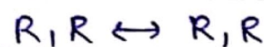
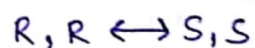
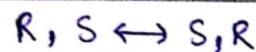
• may be geometrical or optical isomers.



diastereomers

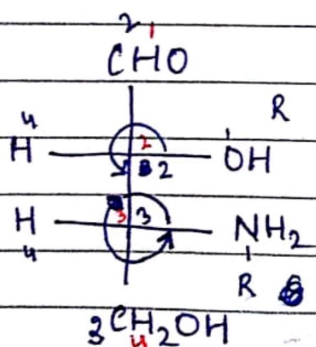


diastereomers

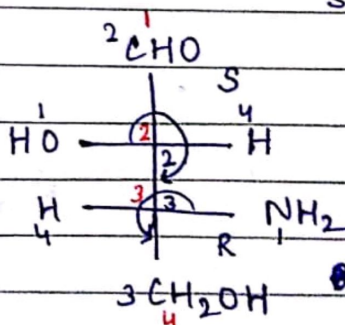


enantiomers

identical

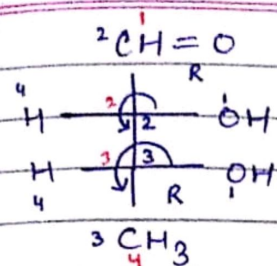


2R, 3R

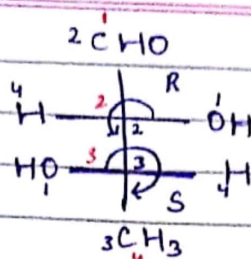


2S, 3R

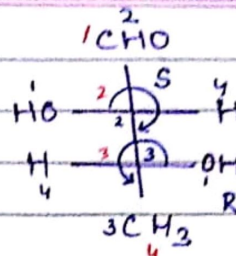
diastereomers



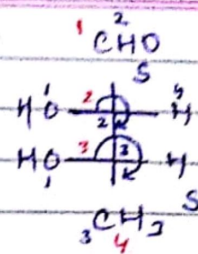
① 2R, 3R



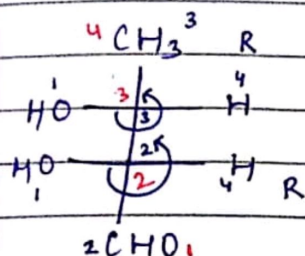
② 2R, 3S



③ 2S, 3R



④ 2S, 3S



⑤ 2R, 3R

① & ② } diastereomers

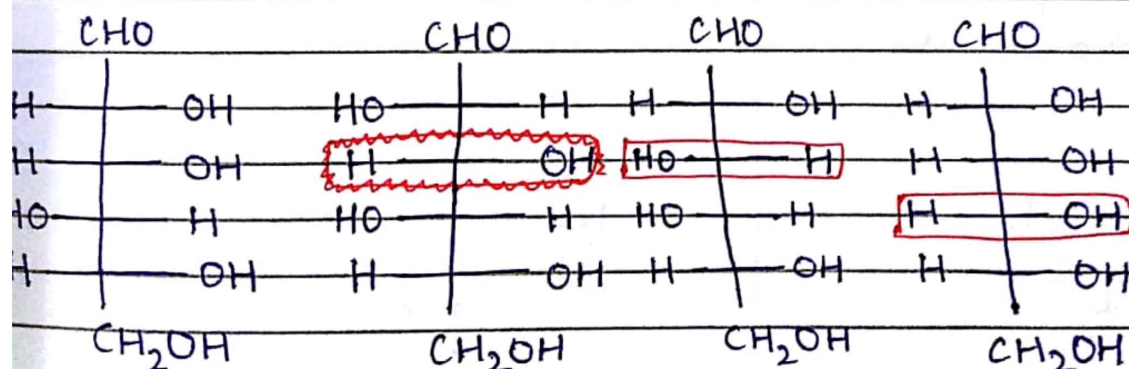
① & ③

① & ④ enantiomers

① & ⑤ identical

② & ③ enantiomers

Epimers :- When 2 ^{mono}saccharides are different in configuration around a single specific chiral carbon are c/a epimers.



D-Glucose

D-Glucose

D-Glucose

D-Glucose

C₂ epimer

C₃ epimer

C₄ epimer

for free

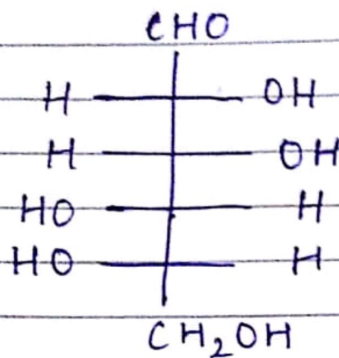
study material.

Visit : www.sbgstudy.com

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Notes, Papers, Syllabus

Practice Paper, Sample Paper

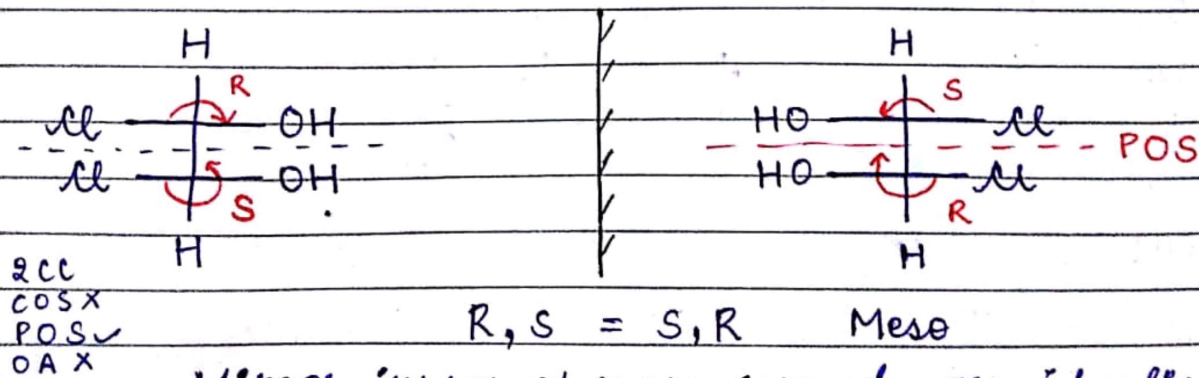


L-Glucose
C₅ Epimer

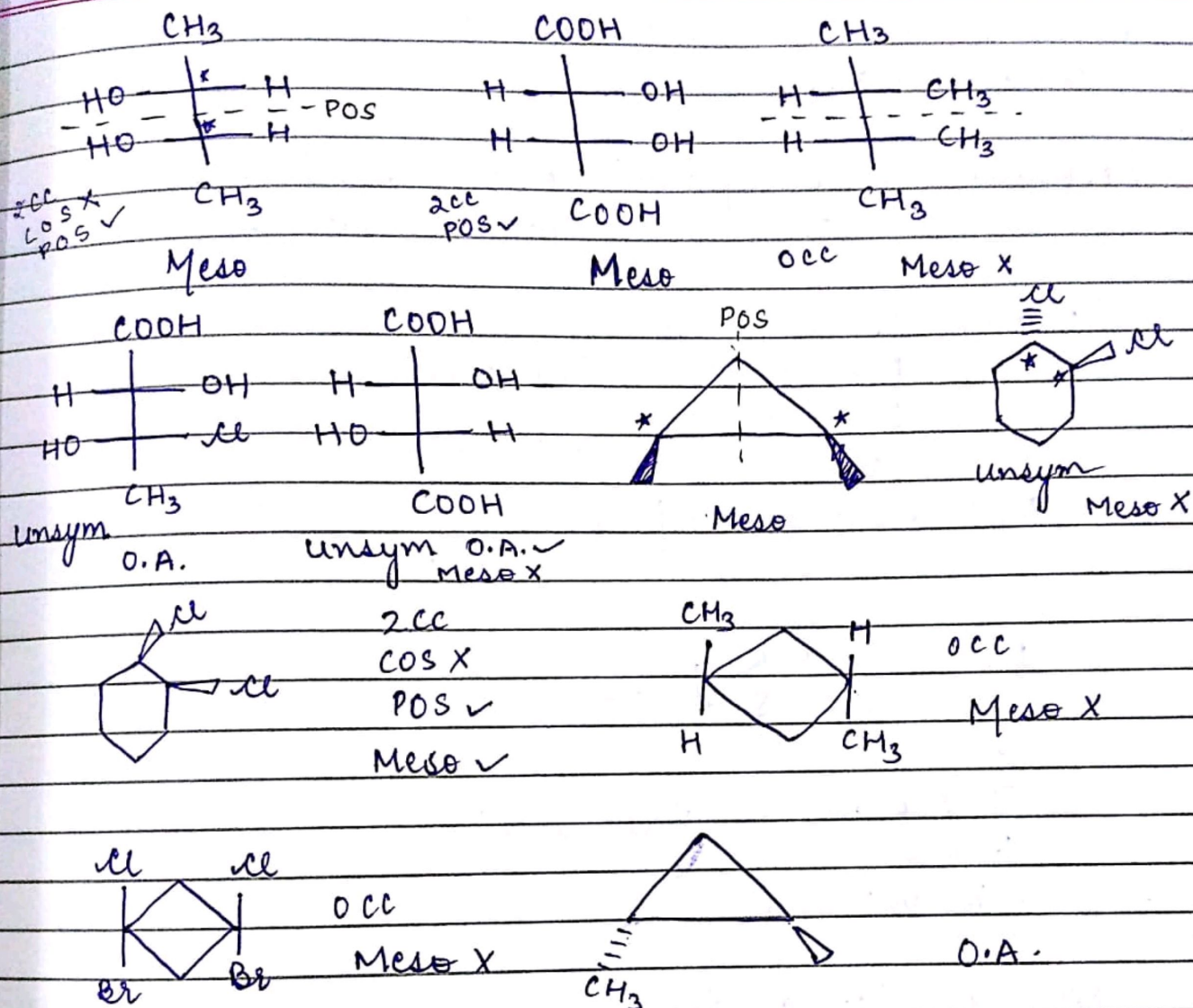
→ All epimers are diastereomers but vice versa not true

Meso compound: Meso-compd. are optically inactive i.e. optically inactive compounds which have more than one chiral carbon but element of symmetry is not within the molecule.

- Meso compounds are optically inactive due to internal compensation or intramolecular compensation.

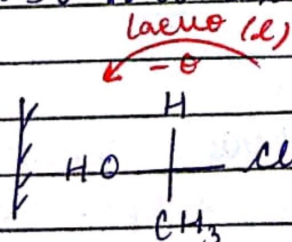
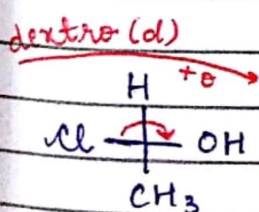


Mirror image of meso compounds are identical
R & S cancel each other



Racemic Mixture :-

It is a 50 : 50 mixture of enantiomers (i.e. d & l)
50 : 50 :: d & l



50 : 50
d & l
+θ & -θ
net rotation = +θ + (-θ)
= 0

Racemic molecule is opt. active

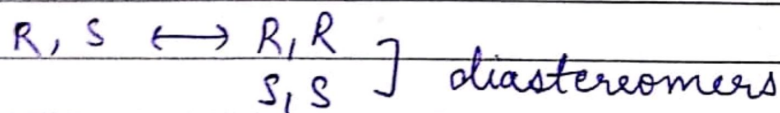
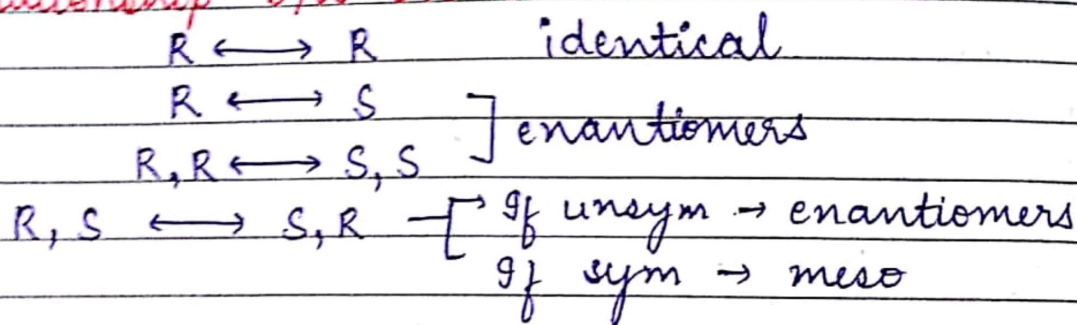
PAGE NO. : 63

DATE : / /

Racemic mixture is opt. inactive due to external compensation.

Resolution : To separate out d & l from racemic mixture is c/a resolution.

Relationship b/w stereoisomers :-



d & l
 D & L
 R & S
 50% 50%

→ Racemic mixture

No. of Optical Isomers

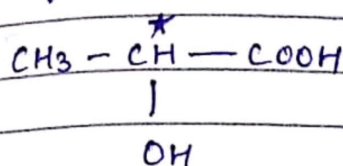
	Opt. Active (d & l)	Opt. Inactive (meso)
1. Unsymm. compd.	2^n	0
2. Symm. compd. → n = even	2^{n-1}	$2^{n/2}$
↳ n = odd	$2^{n-1} - 2^{n-1/2}$	$2^{n-1/2}$

n → no. of Chiral centre

Total no. of O.I. = opt. active + Opt. inactive

$$\frac{\text{no. of racemic mix.}}{\text{or}} = \frac{\text{no. of opt. active}}{2}$$

no. of enantiomer pairs



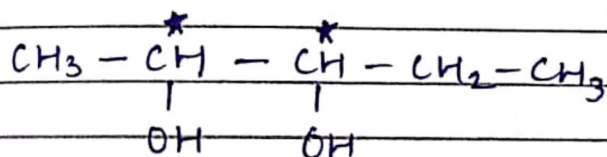
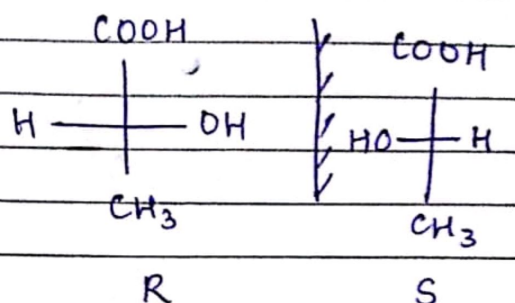
Lactic Acid

$$\text{no. of opt. active} = 2^n = 2^1 = 2$$

$$\text{no. of meso} = 0$$

$$\text{Total} = 2$$

$$\text{no. of racemic mix} = \frac{2}{2} = 1$$



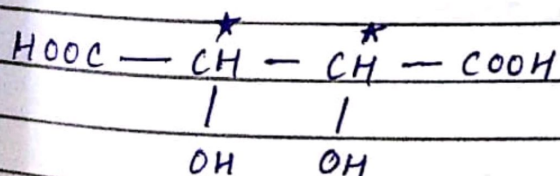
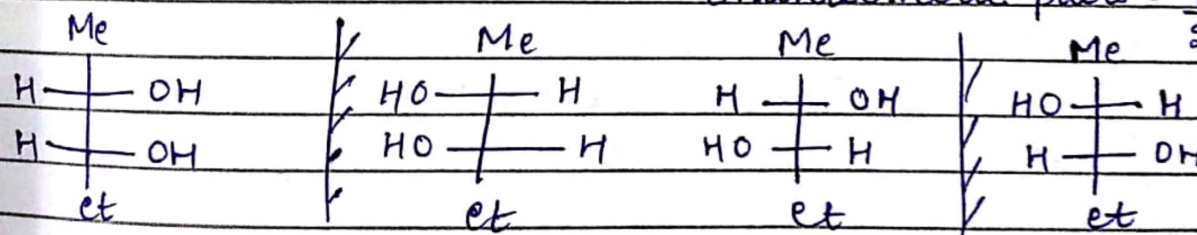
$$\text{no. of opt. active} = 2^2 = 4$$

$$\text{no. of meso} = 0$$

$$\text{total o. t.} = 4 + 0 = 4$$

$$\text{unsym } n=2$$

$$\text{no. of racemic mix. / enantiomeric pairs} = \frac{4}{2} = 2$$



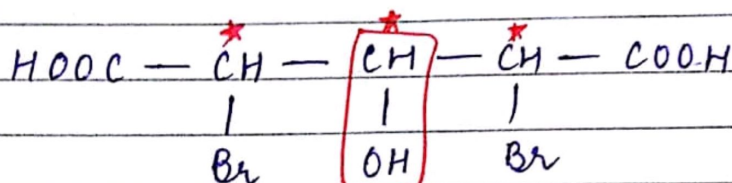
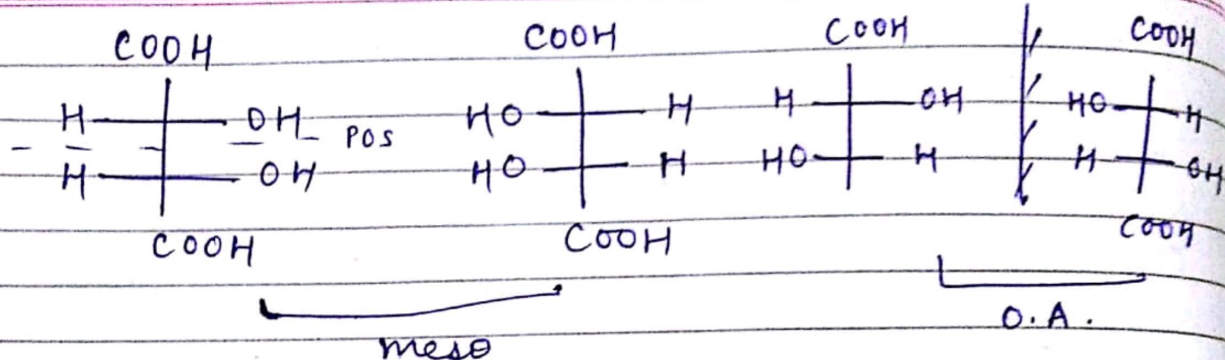
$$\text{no. of opt active} = 2^{2-1} = 2$$

$$\text{meso} = 2^{n/2} = 2^{2/2} = 2$$

$$\text{total} = 4$$

$$\text{sym. } n=2 \text{ even}$$

$$\text{R.M.} = \frac{4}{2} = 1$$



Pseudo chiral

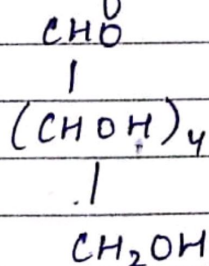
Sym
 $n = 3$ odd

$$\begin{aligned} \text{no. of O.I.} &= 2^{n-1} - 2^{n-1/2} = 2^{3-1} - 2^{3-1/2} \\ &= 2^2 - 2^1 = 2 \\ \text{meso} &= 2^{n-1/2} = 2^{3-1/2} = 2 \end{aligned}$$

$$\text{total} = 4$$

$$\text{R.M.} = 2/2 = 1$$

no. of O.I. in Glucose

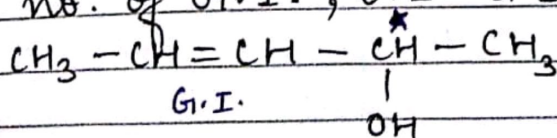


$$\begin{aligned} \text{unsym. } n &= 4 \\ \text{no. of O.I.} &= 2^4 = 16 \\ \text{meso} &= 0 \end{aligned}$$

$$\text{Total} = 16 + 0 = 16$$

$$\text{R.M.} = \frac{16}{2} = 8$$

Ques find no. of G.I., O.I. & stereoisomers in

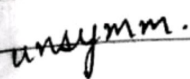


unsym

$$\begin{aligned} \text{no. of G.I.} &= 2^n = 2^1 = 2 \\ \text{no. of O.I.} &= 2^1 = 2 \end{aligned}$$

Alce

Ques Find no. of C.I., O.I. & stereomers in

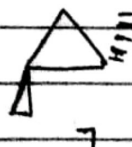
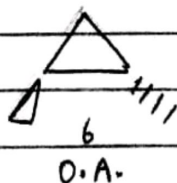
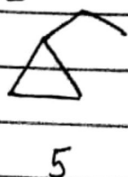
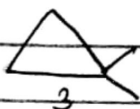
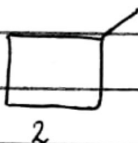


no. of G.I. = $2^2 = 4$

no. of O.I. = $2^1 = 2$

no. of stereoisomers = $4 \times 2 = 8$

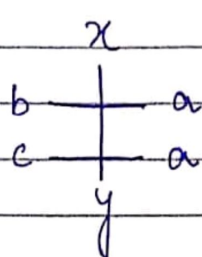
Ques How many cyclic isomers (including stereoisomers) are possible if compd has M.F. C_5H_{10} .



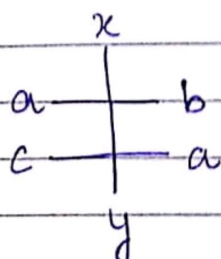
Erythro & Threo :-

The system is applicable only when these 2 cond^s are satisfied.

- Compd must have only 2 chiral carbon.
- Out of 6 gp attached to 2 chiral carbons atleast 2 must be same & 2 must be diff.

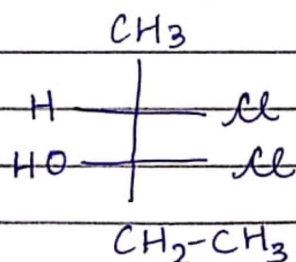


Erythro
(same gp same side)

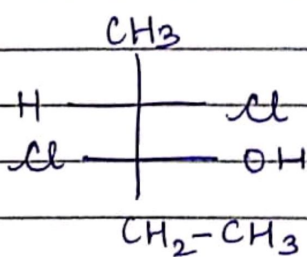


Threo
(same gp diff. side)

+ They are always O.A.

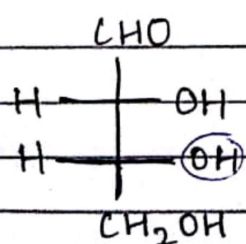


Erythro

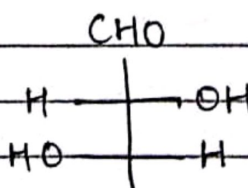


Threo

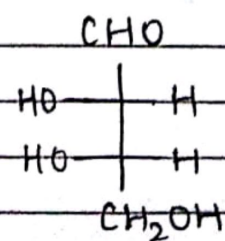
Ques



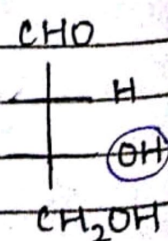
D Ery



L-Th

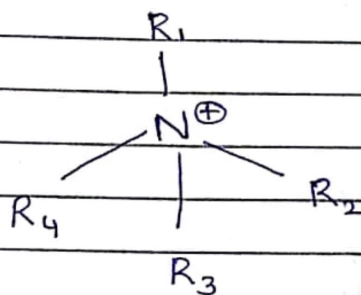
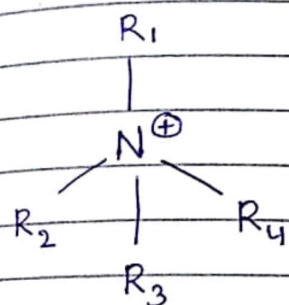


L-Ery



D-Threo

- ⑫ Correct confi is -
① D-Eryth , L-Eryth , L-Threose , D-Threose
② D-
③
④



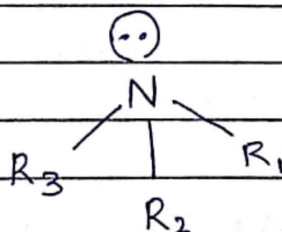
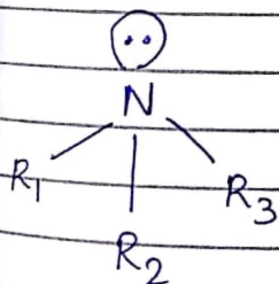
$N \rightarrow sp^3$

$\rightarrow$ chiral

$\rightarrow$ unsym

$\rightarrow$ mirror non-superimposable

$\rightarrow$ O.A. / Chiral molecule



$N \rightarrow sp^3$

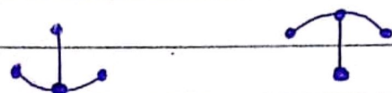
$\rightarrow$ chiral

$\rightarrow$ unsym

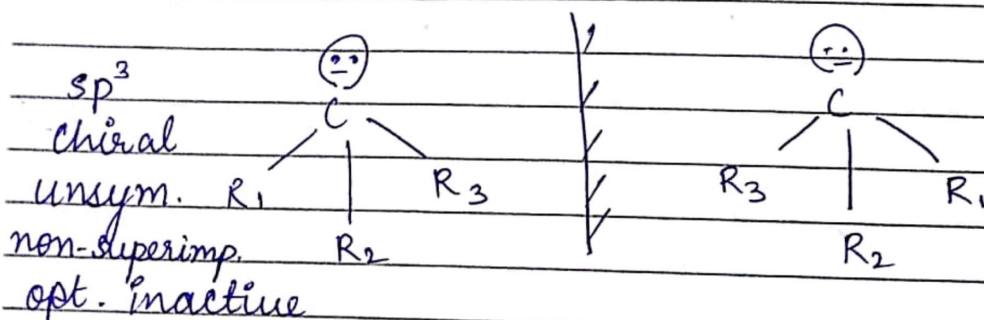
$\rightarrow$ Mirror image - non super imposable

$\rightarrow$ molecule is opt. inactive

Reason: Due to flipping of lp it cause rapid umbrella inversion.



+ Energy req^d for this conversion is available at room temp. & they can't be separate & become identical



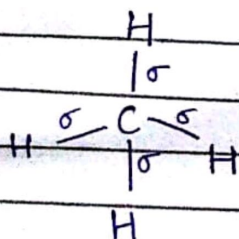
Conformational Isomerism :-

Such stereoisomers ^{which} are formed due to rotation around C-C ~~sigma~~ sigma bond c/g Rotamer & ~~phero~~ phenomena is k/n as conformational isomer or rotational isomerism.

→ Conformers are separate interconvertable at room temp. & hence ~~are~~ ~~can~~ cannot be separated out.

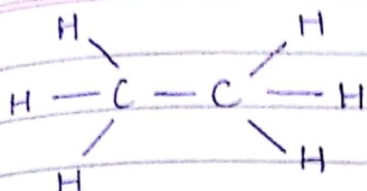
→ One compd. have infinite conformers.

Condⁿ → Comps which contain atleast 3 continuous σ-bond will show conformational isomerism.

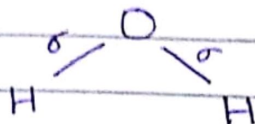


2σ

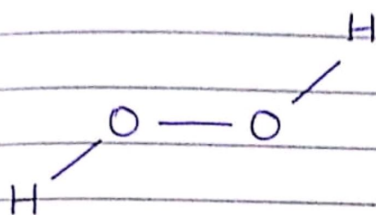
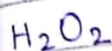
C.I. X



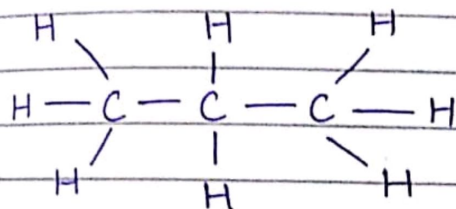
C.I. ✓



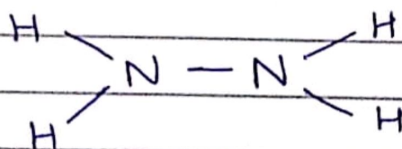
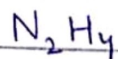
C.I. ✗



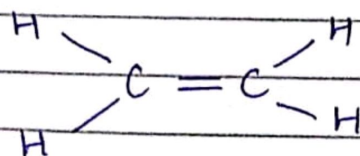
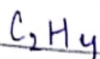
C.I. ✓



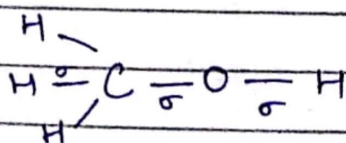
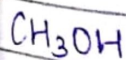
C.I. ✓



✓



✗



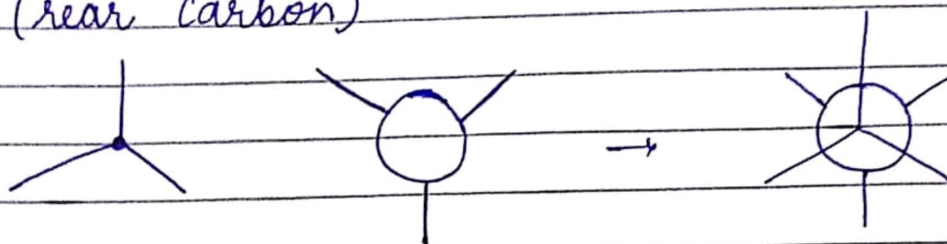
C.I. ✓

3D $\rightarrow$ 2D

Newmann Projection :-

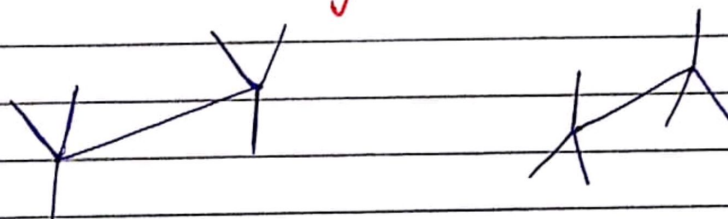
Front Carbon $\rightarrow$ •

Back Carbon $\rightarrow$ ○
(rear carbon)



From carbon back carbon
 (rear carbon)

2. Saw Horse Projection :- side view

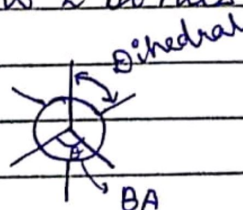


Angle and Strain :-

Bond Angle :- angle b/w 2 bonds at same atom

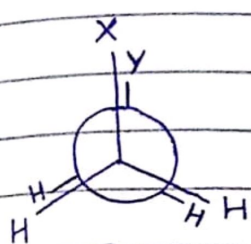
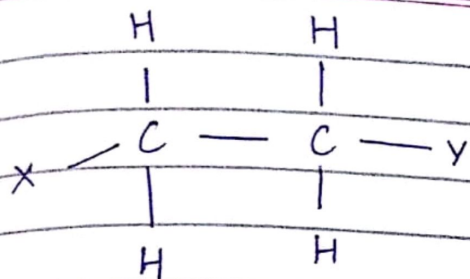


Dihedral Angle : angle b/w 2 bonds at adjacent atom



Steric Strain : Strain b/w 2 atoms

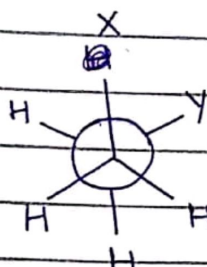
Torsion Strain : Strain/repulsion b/w e⁻ of 2 bonds



① Fully Eclipsed

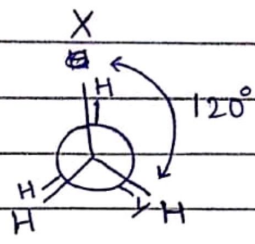
60°

60°



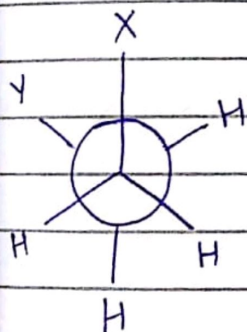
② Gauche

60°



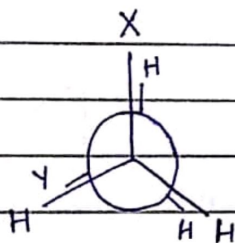
③ Partial Eclipsed

60°



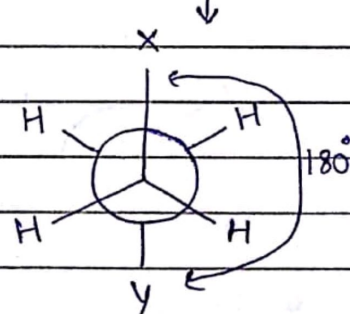
⑥ Gauche

60°



⑤ Partial Eclipsed

60°



④ Staggered/Anti

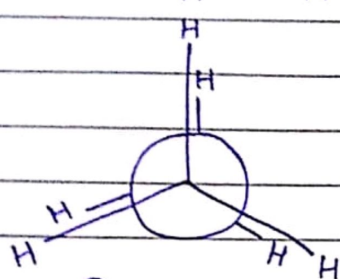
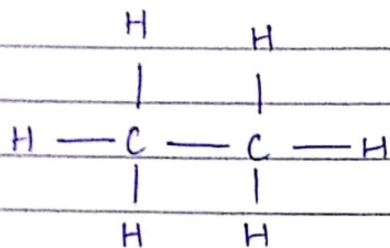
60°

Eclipsed → S.S. max
T.S. max
P.E. max
Stab. min

Staggered → S.S. min
T.S. min
P.E. min
Stab. max^m

Energy Eclipsed > Partial Eclipsed > Gauche > Staggered/Anti
Stab. Eclipsed < Partial eclipsed < Gauche < Staggered/Anti
Skew Form: There are ∞ conformers b/w eclipsed & Staggered form k/n as skew form.

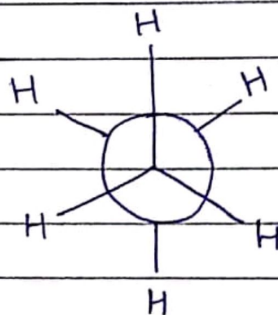
Conformers of Ethane :-



① Eclipsed

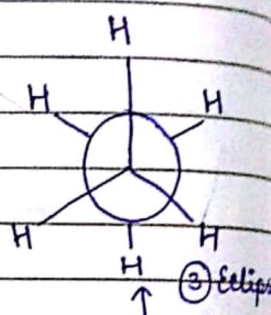
$\updownarrow 60^\circ$

$\longleftrightarrow 60^\circ$



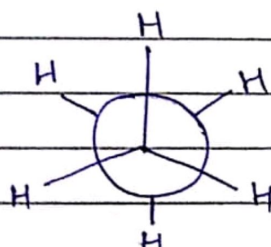
② Staggered

$\longleftrightarrow 60^\circ$



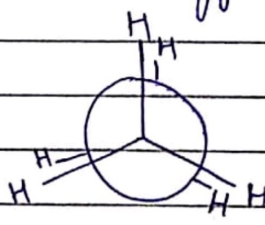
③ Eclipsed

$\updownarrow 60^\circ$



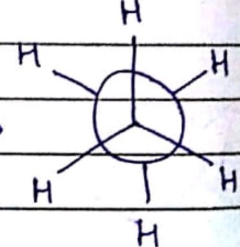
⑥ Staggered

$\longleftrightarrow 60^\circ$



⑤ Eclipsed

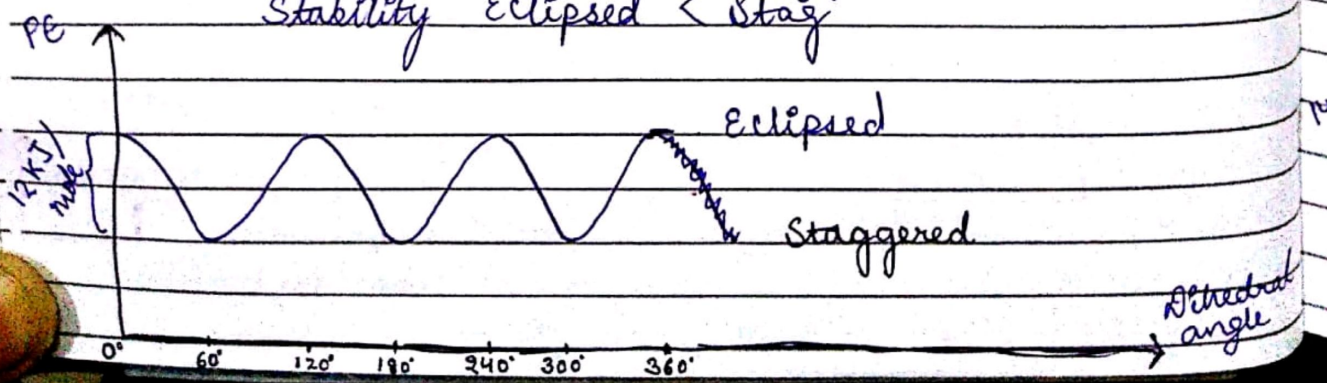
$\longleftrightarrow 60^\circ$

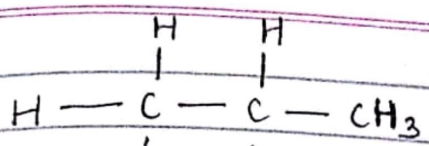


④ Staggered

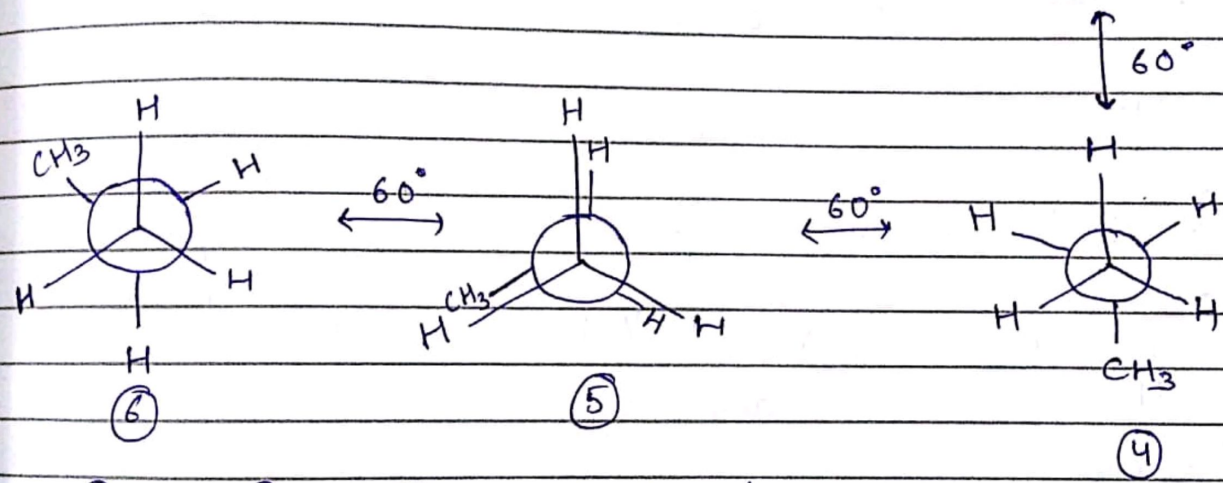
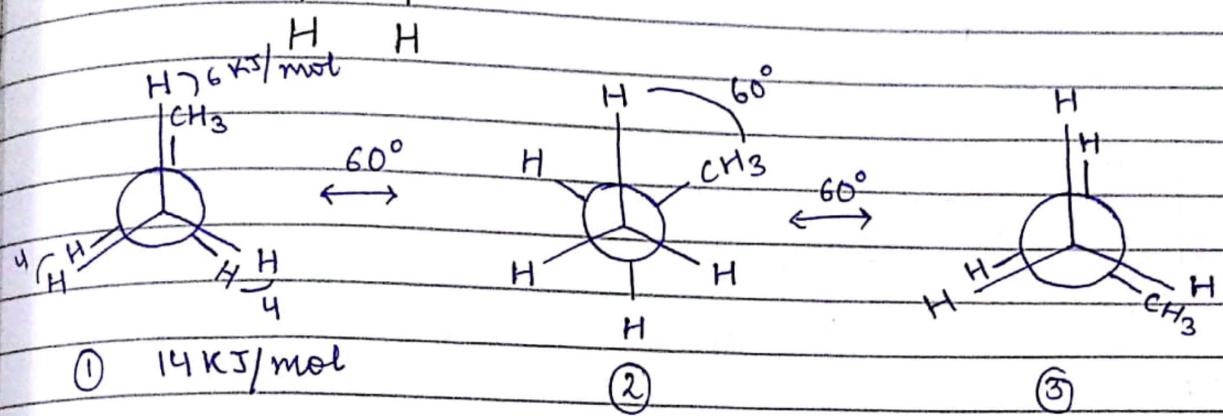
① $\equiv$ ③ $\equiv$ ⑤ Eclipsed
② $\equiv$ ④ $\equiv$ ⑥ Staggered

Energy Eclipsed > Stag
Stability Eclipsed < Stag

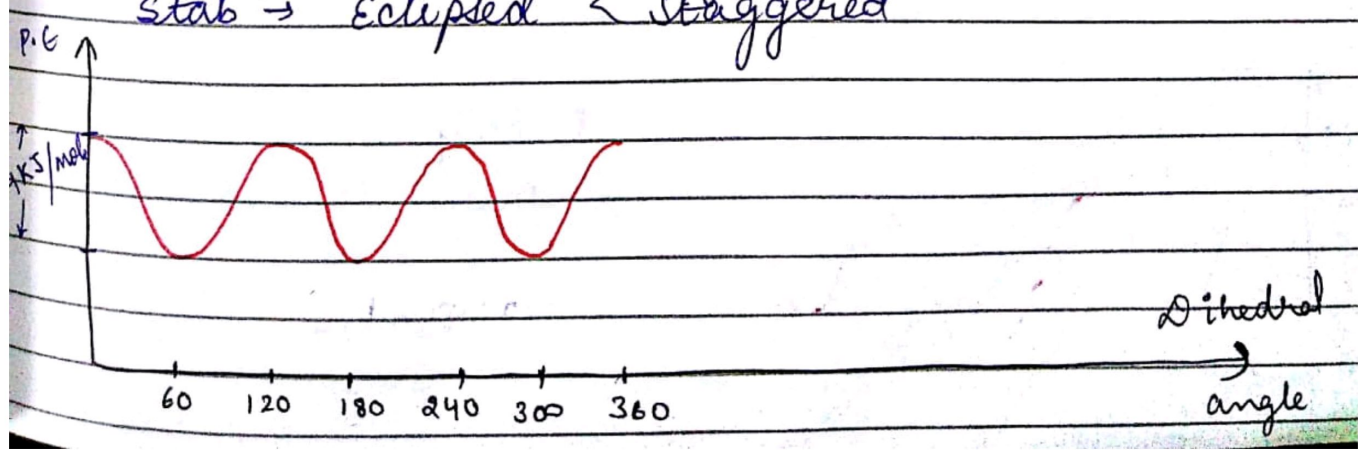




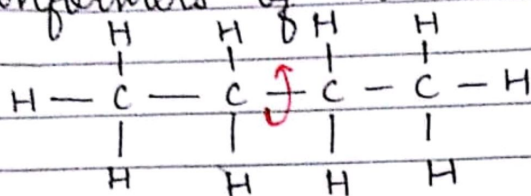
X = H
Y = CH₃



① = ③ = ⑤ Eclipsed
② = ④ = ⑥ Staggered
Energy → Eclipsed > Staggered
Stab → Eclipsed < Staggered

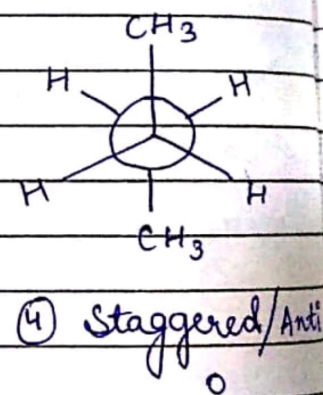
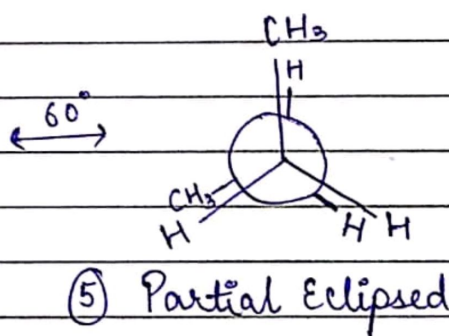
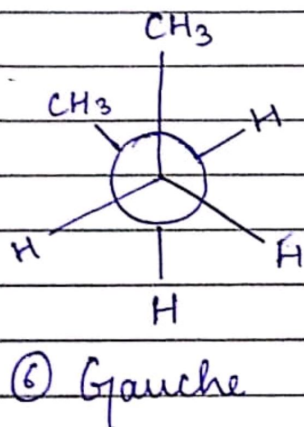
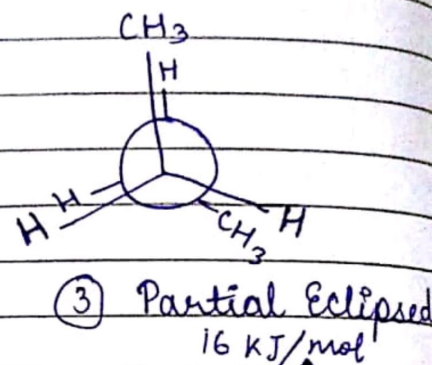
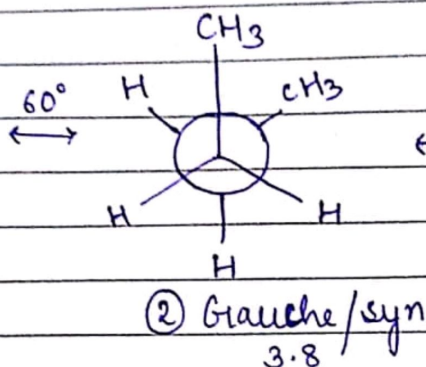
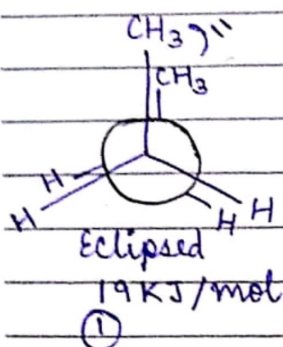


Conformers of n-Butane around C-2 & C-3



X = CH₃

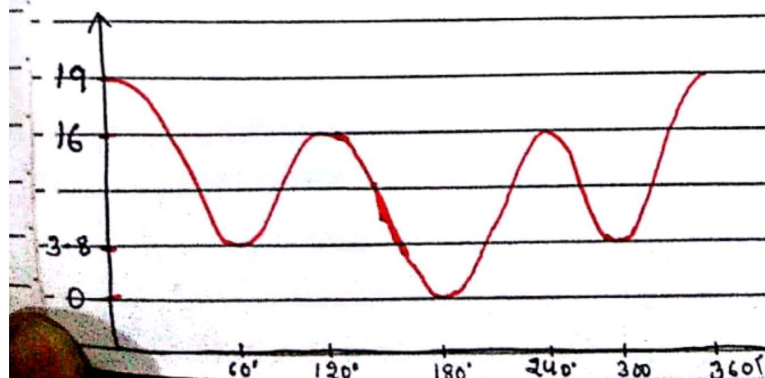
Y = CH₃



$$E \rightarrow ① > ③ = ⑤ > ② = ⑥ > ④$$

Eclipsed > Partial Eclipsed > Gauche > Staggered

$$① < ③ = ⑤ < ② = ⑥ < ④$$



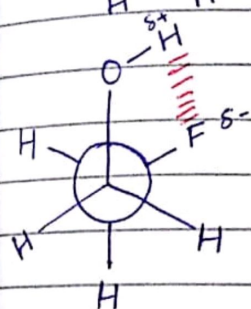
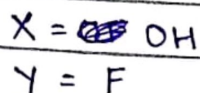
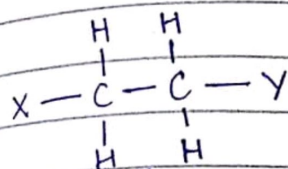
● Eclipsed
Partial Eclipsed

Gauche
Staggered

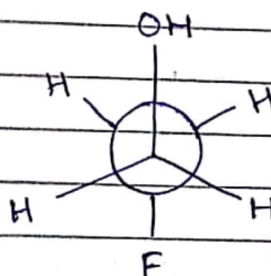
~~When attractive forces are~~

When attractive forces are +ve b/w X & Y like

- ① H-Bonding
 - ② electrostatic force of attraction
- then $\text{Gauche} > \text{Staggered}$
stab. order



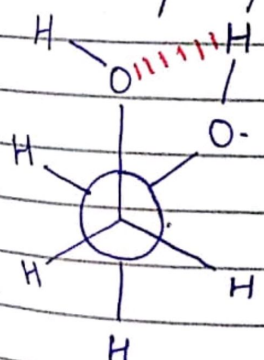
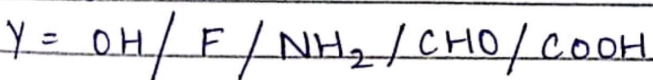
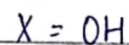
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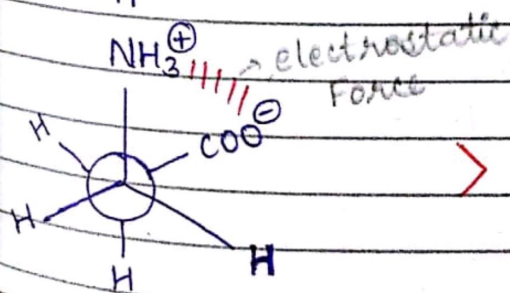
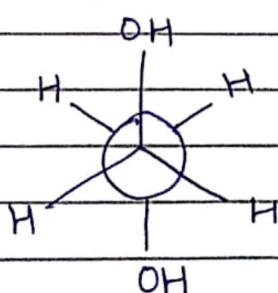
AIEEE-07

Gauche

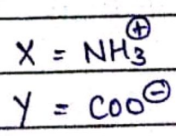
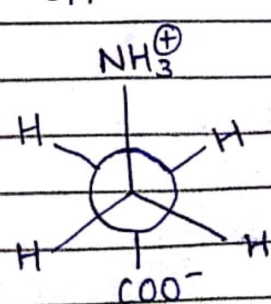
Stagg.

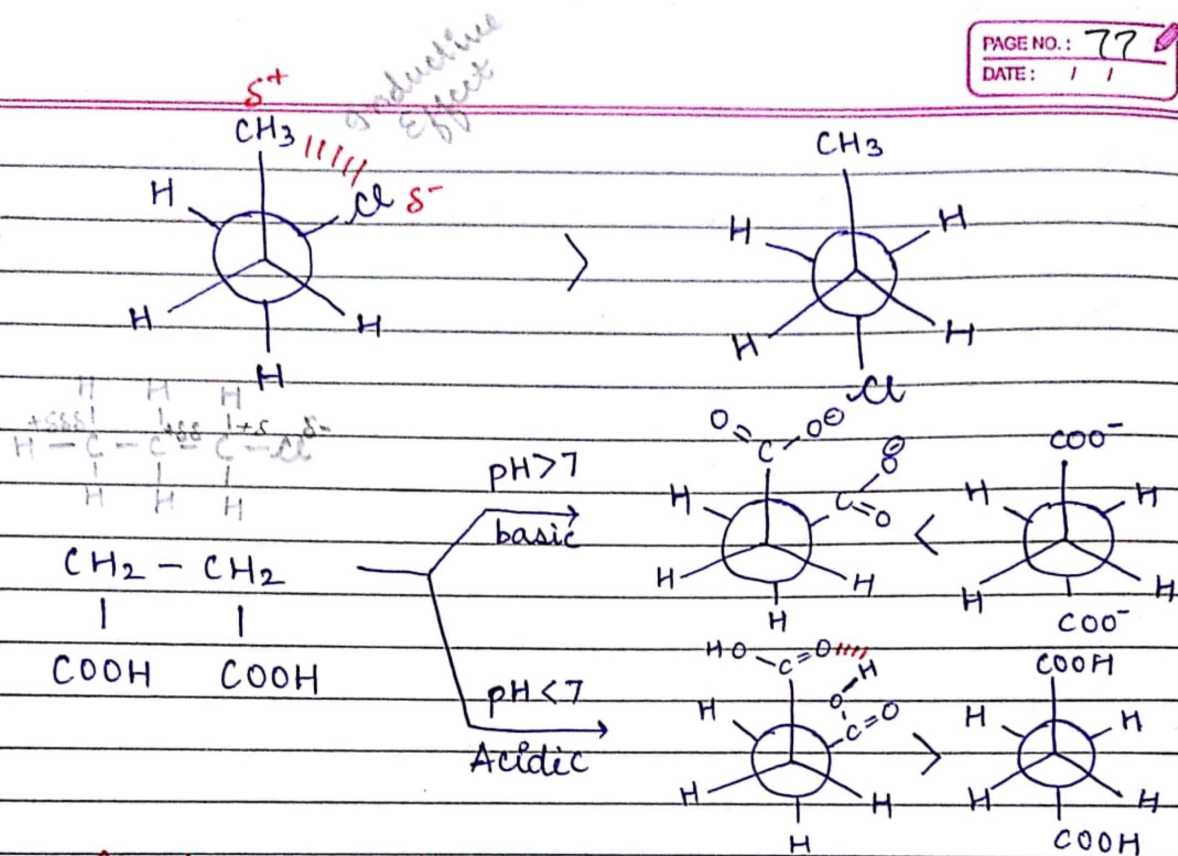


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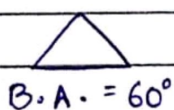
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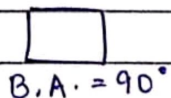


Conformers of Cyclohexane

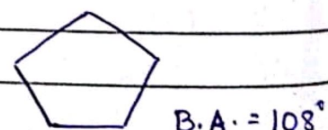
In open chain alkane $\rightarrow \text{C} + \text{sp}^3$ B.A. = $109^\circ 28'$



A.S. = $109^\circ 28' - 60^\circ$
= $49^\circ 28'$



A.S. = $109^\circ 28' - 90^\circ$
= $19^\circ 28'$



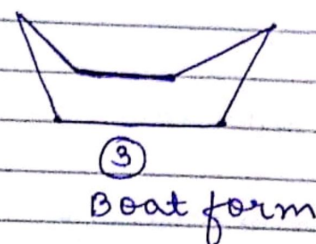
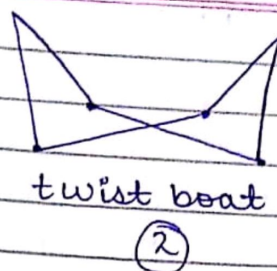
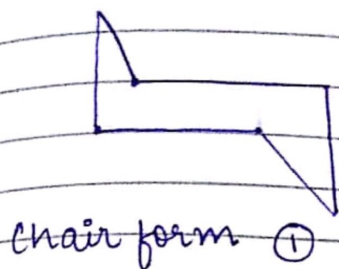
A.S. = $109^\circ 28' - 108^\circ$
= $1^\circ 28'$

due to angular strain, ,  &  do not

show conformational isomerism.
cyclohexane



B.A. = 120°
No A.S.
conformer $\checkmark$



Half chair

(4)

E → chair form < twist boat < boat form < half chair
Stab → chair form > twist boat > boat form > half chair

