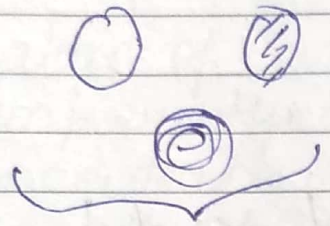
20/06/17

SBG STUDY

Optical Isomerism

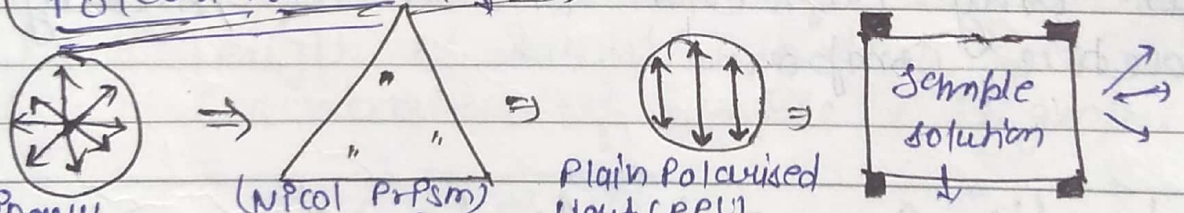


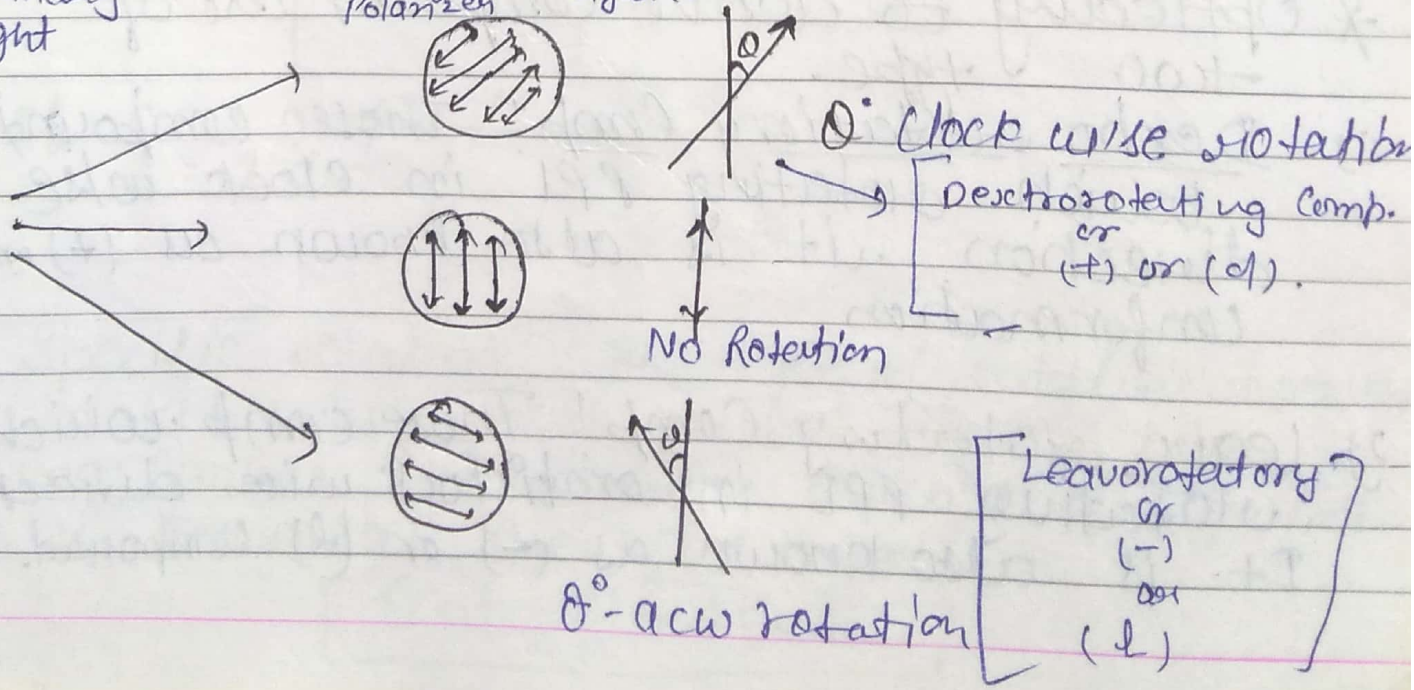
optical Isomerism

M.f : Same
Structural formula : Same
Behabour toward PPL : Different

The compound having same molecular formula, same structural formula but diff. behaviour toward plain polarised light are known as optical and the ~~fiton~~ phenomina as optical Isomerism

(Polarimeter device)





* ON the basis of behavior towards P.P.L Compound are of two type.
1) optically inactive compound.
2) optically active compound.

1) Optically inactive Compound:

Those comp. which not rotated PPL in any direction known as optically inactive.

2) optically active Compound:

Those compound which are rotating PPL in any direction known as optically active compound.

* optically active compound are of two type.
1) Dextro rotatory Comp: Those compound which rotating PPL in clock wise direction. it is also known as (+) or (d) conformation

2) Leavo rotatory Comp: Those comp. which rotating PPL in anticlock wise direction It is also known as (-) or (l) compound.

* Factors affecting angle of Rotation in PPL

1. Nature of Solvent. (should be inactive)
2) Nature of Compound.
3) Temperature
4) Concentration of Sample Solution. ($\theta \propto$ Concentration)
5) Length of Sample Tube. ($\theta \propto$ length of Sample tube).

$\theta \propto c$ -(i)

$\theta \propto l$ -(ii)

$\theta \propto c \cdot l$

$$\boxed{\theta = [\alpha] \cdot c \cdot l} \quad \text{-(iii)}$$

$[\alpha]$ → A constant k/a specific rotation.
l → length of Sample (in dm).
c → concentration of Sample (in gm/ml)

$$\boxed{\alpha = \frac{\theta}{c \cdot l}} \quad \text{-(iv)}$$

If $c = 1$ gm/ml
$l = 1$ dm
then $\alpha = \theta$

* Specific Rotation: The angle of rotation observed in PPL when it is passed throw 1dm long Sample tube having Solution of 1 gm/ml is known as specific Rotation

θ at fixed value.

A/b → Ex = 2
Raa ÷ 6

(C - g/m → 1 - dm)

cm
200 mm → 2dm

* Specific rotation for a Compound is always Constant.

Qu: 6gm of 2-Butanol is dissolve in 40ml to make 40ml solution. and when it is ~~Passed~~ Placed in a Sample tube of 200mm long. then angle of rotation observed is -4.05° then what will the Specific rotation of 2-Butanol.

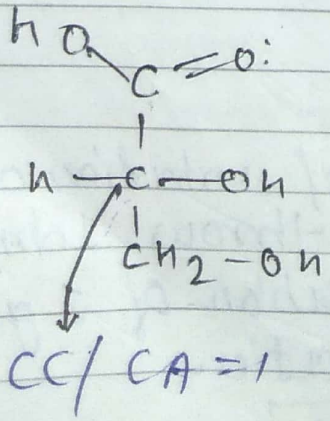
Ans $$\alpha = \frac{-4.05}{\frac{6}{40} \times 2} = -13.5°$$

* Basic Information for Optical Isomerism

1 chiral - atom / chiral centre : sp^3 hybridised atom with four different gp. is known as Chiral Atom / Chiral centre.

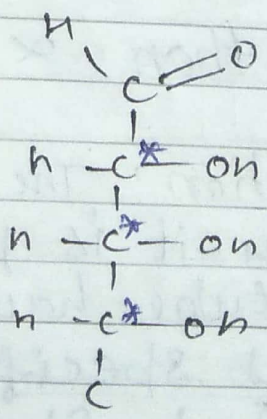
Condition:
1. four different gp.
2. sp^3 hybridisation.
3. l.p also count in ~~atom~~

Ex: (1)



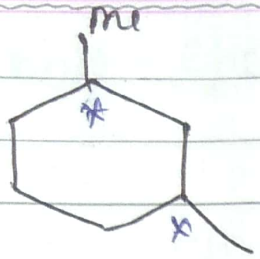
CC / CA = 1

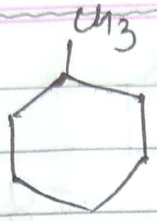
(2)

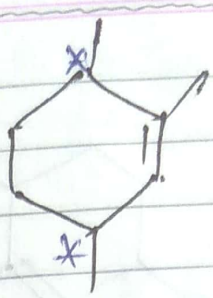


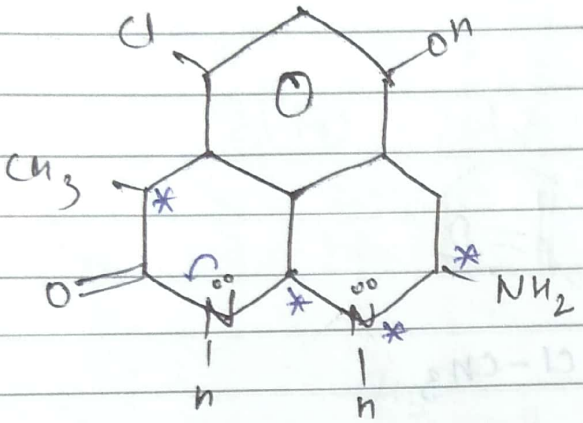
CC = 3

H.W ⊥ A/b ⇒ Ex = 3 . J.M = Complex

(3) 

(4) 

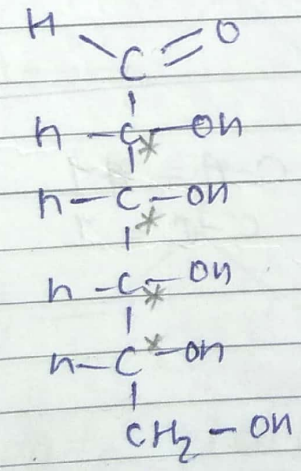
(5) 

(6) 

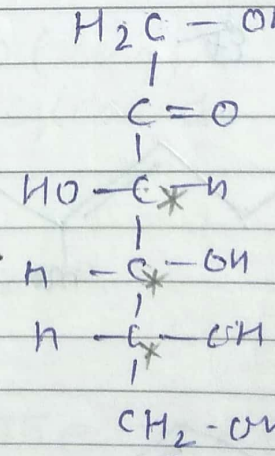
Chiral atom = 4
Chiral carbon = 3
= Chiral centre = 4

Note: The lone pair participate in Resonance does not count in chiral ~~desid~~ decide.

Que: decide ✱ chiral atom / chiral carbon in following structure.

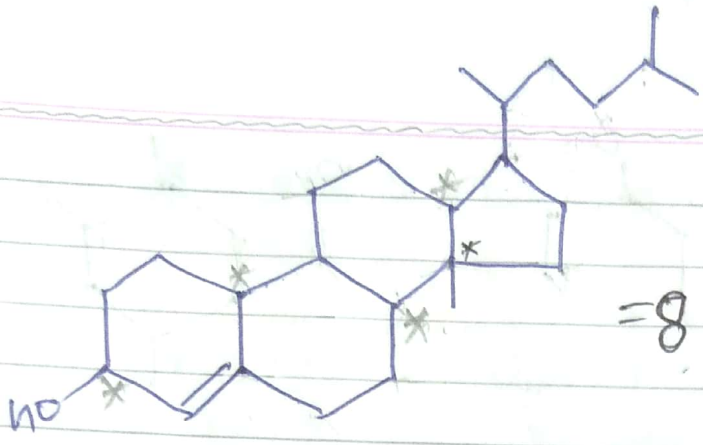
(7) 

D-Glucose.
4

(8) 

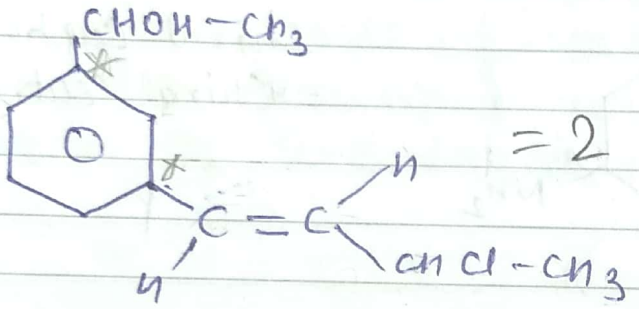
2-fructose
3

(9)



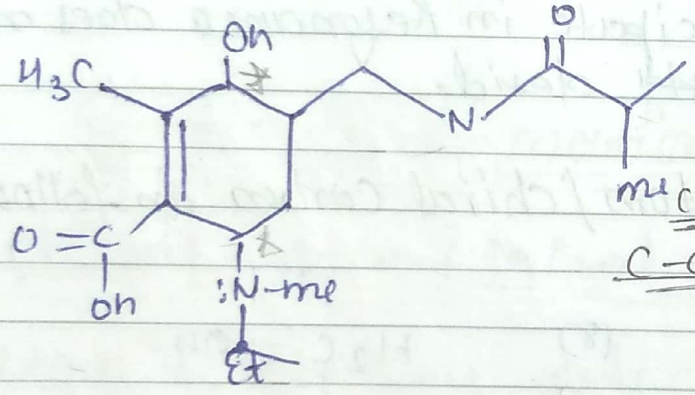
= 8

10)



= 2

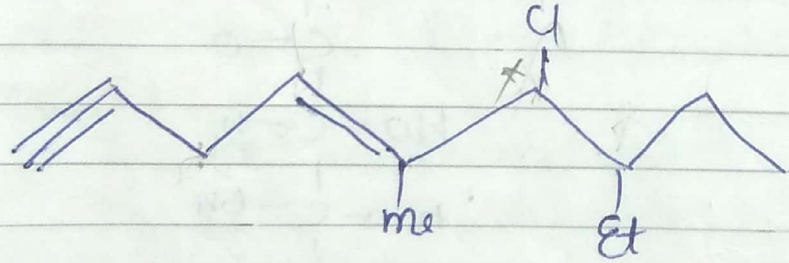
(11)



C.A = 4

C-C = 3

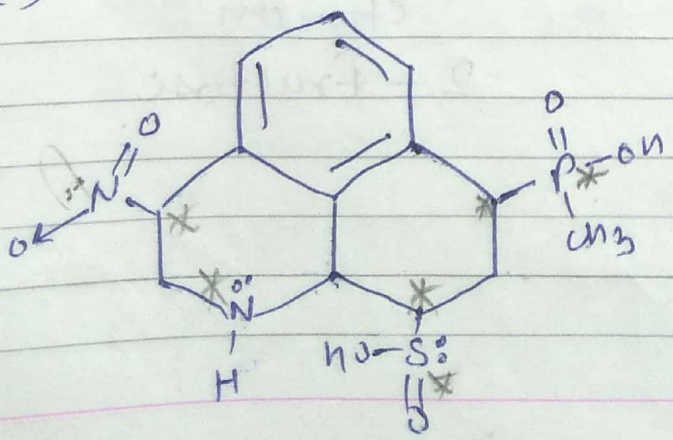
(12)



C-A = 1

C-C = 1

(13)



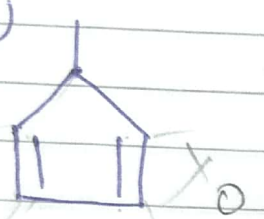
= C.A = 7

C-C = 4

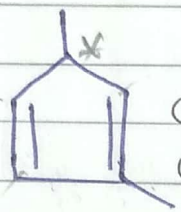
(14) $COOH - CHOH - CHOH - CH_2OH$ = C-A = 2, C-C = 2

15) $HOOC - CH = CH - COOH$, O

(16)

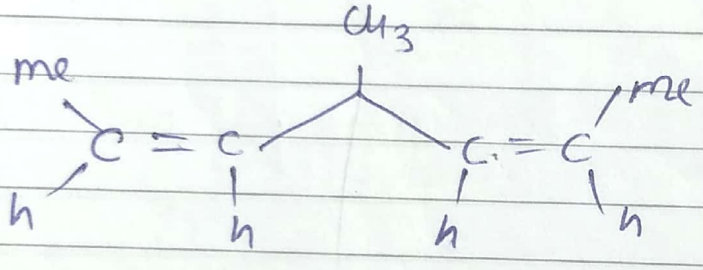


(17)



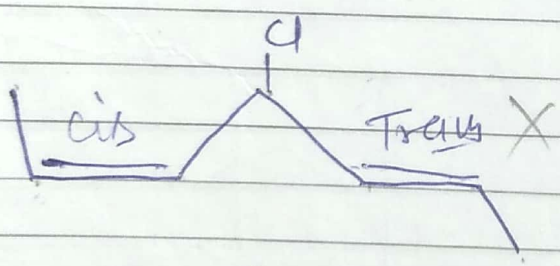
CA = 1
C-C = 1

(18)



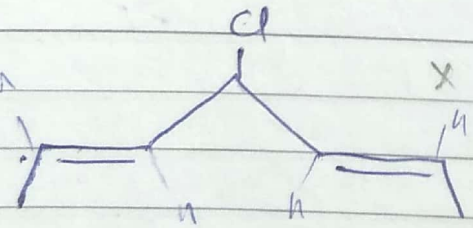
O (zero)

(19)



O (zero) X
C-C/CC = 1

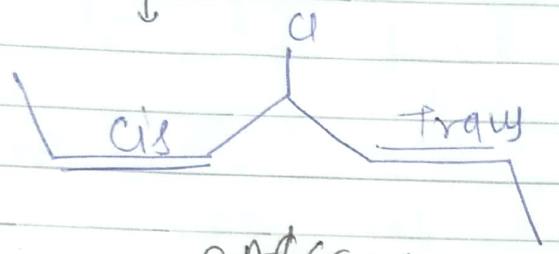
(20)



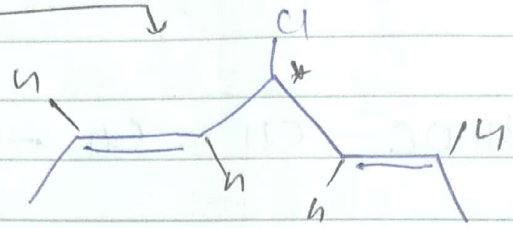
O (zero

* Pseudo chairal atom: The carbon of such chirality depends on stereo chemistry of Attached gp. is known as Pseudo chairal atom.

Eg: $CH_3-CH=CH-\underset{\displaystyle Cl}{CH}-CH=CH-CH_3$



CA/CC = 1



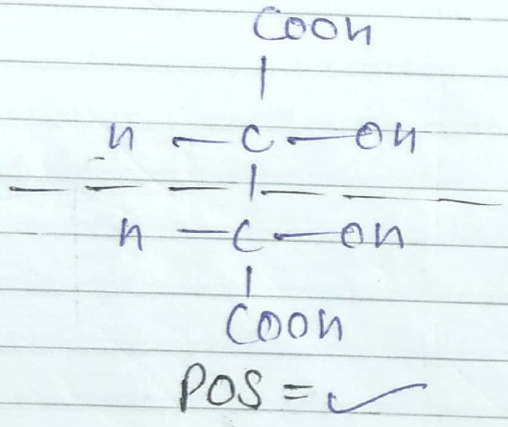
CC/CA = 20

* Elements of Symmetry :

	Symbol	Sh-
→ Plane of Symmetry	(σ)	→ POS
→ Centre of Symmetry	(Ci)	→ COS
→ Alternating Axis of symmetry	(S_n)	→ AAOS
→ Axis of Symmetry	(C_n)	→ AOS

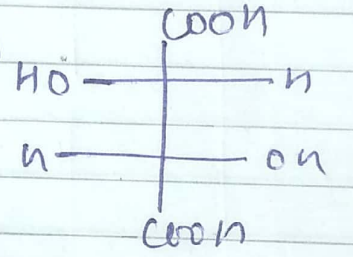
* Plane of Symmetry : (POS) → (σ) :

(1)



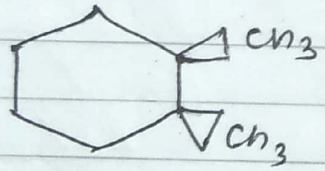
POS = ✓

(2)



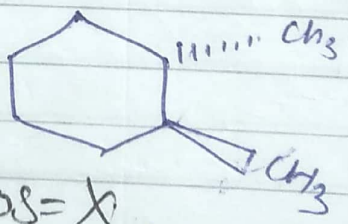
Pos = ✗

(3)



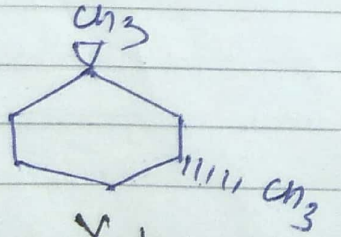
POS = ✓

(4)

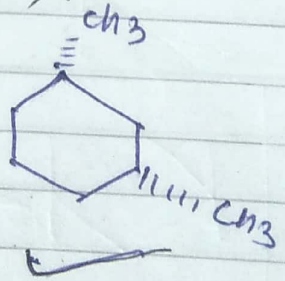


POS = ✗

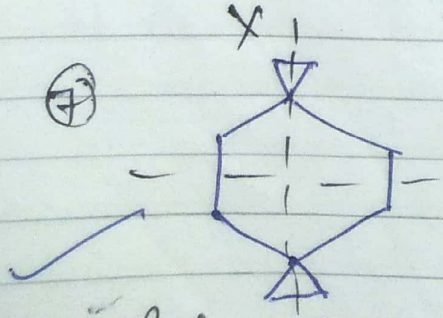
(5)



(6)

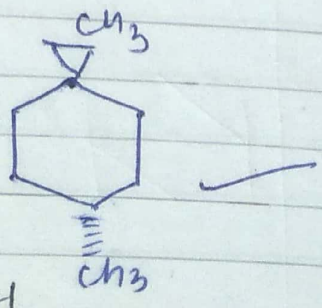


(7)



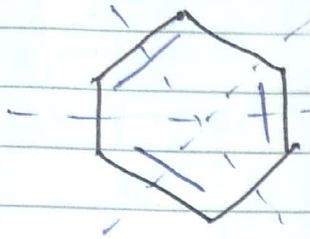
POS = 2

(8)



POS = 1

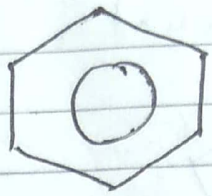
(9)



POS ⇒ 4

R.S of Benzene

(10)

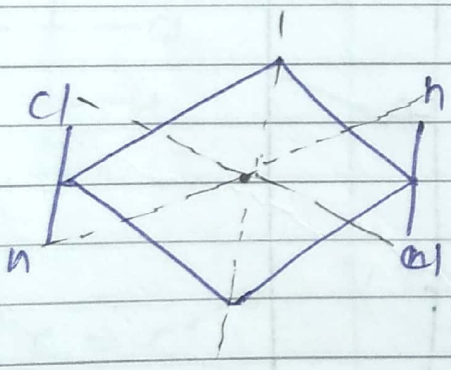


(7)

R.H of Benzene

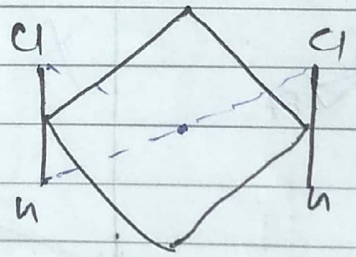
* Planar system always have slice Plane of Symmetric

* Centre of Symmetry = (centre of Inversion)
(CoS) → (Ci)



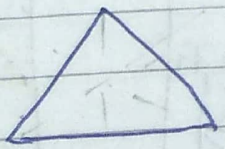
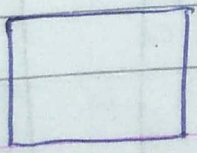
CoS = ✓

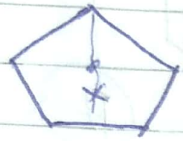
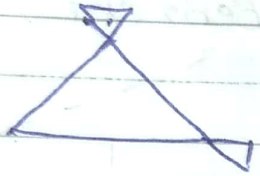
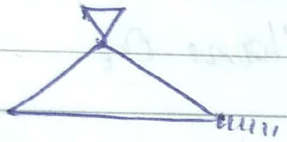
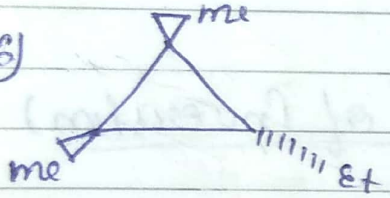
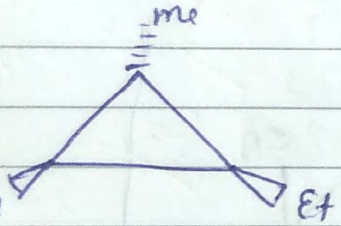
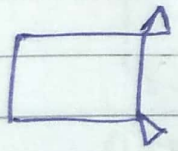
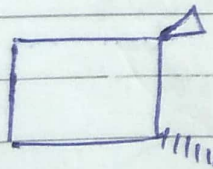
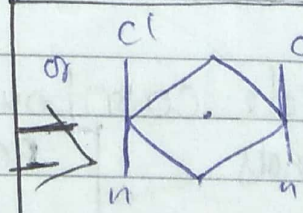
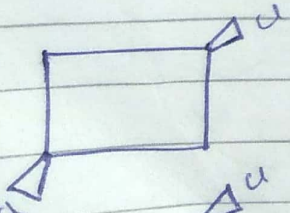
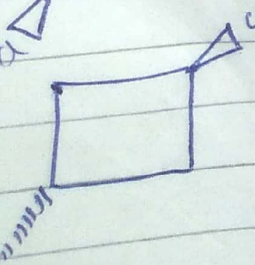
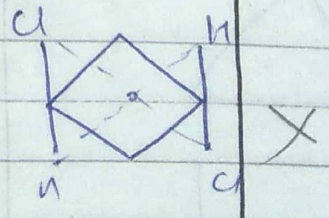
Trans-1,4-DCCB

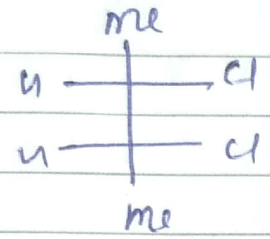
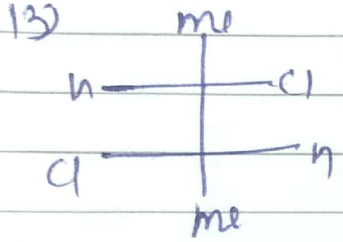
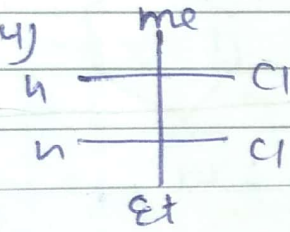
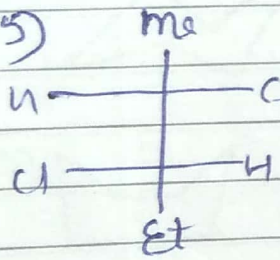
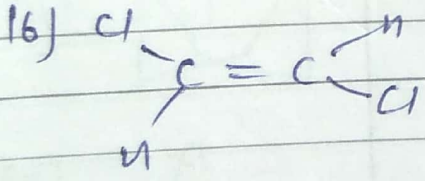
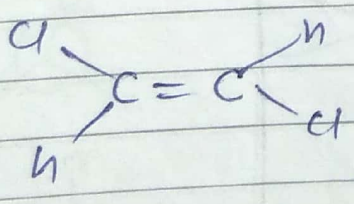
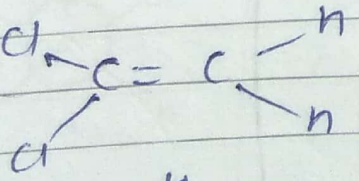
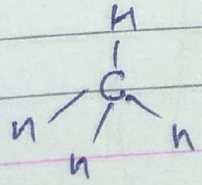


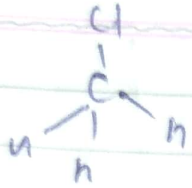
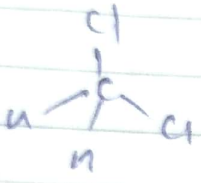
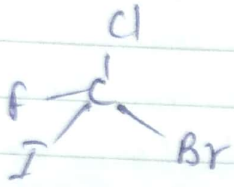
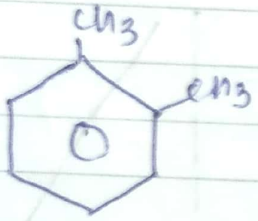
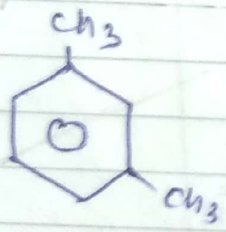
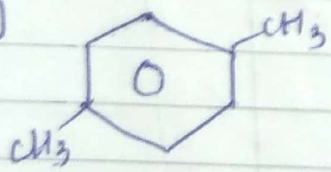
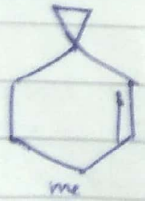
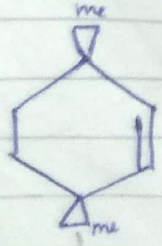
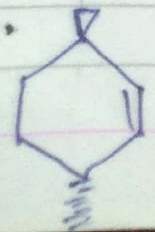
CoS = X

Que: Decide compounds

compounds	POS	CoS	chiral OC
1) 	✓ 4	X	X
2) 	✓ 5	✓	X

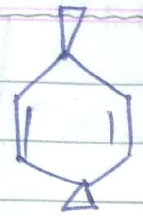
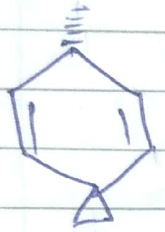
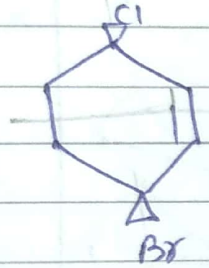
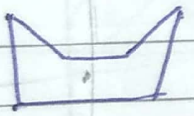
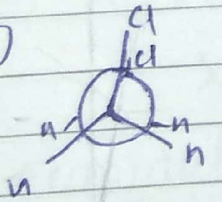
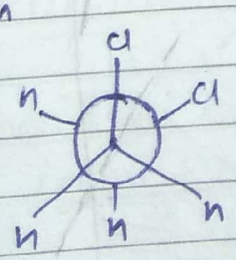
Compound	Pos	Cos	Chiral
3) 	✓ 5	X	X cot g
4) 	✓	X	X
5) 	X	X	✓
6) 	✓ 1	X	X
7) 	X	X	✓
8) 	✓	X	X
9) 	X	X	✓ 
10) 	✓ 2	X	X
11) 	✓ 1	~~✓~~ 1	X 

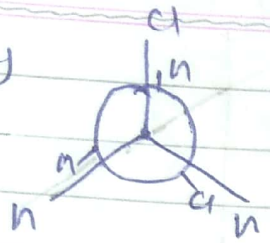
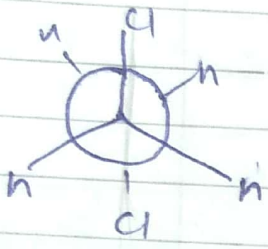
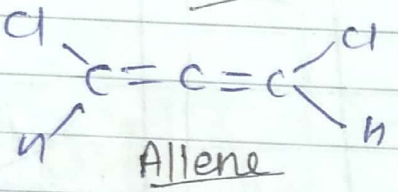
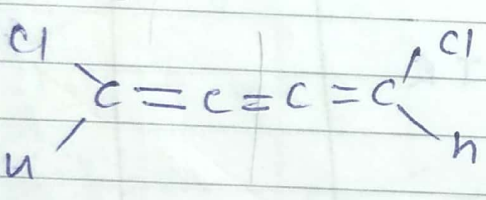
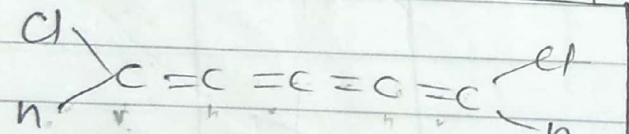
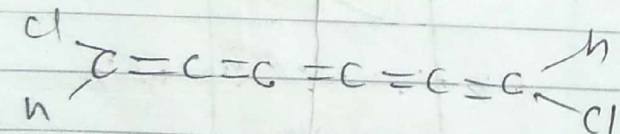
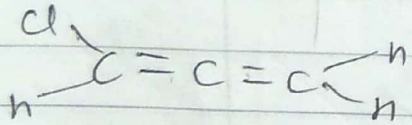
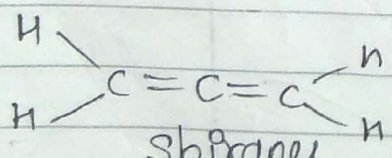
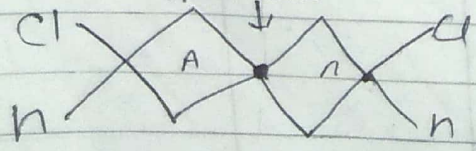
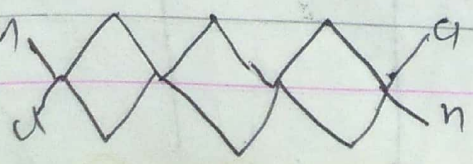
	Pos	Cos	Chiral o.a
12) 	✓	X	X → ✓ (S/A = Cos)
13) 	X	X	⇒ Open chain non planar system has no COS Generally. Cis system has no Cos. sp^3 hybridisation no Cos. (non Planar)
14) 	X	X	✓
15) 	X	X	✓
16) 	✓ =2	X	X
17) 	✓ =1	✓	⇒ X
18) 	✓ =2	X	X
19) 	✓ =6	X	X

	Pos	Cos	Chiral Oa
20) 	=3	X	X
21) 	=2	X	X
22) 	X 0	X	✓
23) 	=2	X	X
24) 	=2	X	X
25) 	=3	✓	X
26) 	X	X	✓
27) 	1	X	X
28) 	X	X	✓

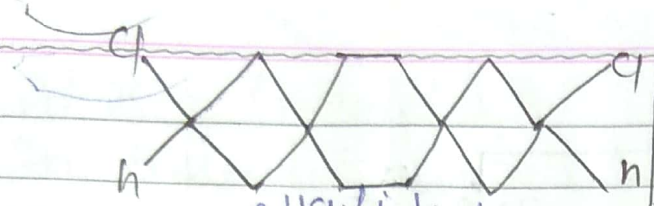
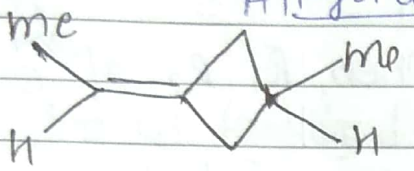
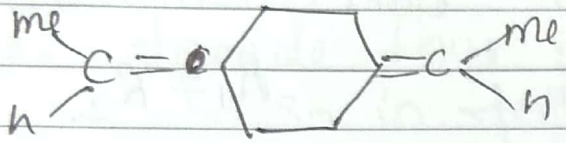
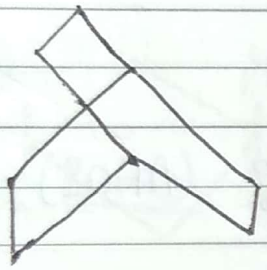
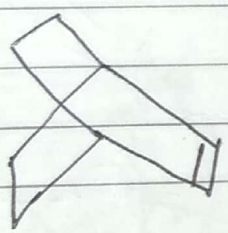
Cis => Neither POS

Trans => Both

		POS	COS		Chiral
					Oa.
29)		✓ 2	X	⇒ because cis	X
30)		✓	✓ ~~X~~	-	X
31)		X	X	⇒	✓
32)		~~X~~ ✓	X	= MTR	X
33)		✓ 2	X		X
34)		X	X		✓
35)		✓	X		X
36)		X	X		✓

	Pos	Cos	Chiral
37) 	X	X	—
38) 	✓	✓	X
Cummulenes			
39)  Allene	X	X	—
40) 	✓	X	X
41) 	X	X	—
42) 	✓	✓	X
43) 	✓	X	X
44)  **Spirane**	✓	X	X
45) 	X	X	—
46) 	✓	✓	X

H·W = JM & JA.

	Pos.	Cos.	Chiral Ca
47)  Allcylidene	✓	X	X
48) 	X	X	✓
49) 	✓	X	X
50) 	=4 ✓	X	X
51) 	=2 ✓	X	X
52) Screw	X	X	✓
53) Kid's tricycle	X	X	✓
54) ceiling fan	X	X	✓
55) Hockey ~~sbr~~ stick.	X	X	✓

* cummulenes / sprane / Alkylidene:

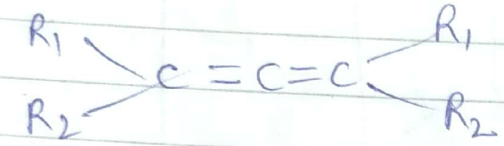
When total no. of dB/cycle/cycle + db. → odd No. → Planar system → Pos (v)

When total no. of db/cycle/cycle + d_b → even no. → Pos ↓ x → when valency of terminal-c one diff. → R_1 → Pos ↓ = v

even no.

POS ✗ → POS ✓

When valency of terminal-C are different



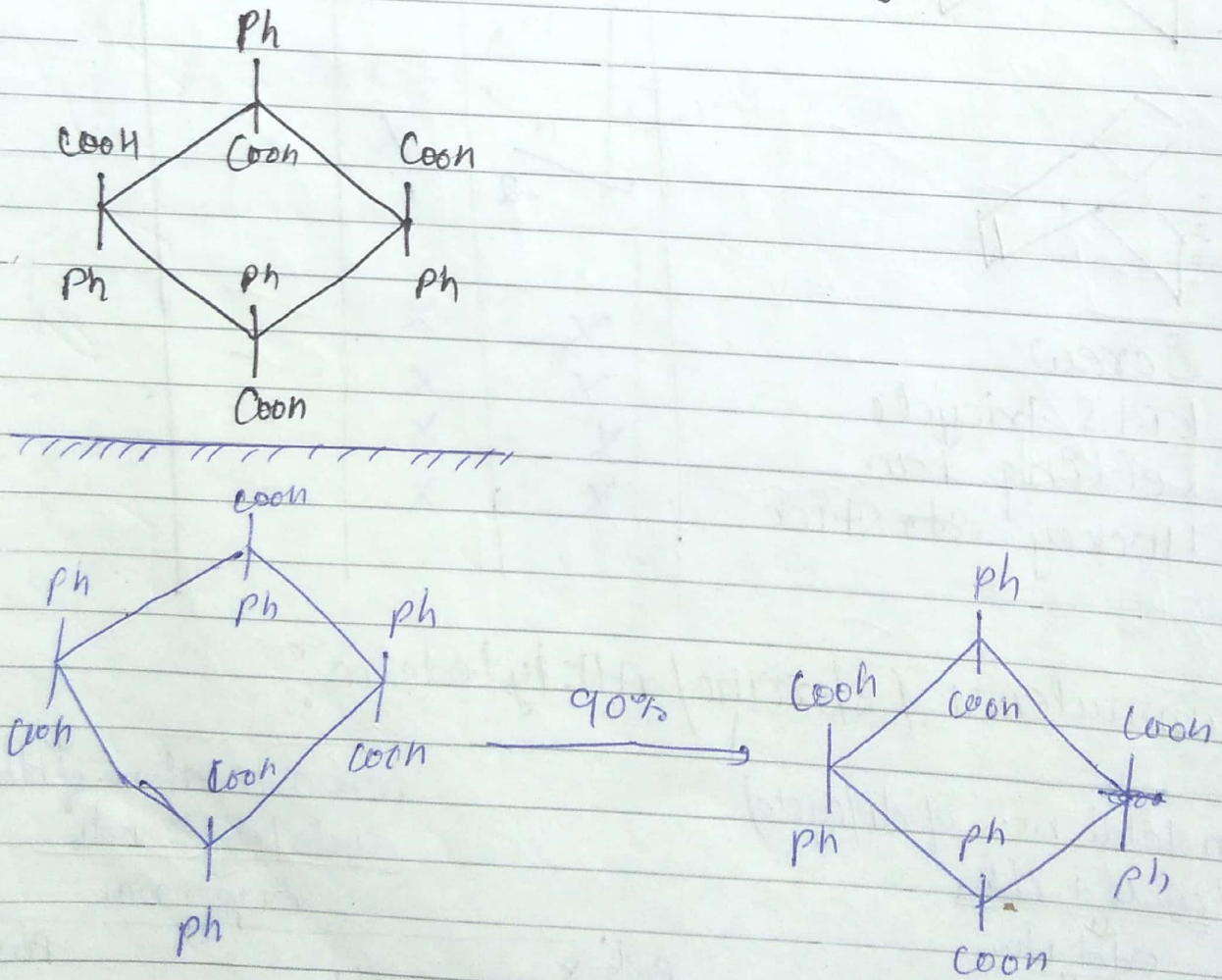
$R_1 \neq R_2$ $R_1 \neq R_2$

when R_1 R_2 of ~~2nd~~ C are both carbon are same

$R_1 = R_2$

✱ Alternating axis of symmetry :- (AAOS) → S_n :-

NCP

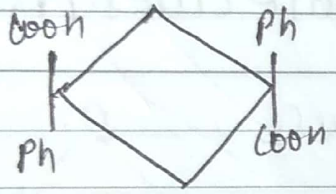


- AAOS Present
- Sn Present = (n = 7)
- $n = \frac{360}{90} = 4$
- ↳ four fold AAOS (S_4)

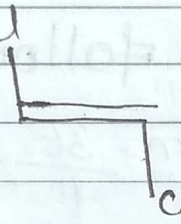
{ Those Comp. which have either POS and COS have AAOS. }

Que: decide four fold AAOS
↳ Sn in following molecules

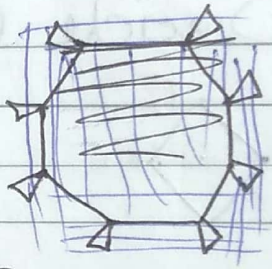
1.



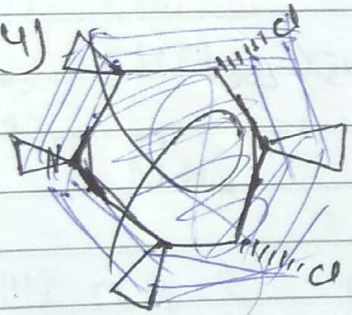
(2)



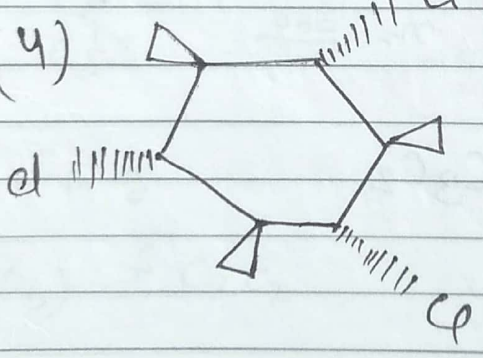
(3)



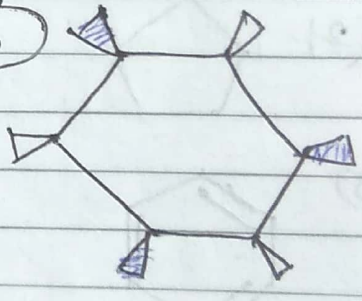
(4)



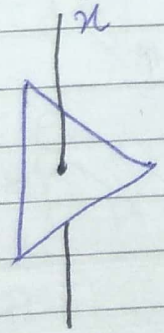
(4)



3

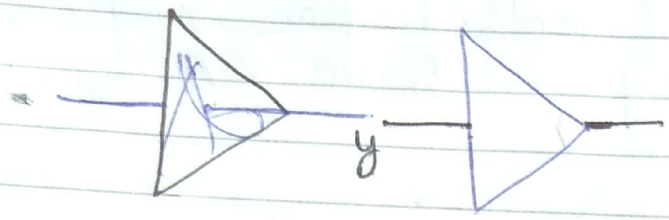


✱ Axis of Symmetry: (AOS) → C_n



- Along n Axis
  - AOS = V
  - C_n = ?
  - $n = \frac{360}{\theta} = \frac{360}{120} = 3$

Three fold AOS - C_3



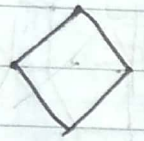
Along Y-axis

AOS = ✓

- $n = \frac{360}{180} = 2$
- $C_n = C_2$

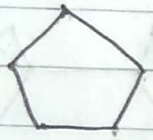
Total $C_n = C_1, C_2, C_3$

* Decide C_n in following molecules (f.M)

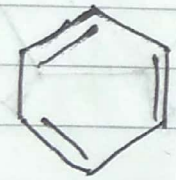
(1) 

4 2 → $n = \frac{360}{90} = 4$ $C_4 C_2$

→ $\frac{360}{180} = 2$

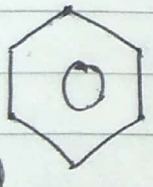
(2) 

→ $n = \frac{360}{}$ ✗ $C_5 C_2$

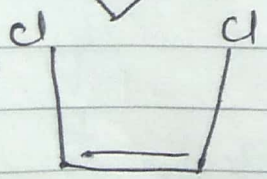
(3) 

$C_3 C_2$ 6 → $\frac{1}{2}$

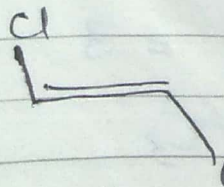
Res. 3 of Benzene

4) 

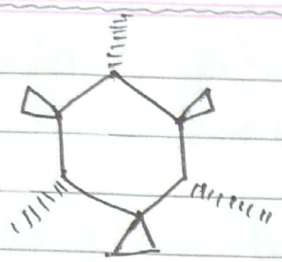
$C_6 C_2$

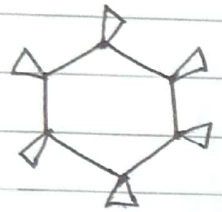
5) 

C_2

(6) 

C_2

7)  $C_3 C_2$

8)  C_6

9) $H-H$ C_∞

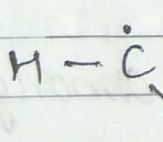
10)  C_2

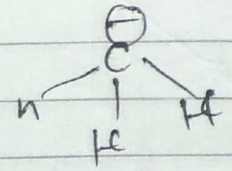
11) CH_4 → C_3, C_2

12) $CHCl_3$ → C_3

13) $\ddot{N}H_3$ C_3

14) $O=\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}$ (SO_3) → $C_3 C_2$

15)  (CH_3) $C_3 C_2$

16)  (CH_3) C_3

17) CH_3 $C_3 C_2$

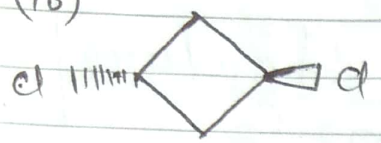
Linear Structure
C_∞, C_2

→ Tbl P. → C_3, C_2
→ Tetrahedral : C_3, C_2
→ Pyramidal : C_3
→ V-shaped : C_2.

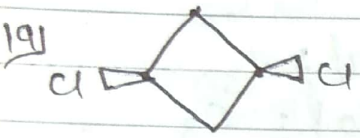
Essential Condition of optically active.

H.W:- Race ÷ 6.

(18)



C_2 Trans

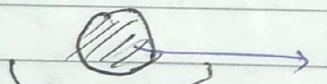
19] 

C_2

20] $\overset{\oplus}{N}H_4$ C_3C_2.

* **Note:-** Essential Condition for optically active those compound which have neither POS nor AAOS nor COS are optically active.

* All optically compound are known as chiral, dissymmetric compound.



→ chiral compound / Dissymetric comp

POS = X
COS = X
AAOS = X

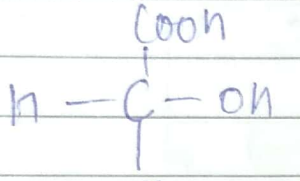
Que:- Identify optically chiral/active compound among following.

Que 1 — 55 Que

~~Cons~~ Conformational

Detail study for 1 Chiral or 2 chiral atoms compounds.

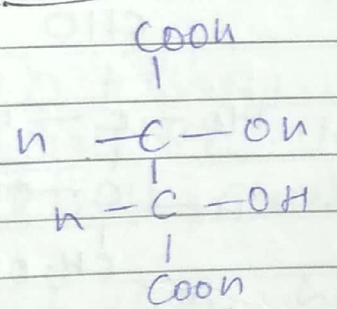
* Single Chiral (c)atom. compounds :-



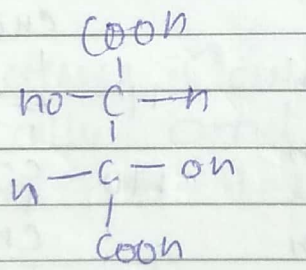
Pos = X
Cos = X
OA / chiral.

Single chiral atom compound are always optically active.

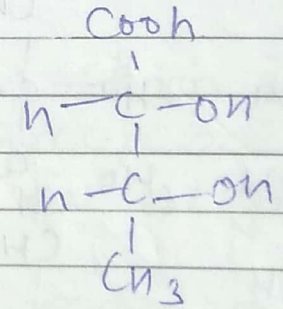
* Two chiral compound :-



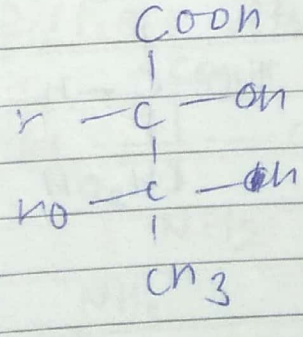
Pos = ✓
OA / chiral



Pos = X
Cos = X
OA chiral



=11



=11

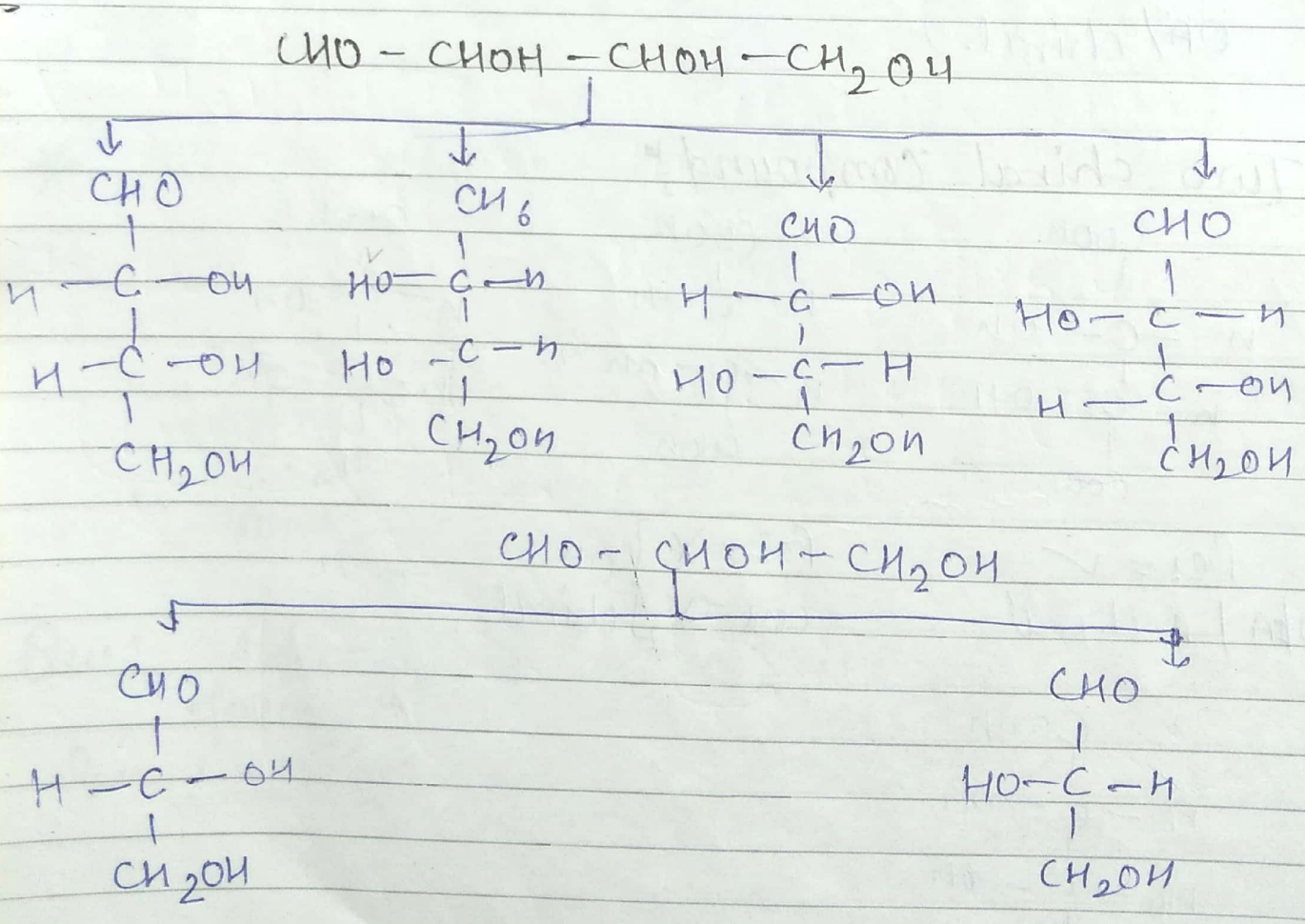
H.W: Rack:7

V. Very. Important.

* Method of representation of molecules:

1. Ball stick.
2. Wedge & dash
3.
4.

5] Fisher projection formula:



— COOH

Oxidation State : No. of O.A = OA $\propto$ O.S

↳ No. of H.A = HA $\propto \frac{1}{O.S}$

↳ (+)ve charge = (+)ve charge ↑, OS ↑

↳ (−) " " = (−)ve " ↑ O.S ↓

Q. $-CH_3$ $-CHO$ $-CH_2-OH$ $-COOH$

OA	0	1	1	2
HA	3	1	3	

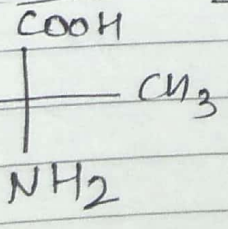
Ans: $-COOH > -CHO > -CH_2OH > -CH_3$

* In fisher structure Carbon chain are written vertically and group on chiral carbon either left or right.

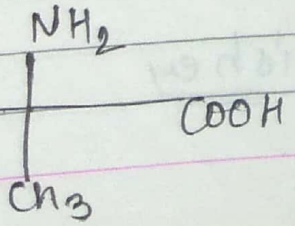
* In Fisher projection formula more oxilised end must be at top.

Q. Which of the following structure(s) is/are fisher structure:-

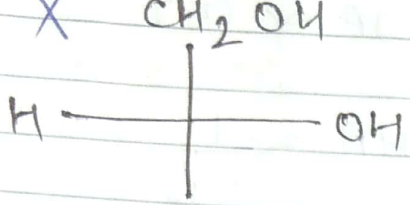
1. ✗



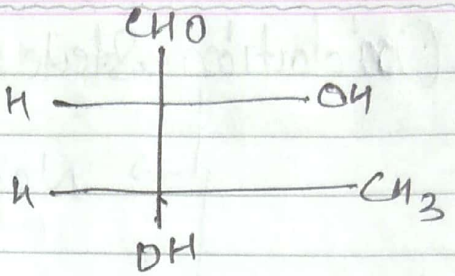
2. ✗



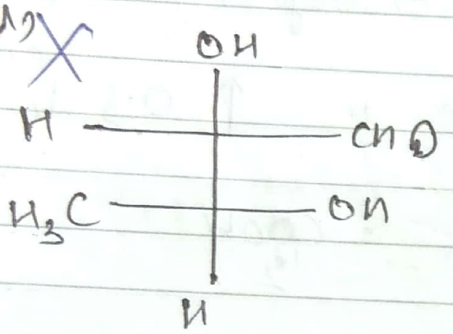
(iii) ✗



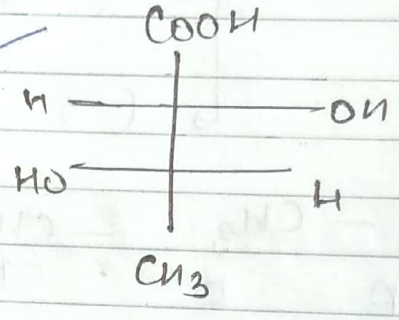
(iv) ✗



(ii) ✗



(v) ✓

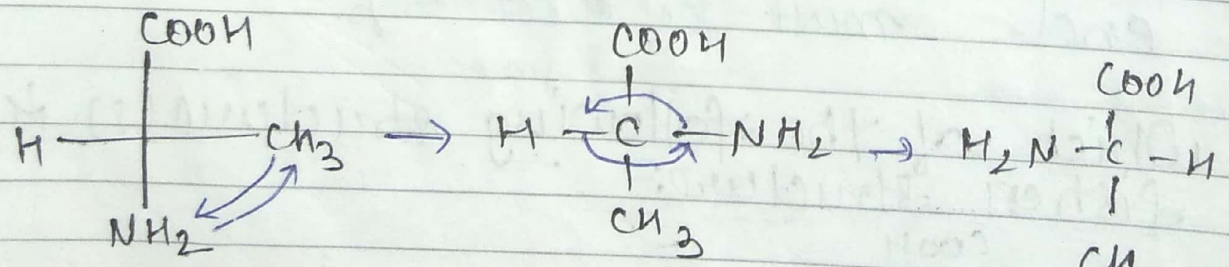


* Method to convert different structure into fisher structure :

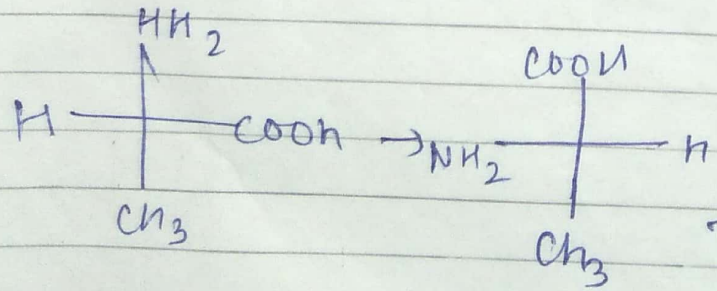
1. from 2D non fisher to fisher :-

Freedom → even interchange on each C. on
→ 180° Rotation

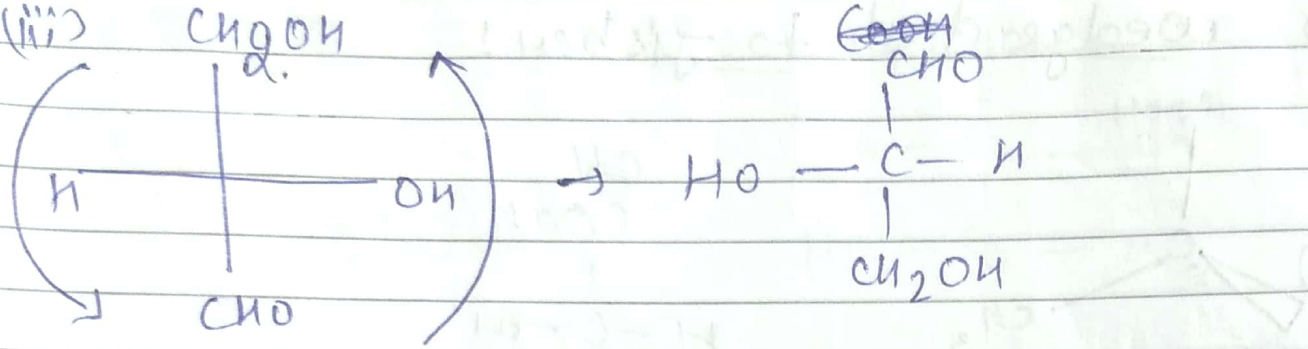
(i)

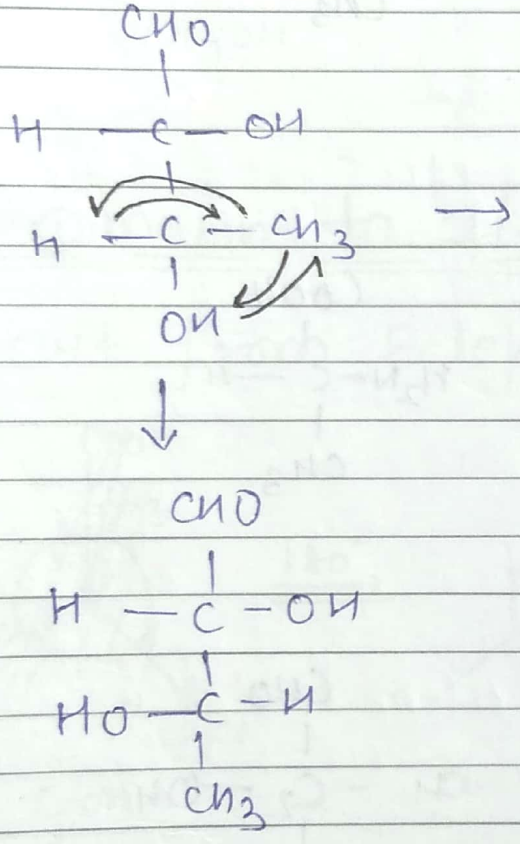


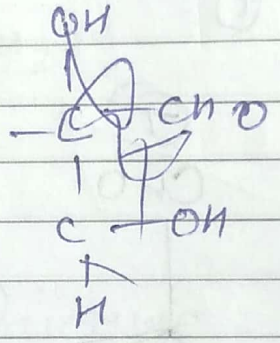
(ii)

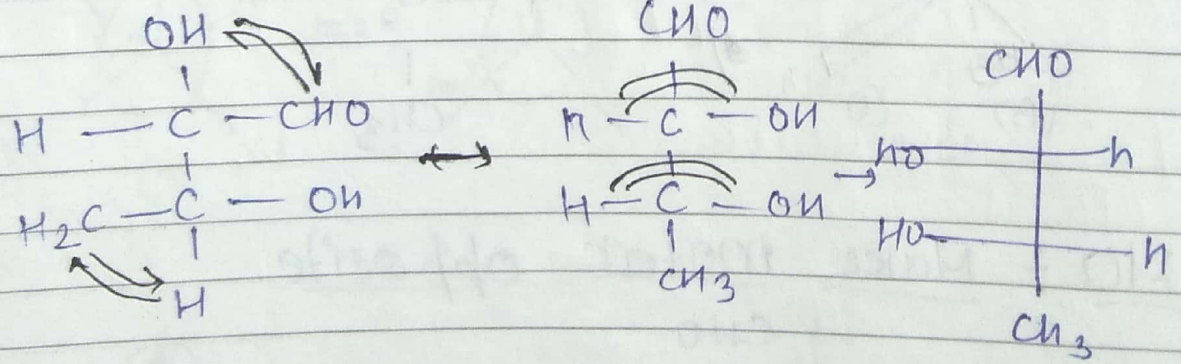


Fisher

(iii) 
CH2OH
H
OH
CHO
COOH
CHO
HO
H
CH2OH

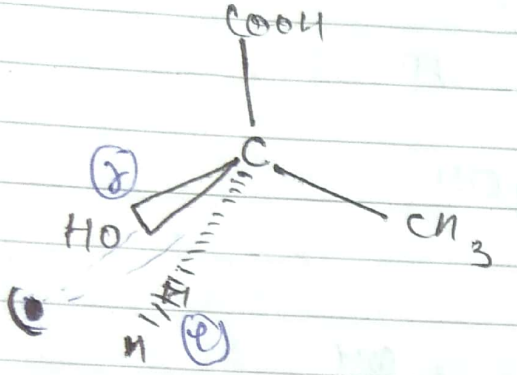
(iv) 
CHO
H
OH
H
CH3
OH
CHO
H
OH
HO
H
CH3

(vi) 
OH
CHO
C
OH
H

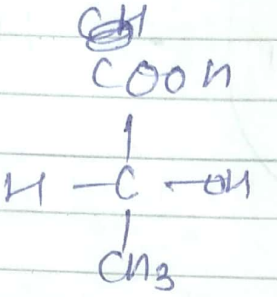
(v) 
OH
H
CHO
H2C
H
CHO
H
OH
H
OH
CH3
CHO
HO
H
HO
H
CH3

* For wedge dash to fisher!

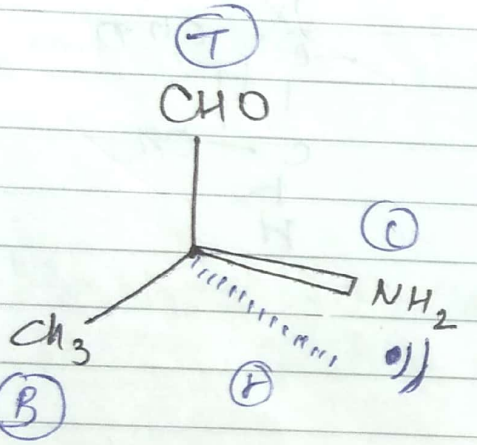
(1)



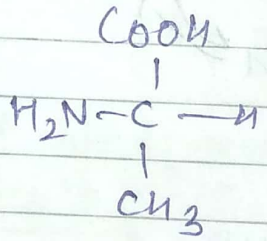
≡



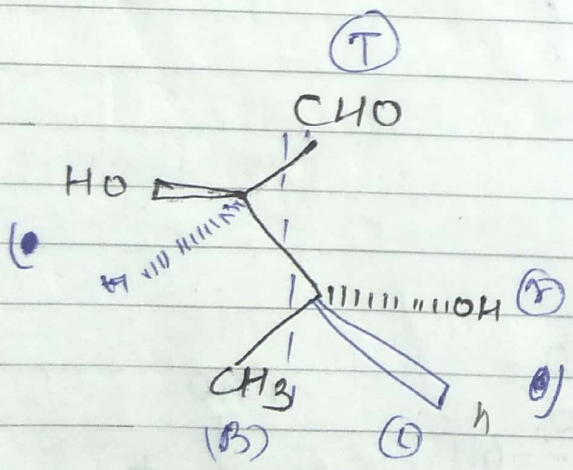
(2)



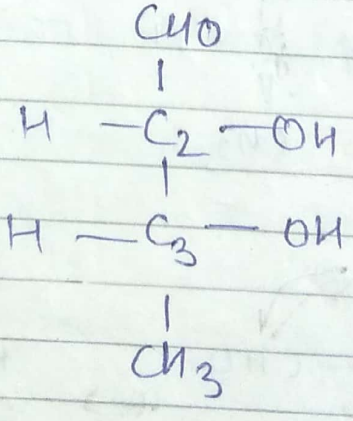
≡



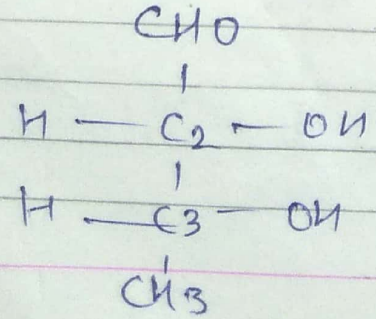
(3)



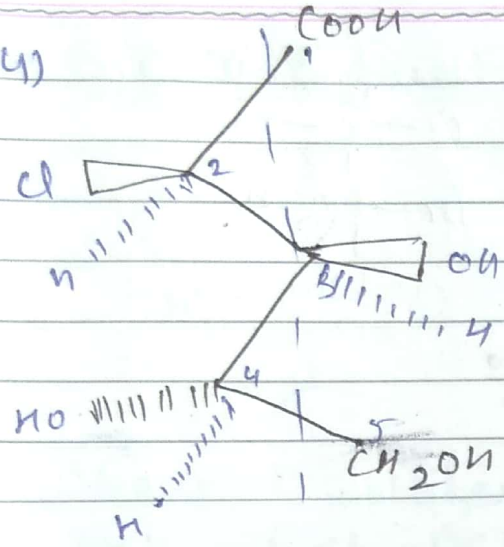
≡



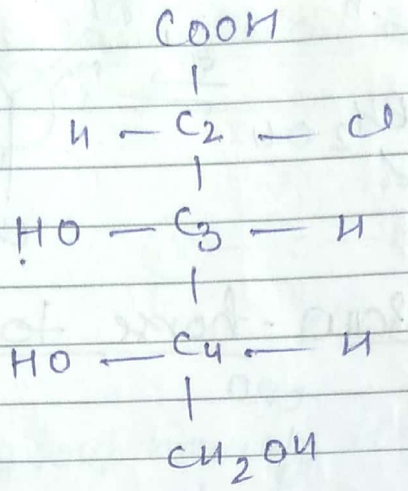
* MMO : Make molar opposite.



(4)

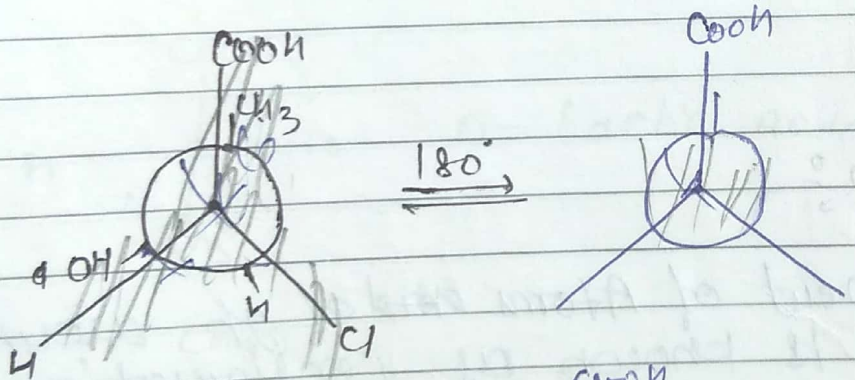


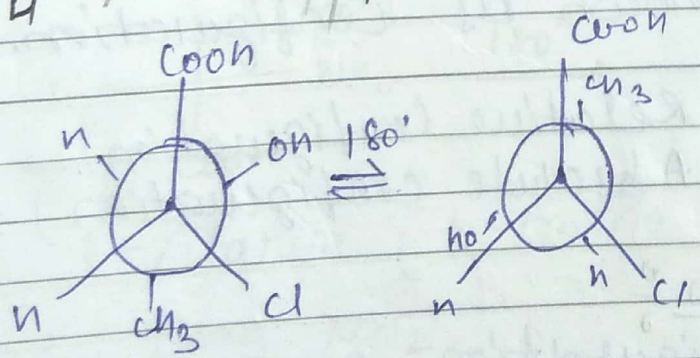
=

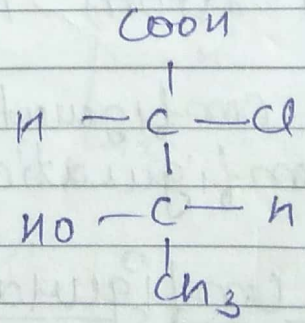


* Neumann to Fisher :

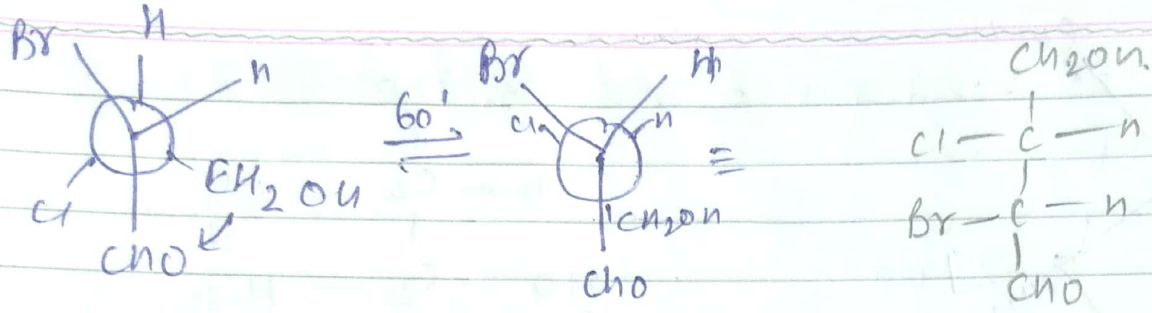
Start from Eclipsed structure



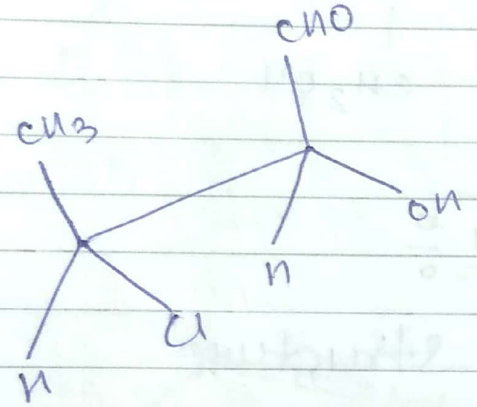




(2)

2) 

* From Saw-horse to fisher :



→ NM → fisher.

* Configuration :

The arrangement of Atoms and of gp around chiral atom is known as configuration.

1) D/L configuration. (Relative configuration).
2) R/S configuration. (Absolute configuration)

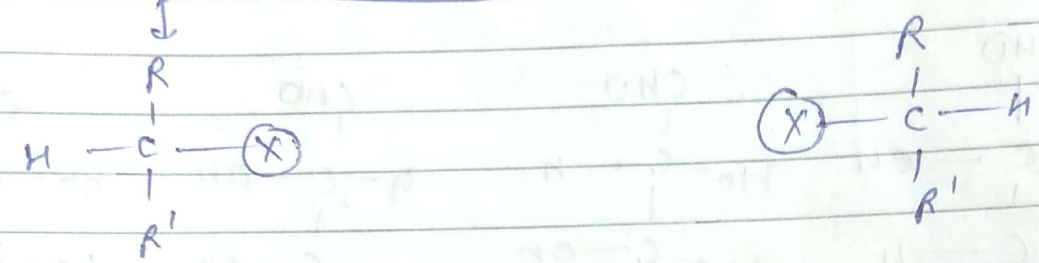
* D/L configuration :

D/L always configuration see only fisher ~~Con~~ structure

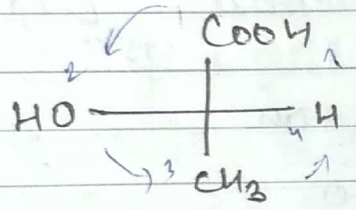
O_2

* D/L configuration in comp. having 1 chiral atom :

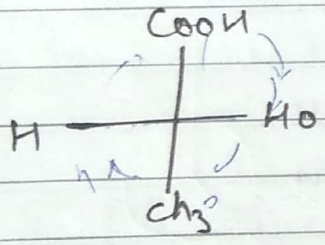
L $R-\overset{*}{C}HX-R$



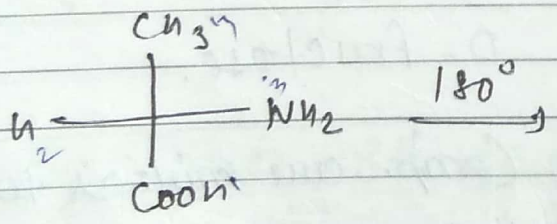
where X = Hetero atom / group having Heteroatom.
Ex: -F, -Cl, -Br, -I, -OH, $-NH_2$ etc.

Q. 

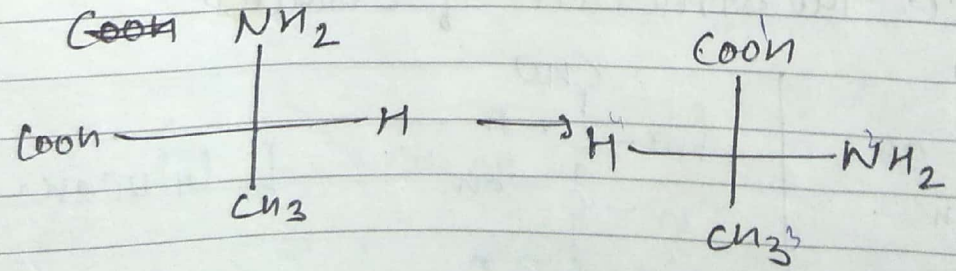
L-Lactic acid.

Q. 

D-Lactic acid

Q. 

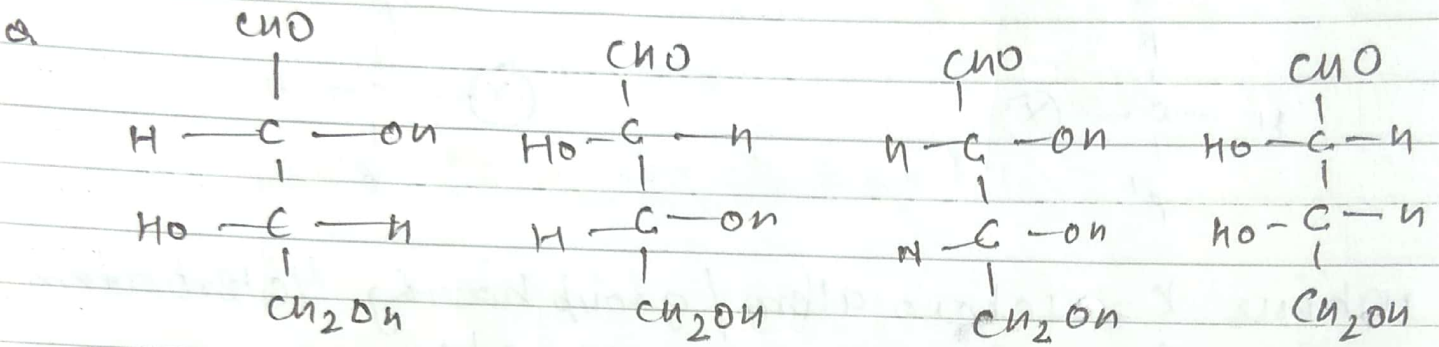
l-Alanine (L-Amino acid).

Q) 

D-Amino acid (D-Alanine

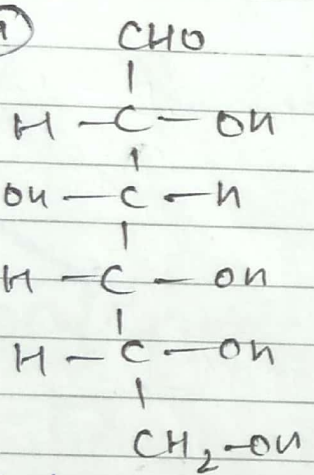
O_3 ~~only maths~~ only Advance

* D/L Configuration in Comp. having more than one chiral atom :



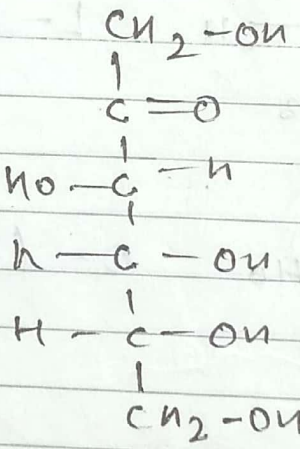
Threo L-Tetrose. Threo D-Tetrose Erythro D-Tetrose Erythro L-Tetrose

Que: (9)



D-Glucose.

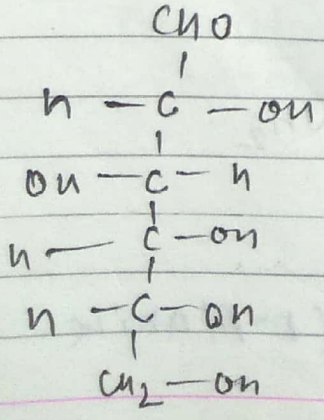
(10)

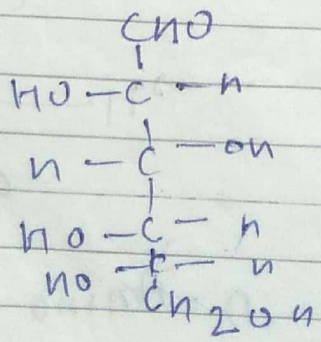


D-Fructose.

Note: D/L Isomer of any Comp. are mirror image to each other.

Que: make the Structure of L-Glucose.

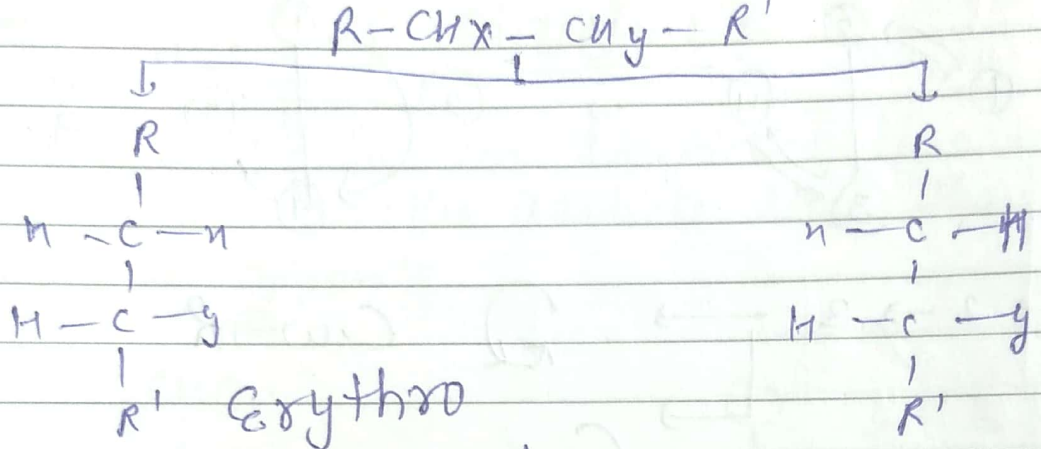




L Glucose

cis Trans

* Erythro / Threo configuration :



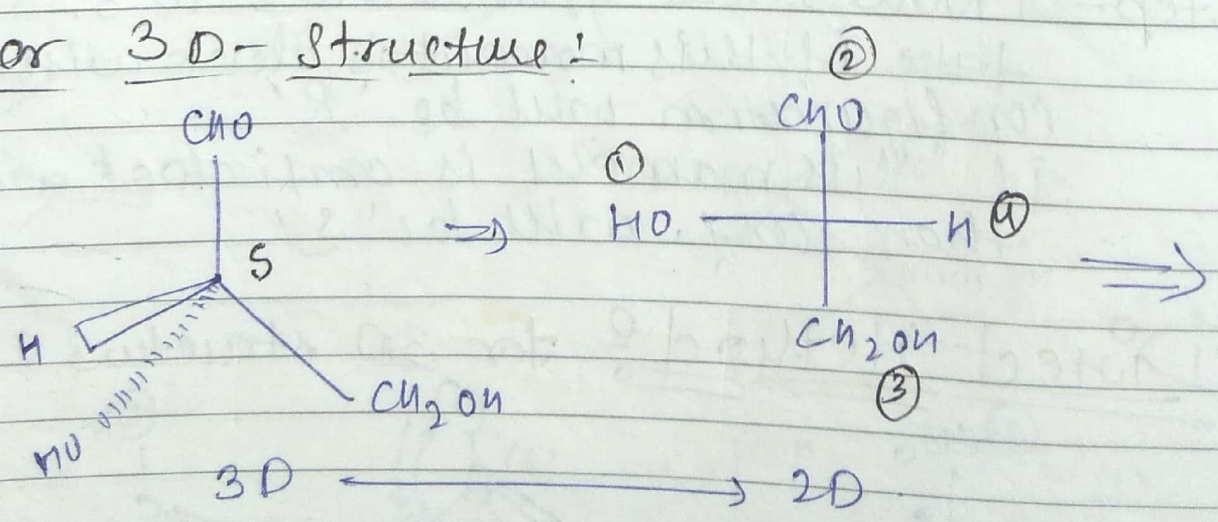
Not in Relvanced

* R/S Configuration :

With the help of R/S configuration the configuration of each metal can be decided

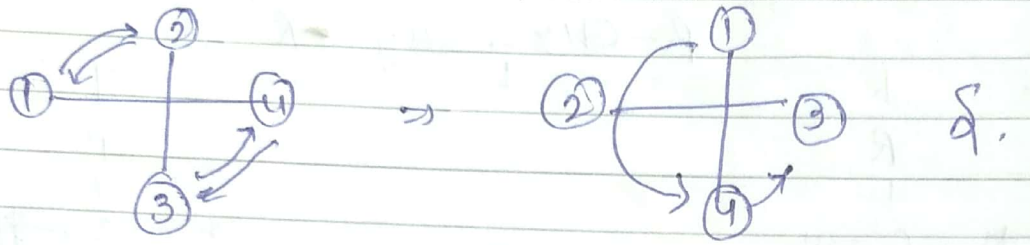
'R' ⇒ Rectus ⇒ CW / RHS
'S' ⇒ Sinister ⇒ ACW / LHS.

(A) for 3D-Structure :



1)

(2) Decide Priority of atom or gp. ⇒ 4 are vertical.
(3) Move from 1 → 2 → 3. anyone



1 → 2 → 3 ⟶ C.W ⇒ R

aCW ⇒ S

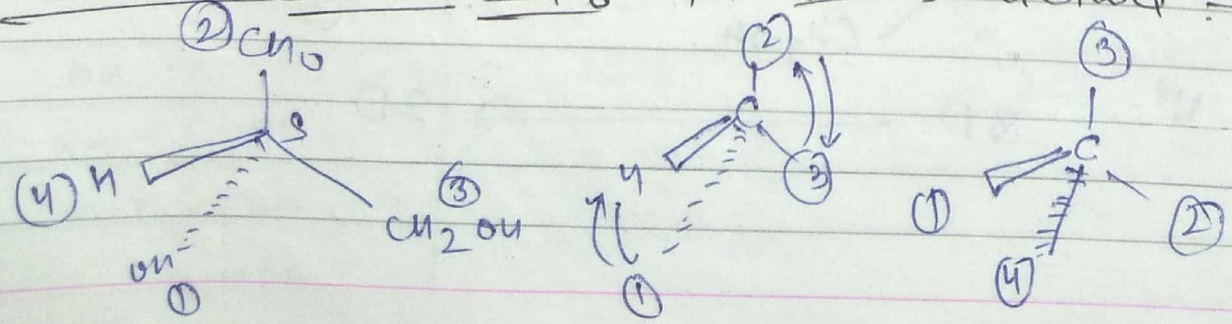
Step ⇒ 1. Convert 3D to 2D

Step - 2. Decide Priority of gps attached with chiral atom.

step - 3 : Now Put 4th Priority gp at bottom line. or Vertical line.

Step → 4 Now move from 1 → to 2 to 3.
~~take~~ if this moment is clockwise then configuration will be 'R'
If this moment is anticlockwise then conf. will be 'S'

Direct Method : for 3D structure :

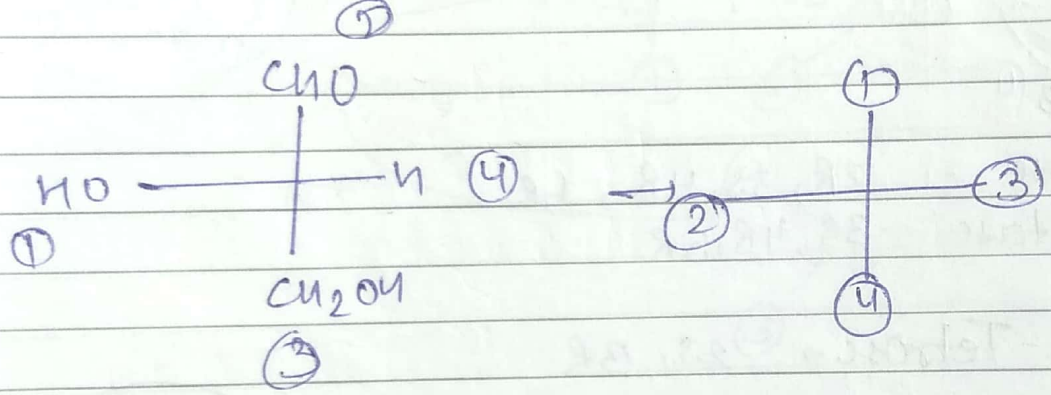


* If 4th is on Dash then Same
* If 4th is not on Dash the R will be S and S will be R.

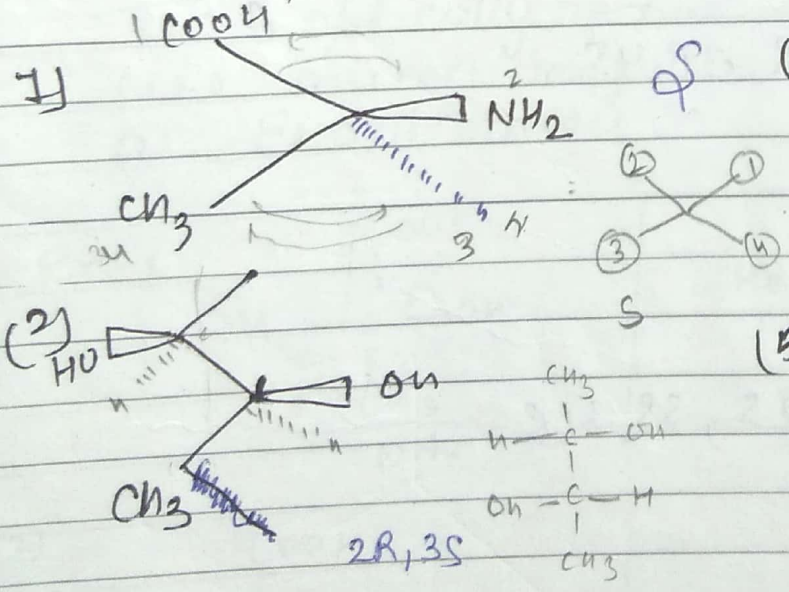
Condition: 4th must be at dash line.

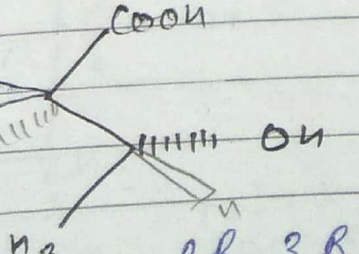
* ~~2D~~ for 2D structure:

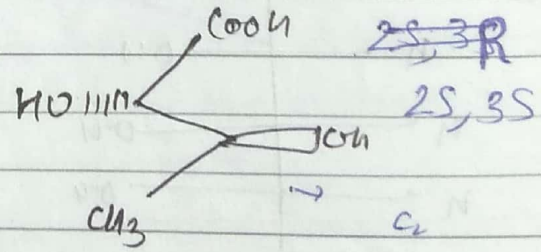
4th must be on Vertical line.
If 4th is not on the vertical line then Result will be opposite.

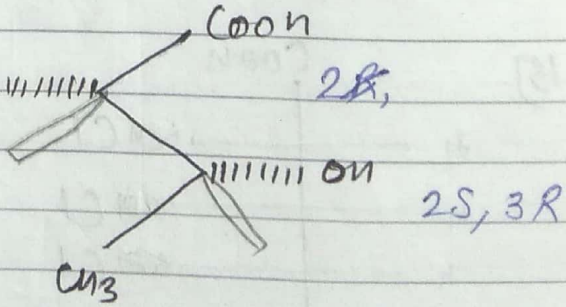


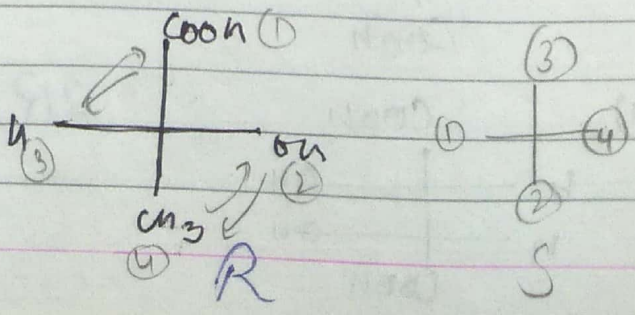
Q. Decide R/S configuration each Chiral carbon in following Compound:





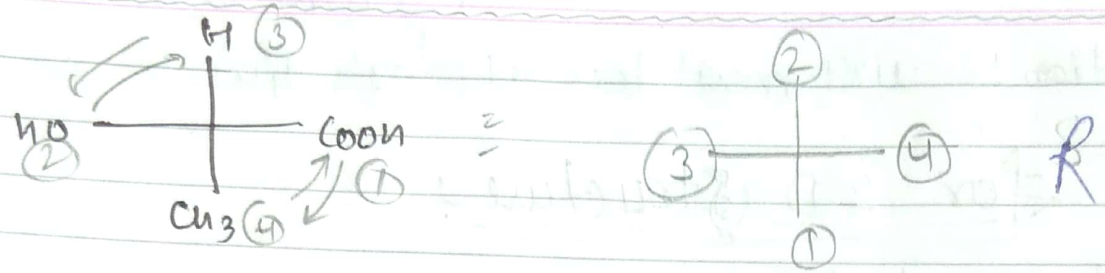




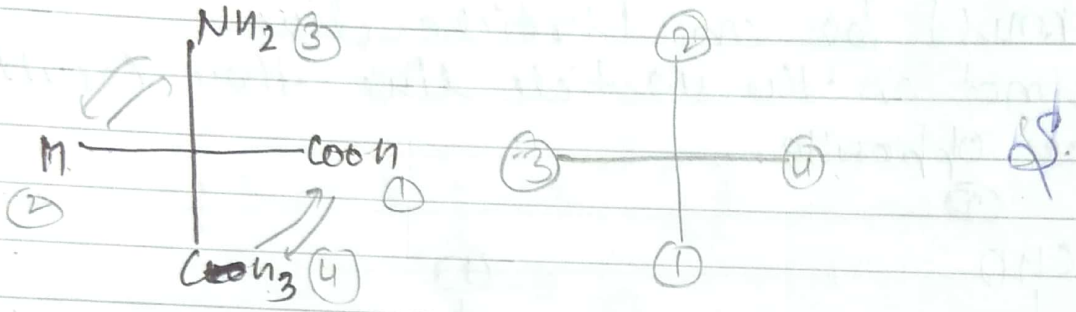


Or

(7)



(8)

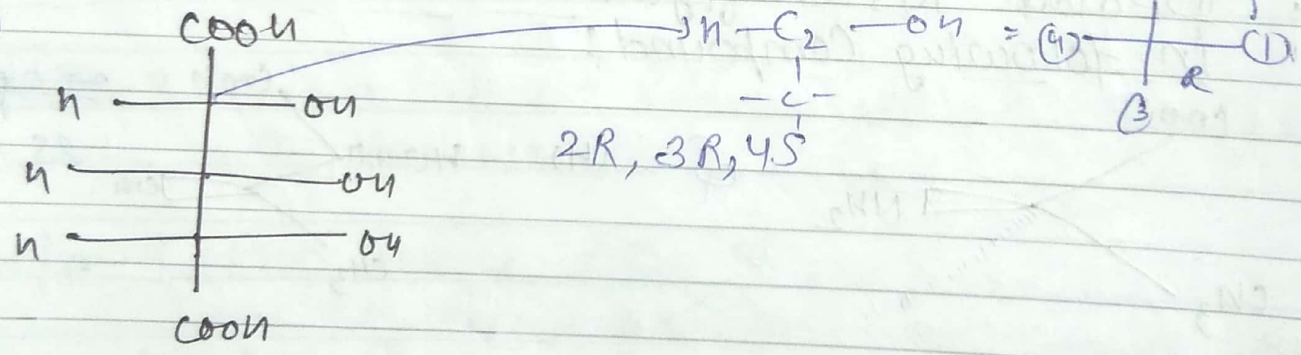


(9) D-Glucose → 2R, 3S, 4R, 5R

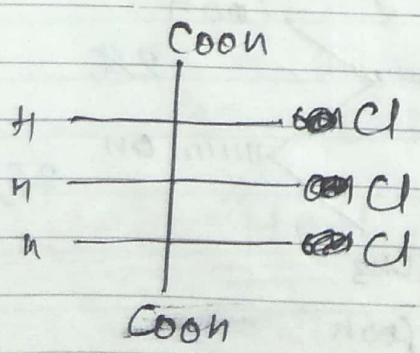
(10) D-fructose 3S, 4R, 5R

(11) Threo-D-Tetrose → 2S, 3R

(12)

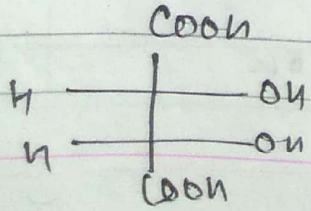


(13)



2S, 3S, 4R

(14)



2R, 3S

MWF 10:30

Hiwois Kace-8 ≠ 21?

08 Isomerism Sheet

15] COOH
HO — H
H — OH
CH_3

2S, 3R

(4) COOH
C_2
S
HO
H
S
OH
H
CH_3

1 2 3 4
C_2

2 1
C_3
3 4

* Enantiomers: /Anti-mers/ Enantiomorph/ Antipods.

Two optically active stereo Isomers which are mirror image to each other are known as Enantiomers.

Ex:-1

COOH
H — C — OH
CH_3
OA.

COOH
HO — C — H
CH_3
OA

(2)

COOH
H — R — OH
OH — S — H
CH_3
OA
(2R)(3S)

POS = ✗
COS = ✗

COOH
HO — C — H (S)
H — C — OH (R)
CH_3
OA
(2S)(3R)

→ Optical active mirror image

* Characteristic of enantiomers:

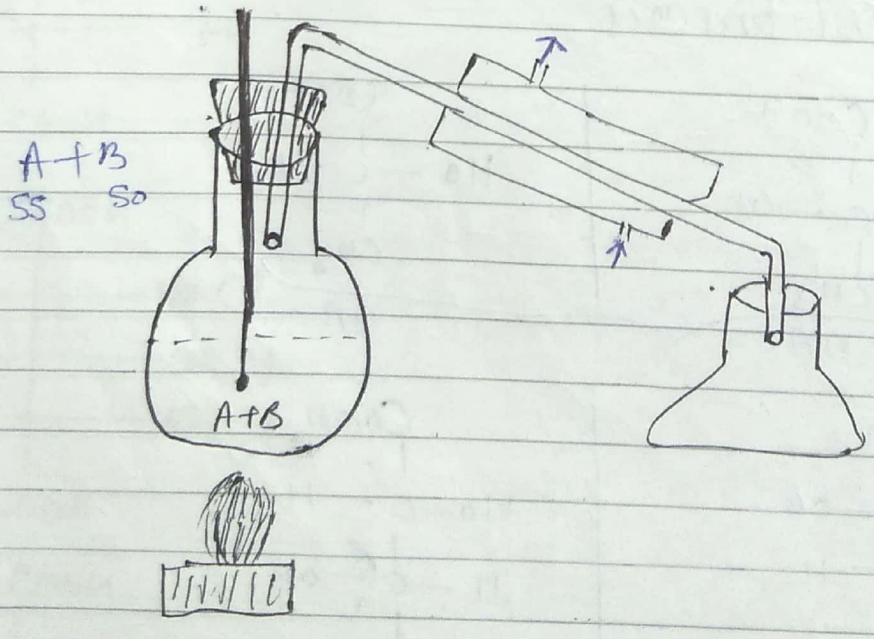
1) They have same M.f (Molecular formula)
2) They have same S.f (structural formula)
3) They are optically active.
4) If one is Dextro rotatory then other Leavo.
5) They have opposite configuration.

R	-	S
RR	-	SS
RS	-	SR
RRS	-	SSR

6) They have same chemical Reaⁿ / Property.
7) They have similar Physical Property.
(M.P, B.P, Dipole moment, stability etc.

Qu: The melting point of (R)-Butan-2-ol is 55°C. then what will m.p. of (S)-Butano-2-ol

(a) +55°C (b) -55°C (c) 0°C (d) can not decided



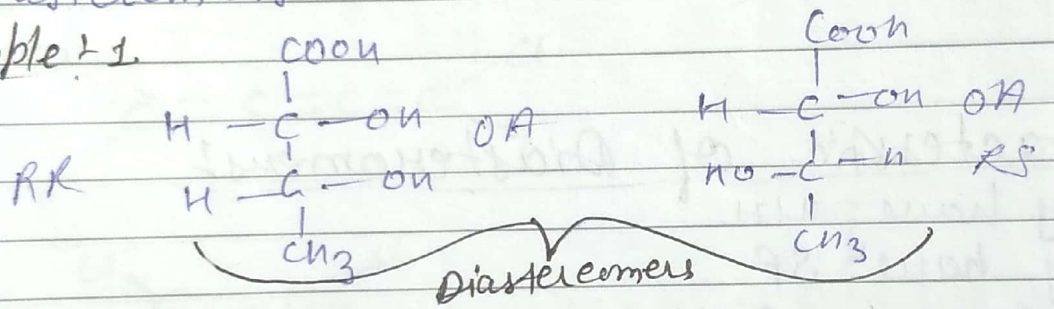
8) In Enantomers Can not seperate by fractional distralation.

9) Enantomers are non super Imposible mirror Image of each other.

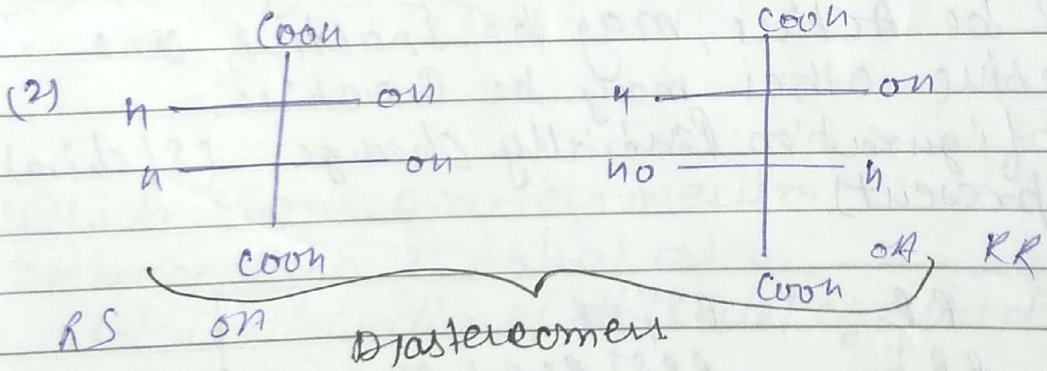
* Diastereomers:

The two steno Isomers which are not mirror image to each other are known as Diasteromers.

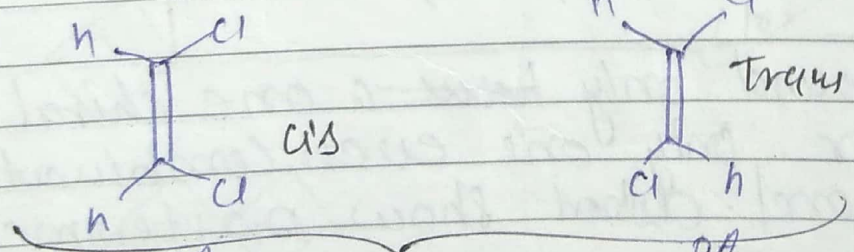
Example:-1.



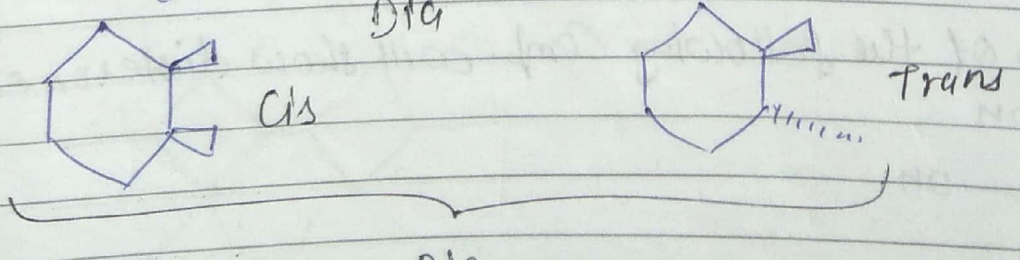
(2)



3)



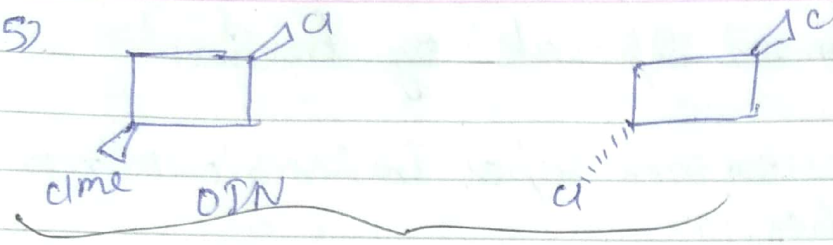
(4)



Di - 2 or more

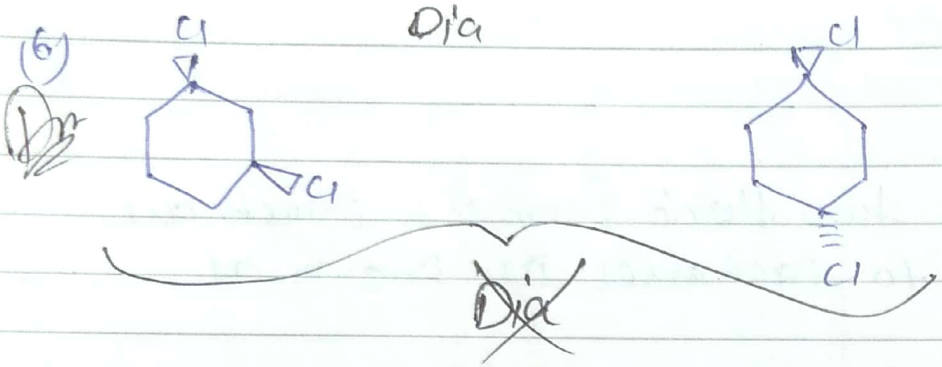
Stereo
Mirror Image

5)



Dia

6)



~~Dia~~

* Characteristic of Diastereomers:

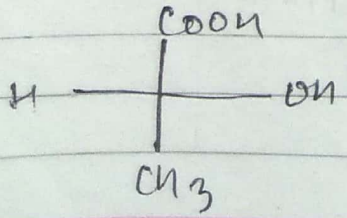
1) They have ≠ MM.
2) They have ≠ SP
3) They may be Active, may be Inactive, one may active other may be Inactive.
4) Their configuration Partially change (If chiral atom present).

RR	RS / SR
RRR	RRS / RSR / SRR

5) Those compound only ~~have~~ one chiral centre or only one even combination of Double bond. do not show Diastereomerism.

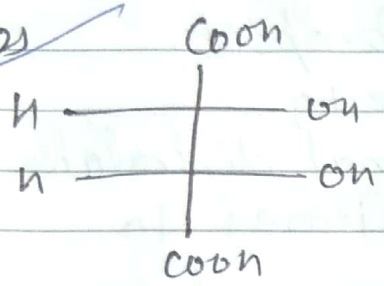
Que: Which of the following Comp. will show disteromerism!

*

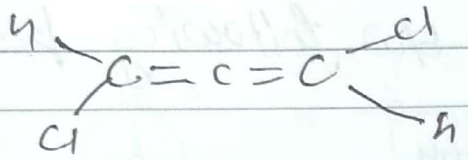


(a's Traced)

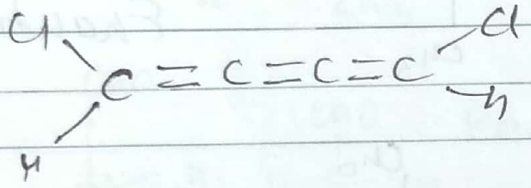
(2)



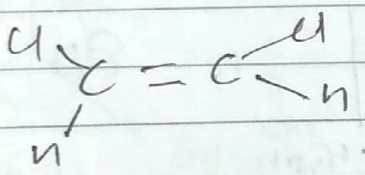
(3)



(4)



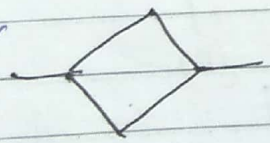
(5)



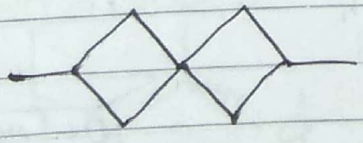
Which show Diastereomerism.

1) 2 or more than 2 chiral atom.
2) Odd Combination of db/cycle/cycle + db.

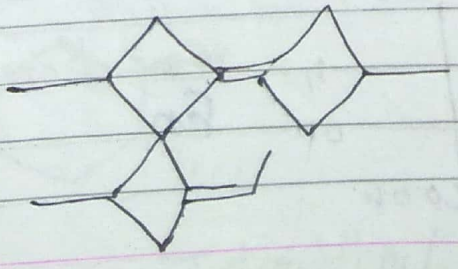
(6)



(7)

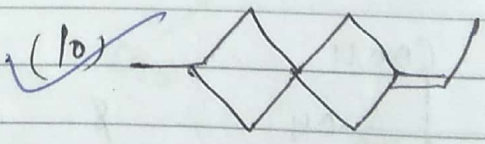


(8)



(9)

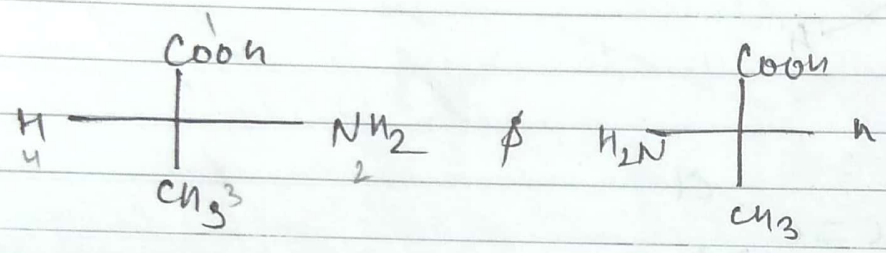
(10)



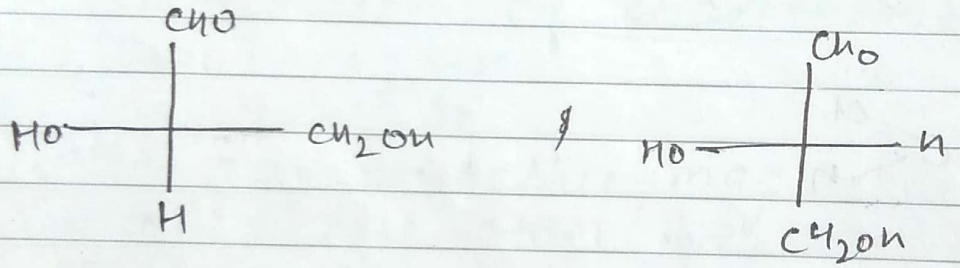
See COS → cycle - planar syste
POS

3) They have different chemical property
4) They have different Physical property
5) They can seperated by fractional distralation
6) Geometrical I. are also diastereomer to each other.

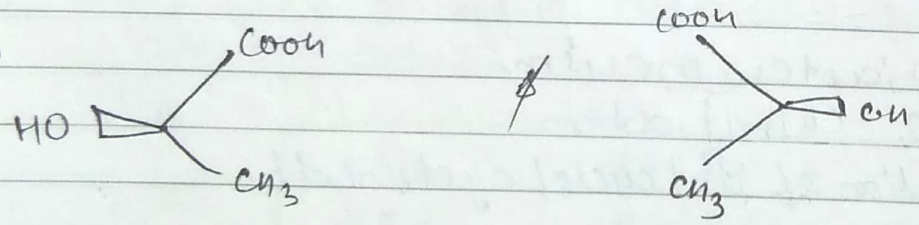
Que:- Decide Relation ship b/w following pair

1) 

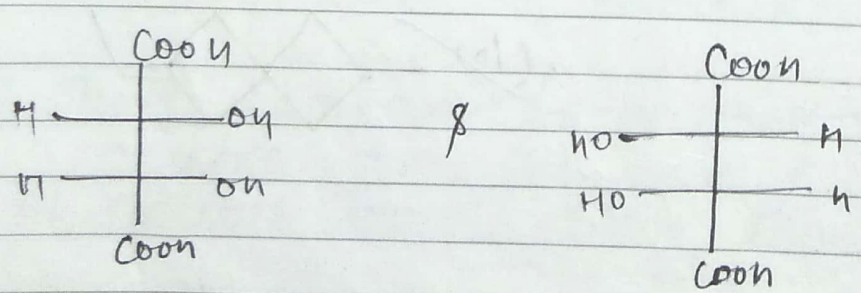
Enantiomers
Enantiomers

2) 

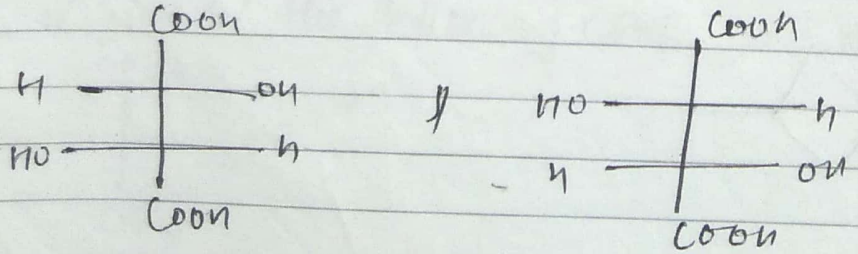
En

(3) 

En
Enantiomers

(4) 

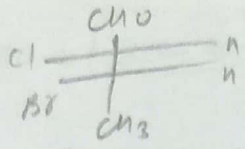
Di
Enantiomers
D. Enactic

(5) 

Enantiomer
En

conf. opt. so, mirror image.

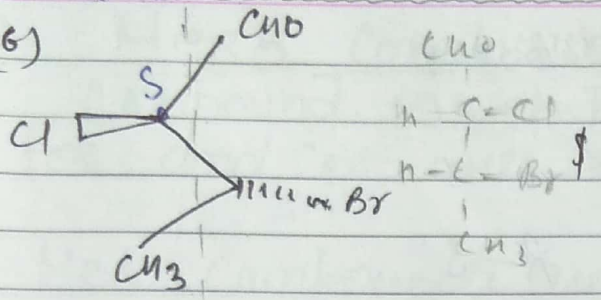
(2S, 3R)



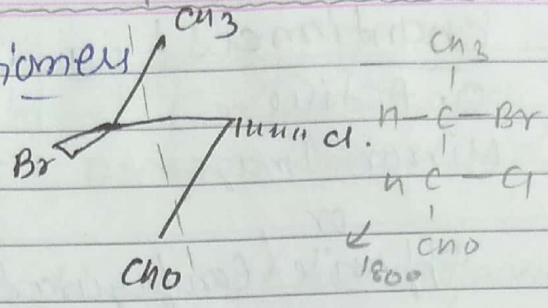
↑ 180°

(2R, 3S)

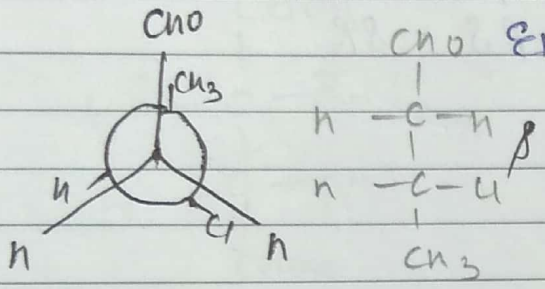
(6)



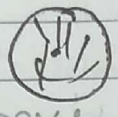
Enantiomers



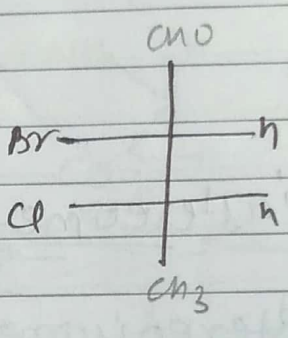
(7)



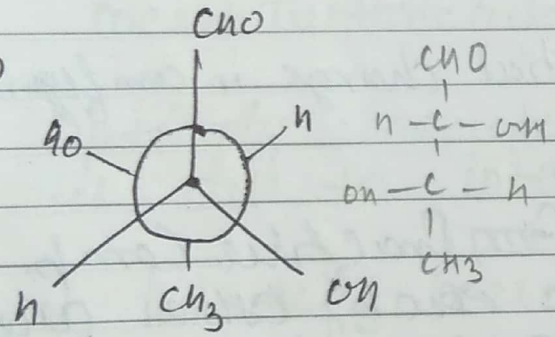
Enantiomer



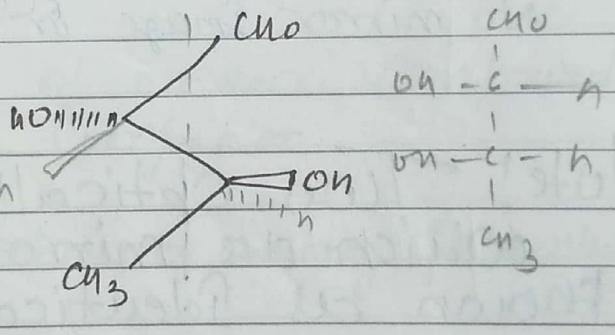
Enantiomers



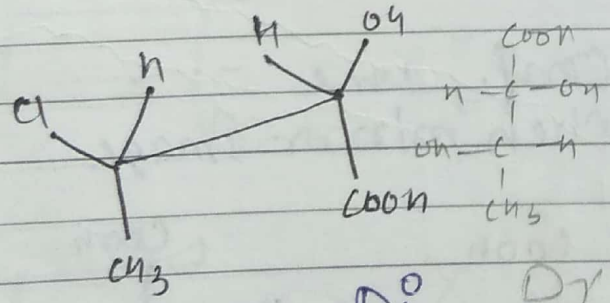
(8)



En.



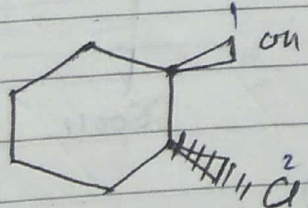
9)



Di

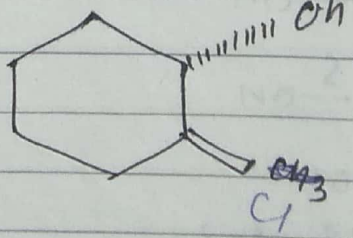
Dr

(10)



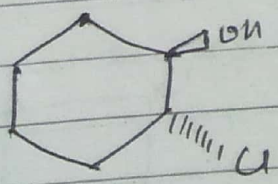
Enen.

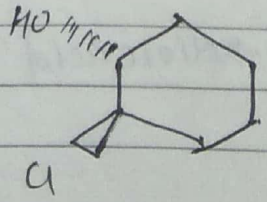
Di



Cl

(11)





Identical

Also → Ex - 1 ⇒ 0, - 1, -2.

* Enantiomers : ↳ Stereo Isomers

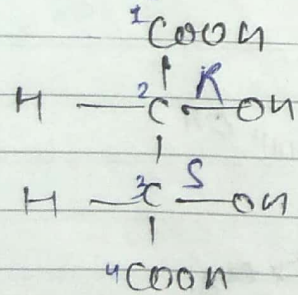
1) O. Active
2) Mirror Image
   or
   opposite configuration R - S
   RR - SS
   RS - SR

* Diastereomers :

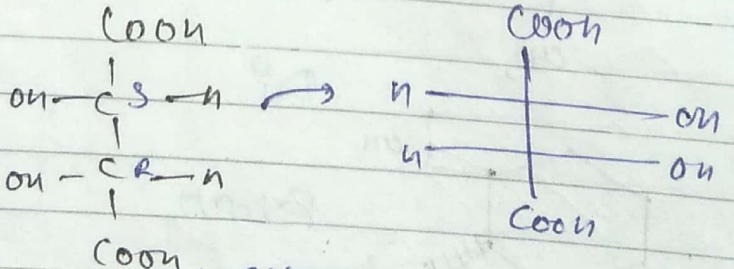
1) Stereoisomers
2) No mirror Image or Partial change in configuration

Note : Two Optically ~~each~~ Practice Comp. which are mirror to each other are known as Identical Compound.

* Identical : Name, Conf., same
  ↳ 2 OIA comp when mirror Image (because)



2R, 3S, -2-3-hydroxybutan-1,4-dioic acid



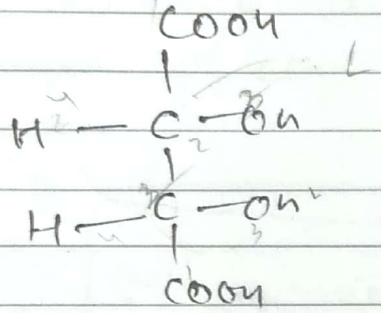
(2R)(3S) - - -

Iso → d. 20 − 89 + 40 ≠ 29.

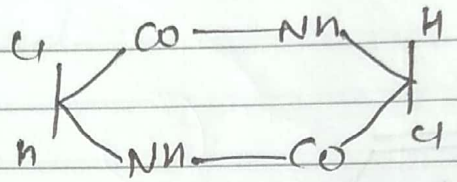
* Meso Compounds :

Compound which have chiral carbon with Pos and Cos are known as measo Compound.

Meso compounds are optical all inactive Compound.



meso-Tartaric acid



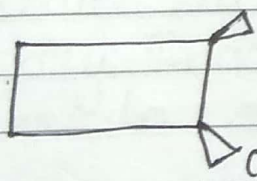
CC = ✓
COS ✓

meso compound.

* optically Inactivity of measo Compound is due to Internal Compition.

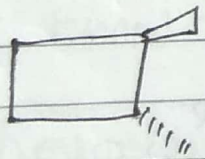
Que: Identify meso-compound among following!

(1)



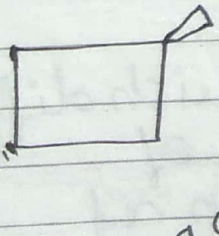
✓

(2)



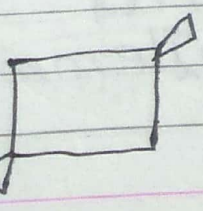
X

(3)



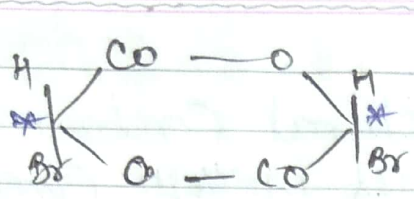
X

(4)

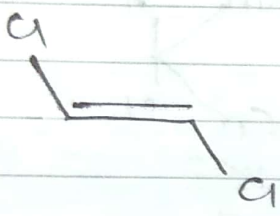


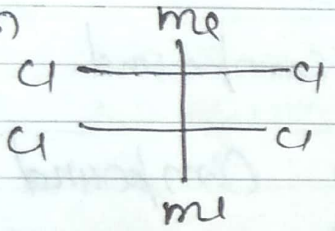
X

MOI — C:C + POS or COS.

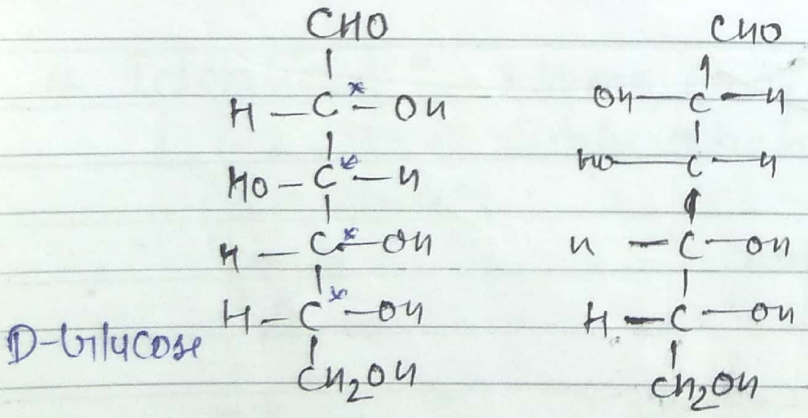
(5) 

(6) 

(7) 

(8) 

* Epimers :



D-Glucose

D-mannose

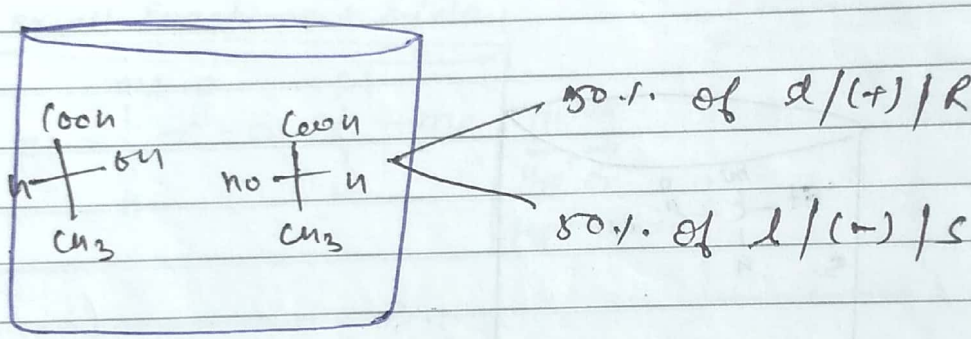
⇒ The two steric Isomers which differ to each other due to Conf. of one chiral atom are known as Epimers. They are a kind of diasteromers.

* Racemic Mixture :

The equimolar mixture of D and L Isomers of any compound is known as Racemic Mixture

OR

The mixture having 50% D and 50% L Isomer of any compound.



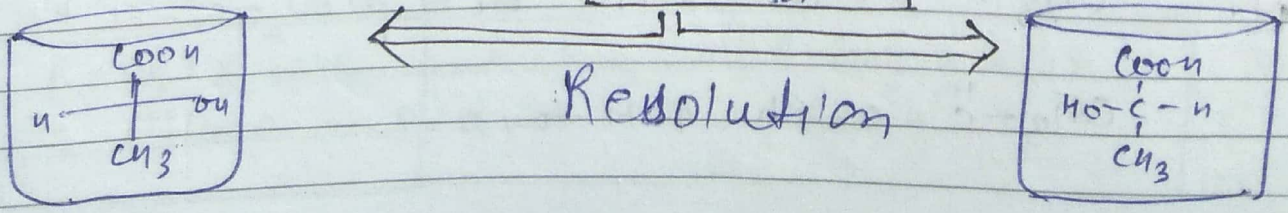
* It is also know as (±) or (dl) or (RS) mixture

* Racemic mixture are optical Inactive mixture optically Inactive of racemic mixture is due to external compensation.

The Process by which Resmic mixture is prepared is known as Resiminzation

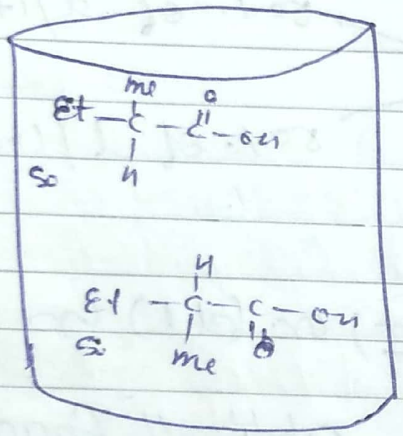
* Resolution :

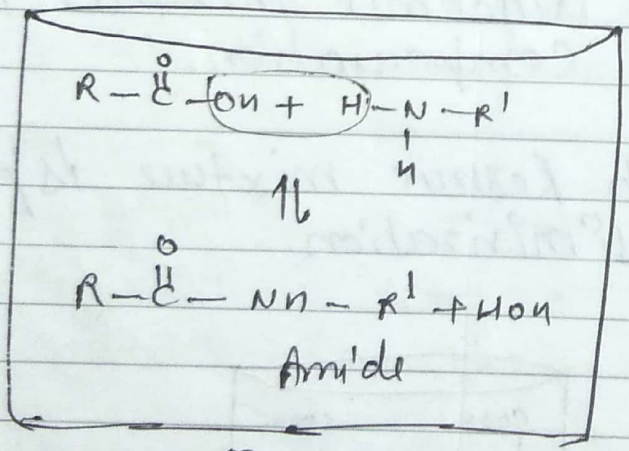
optically comp. are Resolution

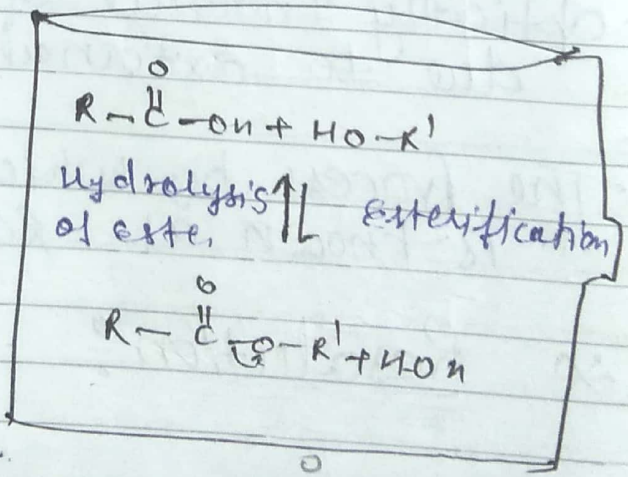


Resolution: → By mechanical method ⟶
→ By Biological " ⟹
→ By chemical method/
or
By Diastereomeric formation.

* Resolution of Racemix mixture by diastereomeric formation:



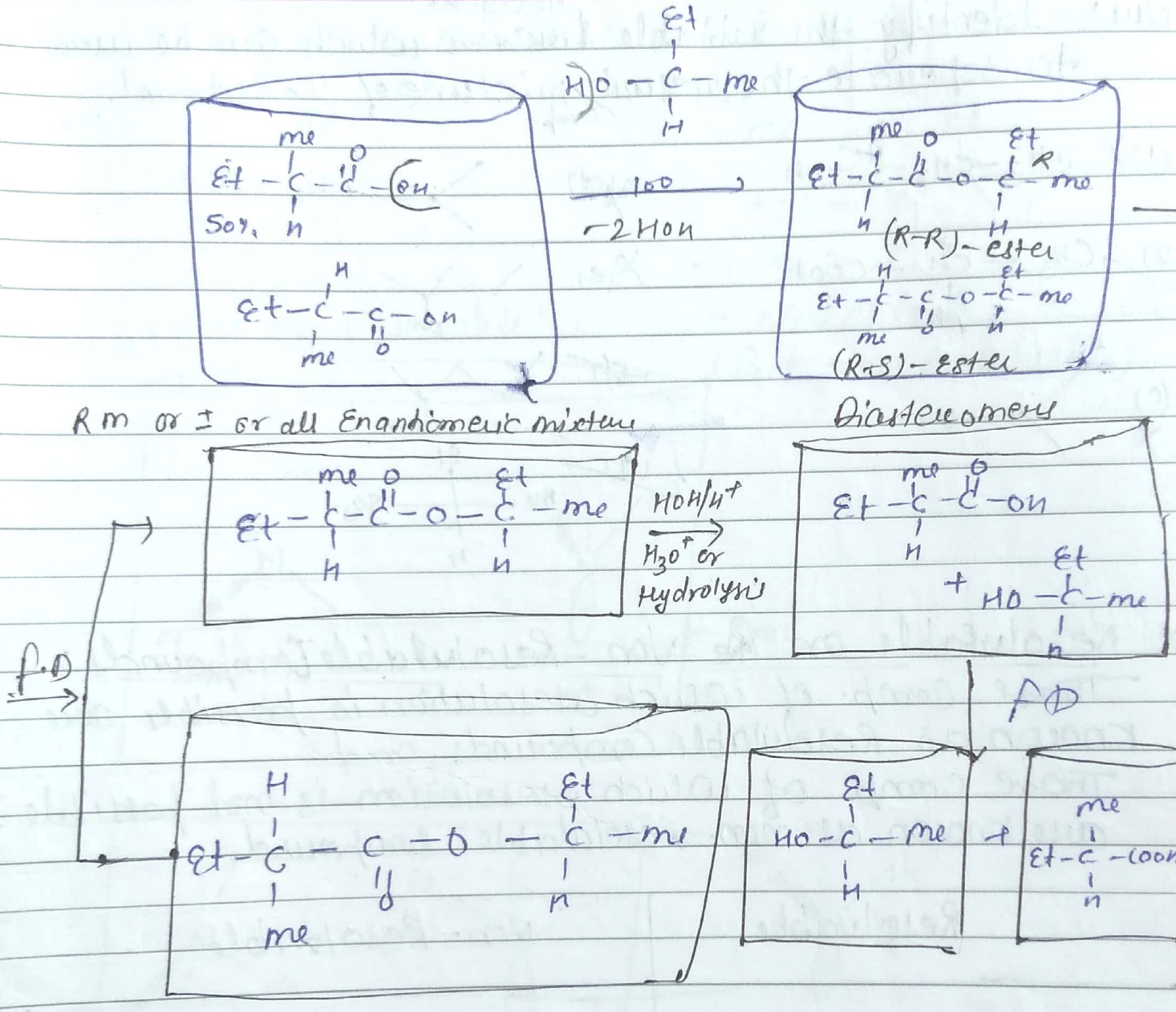




Q. $CH_3-\overset{O}{\overset{\|}{C}}-OH + HO-Et \rightleftharpoons CH_3-\overset{O}{\overset{\|}{C}}-Et + H_2O$

$CH_3-\overset{O}{\overset{\|}{C}}-O-Ph + H-OH \rightleftharpoons ?$

H.W ⇒ Race : 9 and 10.



* प्रयोगशाला :

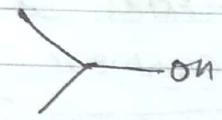
RM	Seperator
R–COOH	optically active R–OH / R–NH_2 (" " Base).
R–OH / R–NH_2 Alcohol	(" " R–COOH / R–SO_3H) (" " Acid)

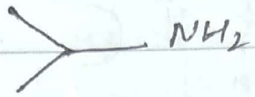
Que:- Identify the suitable ~~reagent~~ reagent which can be used to seperate the ~~resmic~~ mixture of 2-Butanol.

Base

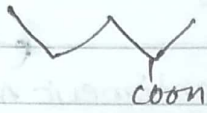
(1) ✗ $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-OH$

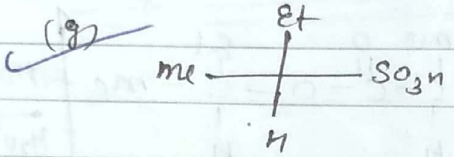
(2) $CH_3-\overset{*}{C}H(Ph)-COOH$

(c) ✗ 

(d) ✗ 

(e) ✗ 

(f) 

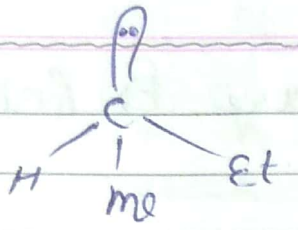
(g) 

* Resolvable or Non-Resolvable Compounds:-
Those comp. of which resolution is possible are known as Resolvable compounds. and
Those comp. of which resolution is not possible are known as non-resolvable compound.

Resolvable	Non-Resolvable
All O.A and chiral compound	All O.A / Achiral compound.

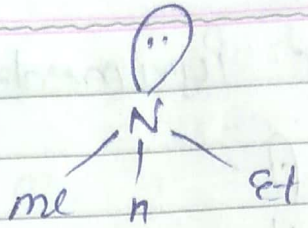
* Exception:- All Primedal Compound with elements are 2nd period at centre are non Resolvable.

Ex:

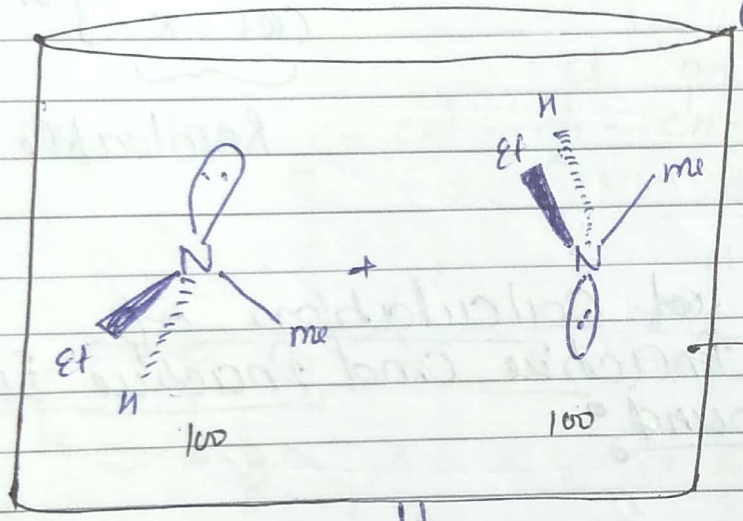


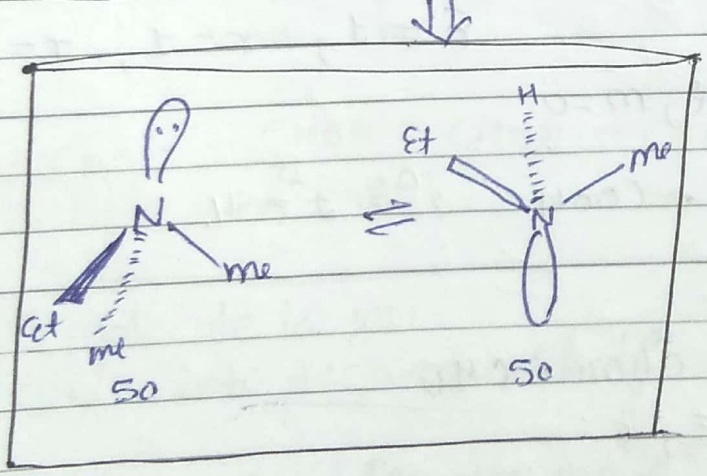
Pos = X
Cos = X
OA/chiral
(But non Resolvable)

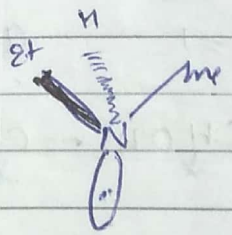
(ii)



Pos = X
Cos = X
OA/chiral
(But non Resolvable)

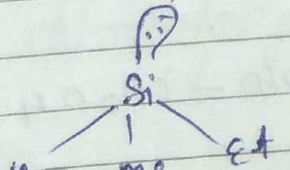






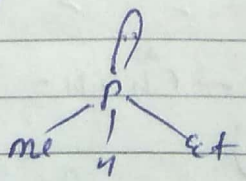
* Pyrimedal structure having central atom of 3ord or higher period are Resolvable

(iii)



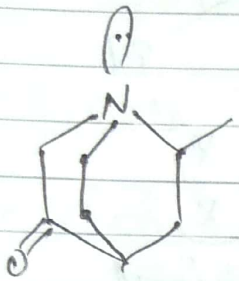
Pos = X
Cos = X
OA/chiral
Resolvable

(iv)

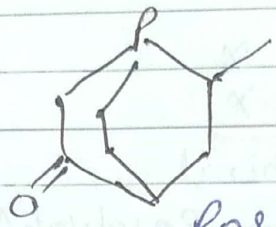


Pos = X
Cos = X
OA/chiral
Resolvable.

* cyclic Pyrimedal structure are Resolvable.



POS = X
COS = X
OA
Resolvable



POS = X
COS = X
} OA
Resolvable

* Determination of Calculation of
* Optical Inactive and Inactive isomer in any Compound.

(1) $CH_3 - \overset{*}{C}H(OH) - COOH$ $\quad \varepsilon = 1,\ r = 1,\ T = 2$

$n = 1 \qquad a = 2^1 = 2,\ m = 0$

(2) $CH_3 - \overset{*}{C}HOH - \overset{*}{C}HOH - COOH \quad = 2^n = 2^2 = 4.$

$n = 2$

(3) $CH_3 - \overset{*}{C}HOH - \overset{*}{C}HOH - \overset{*}{C}HOH - CHO$

$n = 3 \qquad 2^3 = 8.$

(4) $CH_3 - \overset{*}{C}HOH - \overset{*}{C}HOH - \overset{*}{C}HOH - \overset{*}{C}HOH - CH_2OH$

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

(5) $CH_2OH - \overset{*}{C}HOH - \overset{*}{C}HOH - \overset{*}{C}HOH - \overset{*}{C}HOH - CH_2OH$

$n = 4$ (even) $\qquad a = 2^{n-1} = 2^3 = 8.$

$m = 2^{2-1} = 2^1 = 2$

⑥ $CH_3-\underset{*}{CH}(Cl)-\underset{*}{CH}(Cl)-\underset{*}{CH}(Cl)-CH_3$

$n = 3$

$a = 2^{n-1} - 2^{\frac{n-1}{2}} = 2^2 - 2^{\frac{3-1}{2}} = 2$

$m = 2^{\frac{n-1}{2}} = 2^{\frac{3-1}{2}} = 2^1 = 2.$

(7) $CH_3-CH=C=CH-Cl$

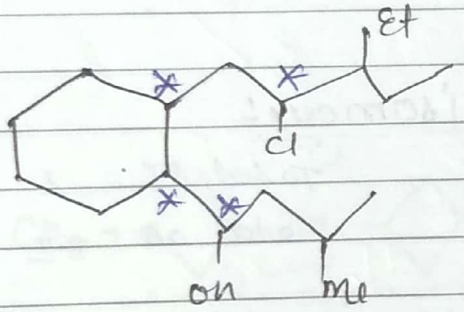
(8) $CH_3-CH=C=C=CH-Cl$ ✗

(9) $CH_3-CH=C=CH-\underset{*}{CH}(Cl)-\underset{*}{CH}(OH)-CH_3$

$n = 3$

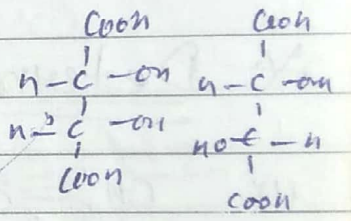
$a = 2^3 = 8$

(10)



$n = 4$

$a = 2^4 = 16.$



(10) $COOH-\underset{*}{CH}(OH)-\underset{*}{CH}(OH)-COOH$

$n = 2$

$a = 2^{2-1} = 2^1 = 2$

$m = 2^{\frac{2}{2}-1} = 2^0 = 1$

When molecule is not divide into two equal half.

When molecules can be divide into two equal half.

a) Total no. of optical Isomers $= 2^n$ → $d = \frac{a}{2}$, $l = \frac{a}{2}$

n = optical Isomer Centre

OR

Chiral atom or even combination of db/cycle/c+db)

even ($n-1$)

$a = 2^{n-1}$

$m = 2^{\frac{n}{2}-1}$

odd

$a = 2^{n-1} - 2^{\frac{n-1}{2}}$

$m = 2^{\frac{n-1}{2}}.$

b) Total no. of O. inactive A (meso) isomers (m) = 0

c) Total no. of Enantiomeric pair (EP) = $\frac{a}{2}$

d) Total no. of Recmic mixture (r) (r) = $\frac{a}{2}$

e) Total no. of OA + OIA Isomer (T)
T = a + m.

✱ Determination of Stereoisomers:

(1) $CH_3-\underset{\text{OIU/CC}}{\underset{|}{\overset{OH}{\overset{|}{C}}}H}-COOH$ → R, S

Total SI = 2
Total OAI = 2

(2) $CH_3-\underbrace{CH=CH}_{\text{GIU}}-COOH$ → E, Z

SI = 2
OAI = 0

(3) $CH_3-\underbrace{CH=CH}_{\text{GIU}}-\underbrace{\overset{OH}{\overset{|}{C}}H}_{\text{OIU}}-COOH$ → ER, ES, ZR, ZS

GIU: E/Z
OIU: R/S

SI = 4
OAI = 4

(4) $CH_3-CH=CH-CH=CH-\overset{OH}{\overset{|}{C}}H-CH_3$

E/Z E/Z R/S

n = 3, SI = $2^3 = 8$

Total no of S.I = 2^n

n = No. of (GIU + OIU)

even = OI
odd = GI

GIV = odd Combination of db/cycle/cycle + db
OIV = even " " " " " "

(5) $CH_3-\underset{GIV}{CH=CH}-\underset{GIV}{CH=CH}-\underset{OIV}{\underset{OH}{\overset{|}{C}H}}-\underset{OIV}{\underset{OH}{\overset{|}{C}H}}-CH_3$ $n=4$

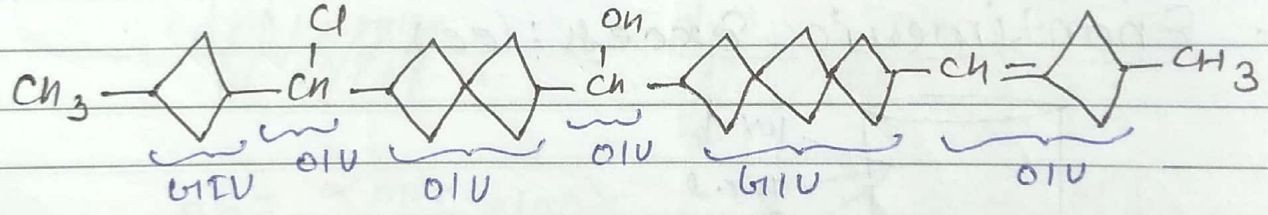
$SI = 2^4 = 16$

(6) $CH_3-CH=CH-\underset{OH}{\overset{|}{C}H}-\underset{OH}{\overset{|}{C}H}-\underset{OH}{\overset{|}{C}H}-CH_3$ $n=4$

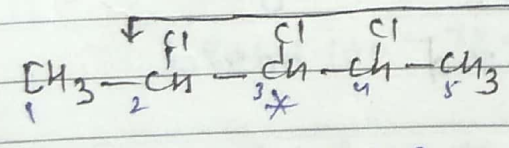
$SI = 2^4 = 16$

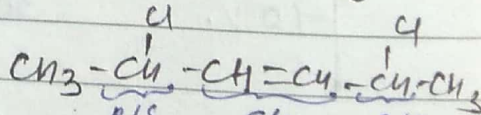
(7) $CH_3-\underset{GIV}{CH=C=CH}-\underset{GIV}{CH=CH}-\underset{OIV}{\underset{OH}{\overset{|}{C}H}}-\underset{GIV}{CH=C=C=CH}-CH_3$

$n=4$, $SI = 2^4 = 16$

(8) 

- This formula fail for those compound which can be divided into two equal half.





R	X	R (2R)(4R)-2,3,4-TCP
S	X	S (2S)(4S)(4S) "
R	R	S (2R)(3R)(4S) "
R	S	S (2R)(3S)(4S) "

R	E	R → (2R)(3E)(5S)-2,5-dichloro hex-3-ene
S	E	S →
~~S~~	~~E~~	~~R~~ →
R	Z	R →
S	Z	S →
R	Z	S →
S	Z	R →

(3) $CH_3 - CH = CH - \overset{*}{CH}(Cl) - CH = CH - CH_3$

E X E

Z X Z

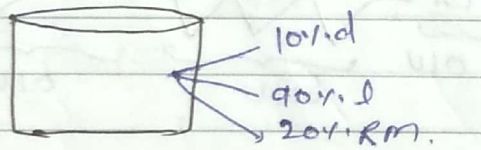
Z R E

Z S E

$COOH - \overset{*}{C}HOH - \overset{*}{C}HOH - COOH$ SI = 4

* Optical purity and Enantiomeric Excess:

1. Enantiomeric Excess: (ee)



d %	l %	Rm %	ee	op
10 %	90 %	20 %	80 % l	80 % l
50 %	50 %	100 %	0 %	0
70 %	30 %	60 %	40 % d	40 % d

$$ee = \left| \frac{d - l}{d + l} \right| \times 100 \quad - (i)$$

(2) Optical purity: (op):

$$op = ee$$

$$op = \frac{\alpha_{mixture}}{\alpha_{pure}} \times 100 \quad - (2)$$

$\alpha_{mixture}$ = S.R of mixture
α_{pure} = S.R of pure isomer

We know op = ee, then

$$\left[\frac{d-l}{d+l}\right] = \left(\frac{\alpha_{mixture}}{\alpha_{pure}}\right) \quad \text{---} (3)$$

Que: Specific rotation of mixture of 2 Butanol is -9.72° and Specific rotation of -/+ — D/L Butanol is -13.5° then what will the optical purity of mixture and also decide d and l Isomer of 2 Butanol in mixture.

M-1

$$op = \frac{\alpha_{mix}}{\alpha_{pure}} \times 100 = \frac{-9.72^\circ}{-13.5} \times 100 = \frac{-972}{-13.5}$$

$$= 72\%.\ l.$$

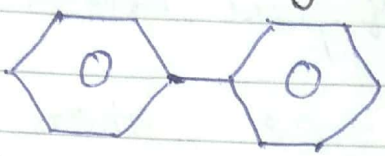
op = 72%. l
ee = 72%. l
RM = 100 − 72 = 28%. — 14%. d, 14%. l

Total % of L = 72 + 14 = 86%.
" d = 14%.

H.W: Iso: Ex: 2 and J-M, and 1-22
Race: 10

Que

* Optical Activity in Byphyenyl:

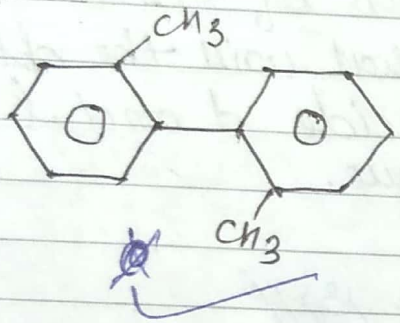


Condition: to be optically active.

1.) Large gp at any/both ortho position to both ring.
2.) NO_2 POS along Intermolecular bond in both ring

Que:-

(1)



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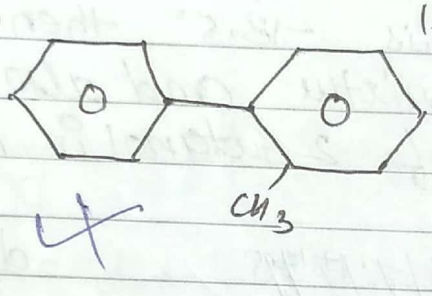
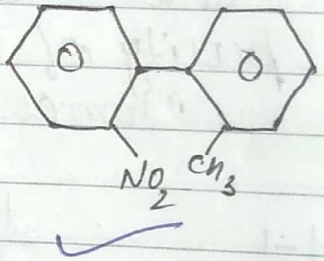


(3)



(4)