VMC Vidyamandir Classes SINCE 1986

IIT JEE | MEDICAL | FOUNDATION

Introduction to organic chemistry

IOC

Topics included:

(1) Nomenclature

(2) GOC-I (Electronic displacement effects)

(3) GOC- II (Stability of intermediates)

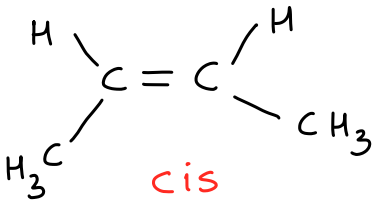
(3) GOC-III (Acidity & Basicity)

(4) Isomerism

Physical Properties of G.I. ⟶

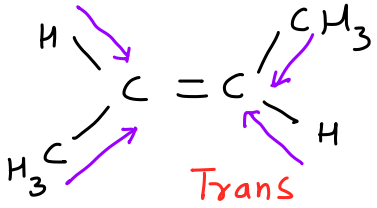
(1) Dipole moment (μ) ⟶

Ex.



cis

$\mu \neq 0$

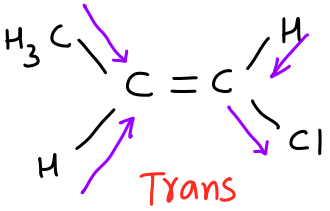


Trans

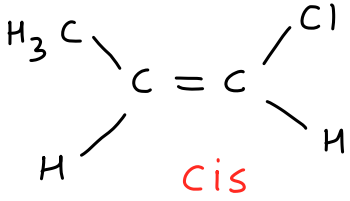
$\mu = 0$

$\mu \rightarrow$ Cis > Trans

Ex



Trans



cis

$\mu \rightarrow$ Trans > Cis

(2) Solubility in H_2O ⟶ Polar comp. ($\mu \neq 0$)

are more soluble in H_2O.

(3) Boiling Point ⟶

B.P. $\propto$ molar mass

$\propto$ surface area

$\propto$ vander waal forces of attraction

$\propto$ H- bonding

$\propto$ dipole moment

(4) melting point →

M.P. ∝ crystal packing efficiency

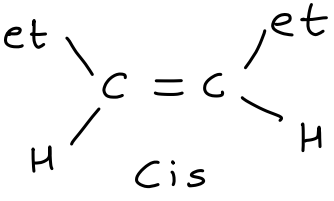
∝ symmetry

Generally Trans form has more M.P. than cis form.

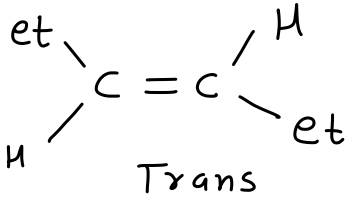
(5) stability → Generally Trans form is more stable than cis form.

Reason → Repulsion b/w two same groups in Trans form is minimum so P.E. will be min. so stab. will be max.

Ex.



Cis



Trans

Stab. → Trans > cis

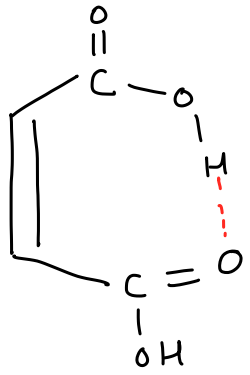
μ → cis > Trans

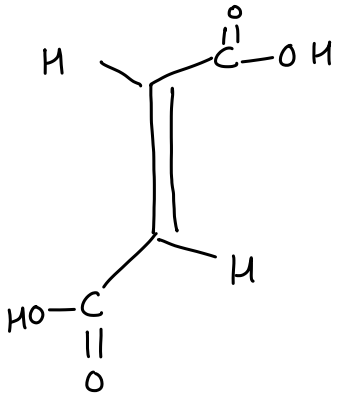
solubility → Cis > Trans

M.P. → Trans > Cis

B.P. → Cis > Trans

Ex.





Cis - But - 2 - endioic acid (maleic acid)

Trans - But - 2 - endioic acid (fumaric acid)

$\mu \longrightarrow$ Cis > Trans

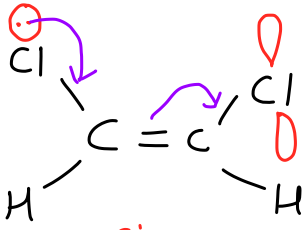
B.P. $\longrightarrow$ Cis > Trans

M.P. $\longrightarrow$ Trans > Cis

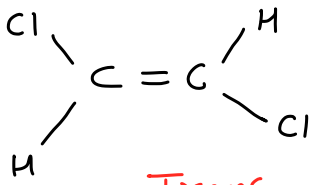
solubility $\longrightarrow$ Cis > Trans

stab. $\longrightarrow$ Cis > Trans

Ex.



Cis



Trans

$\mu \longrightarrow$ Cis > Trans

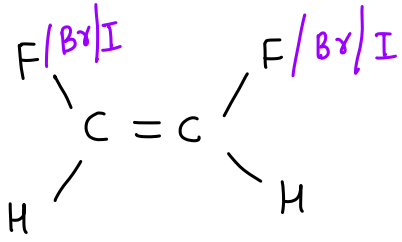
B.P. $\longrightarrow$ Cis > Trans

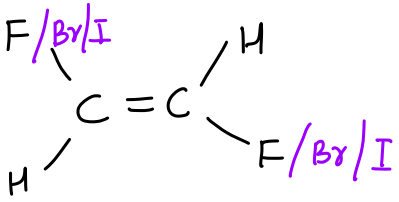
M.P. $\longrightarrow$ Trans > Cis

Solubility $\longrightarrow$ Cis > Trans

Stab. $\longrightarrow$ Cis > Trans

Ex.





stab. → Trans > Cis

Note → In case of cycloalkenes —

3 – 7 C ⇒ only cis exist

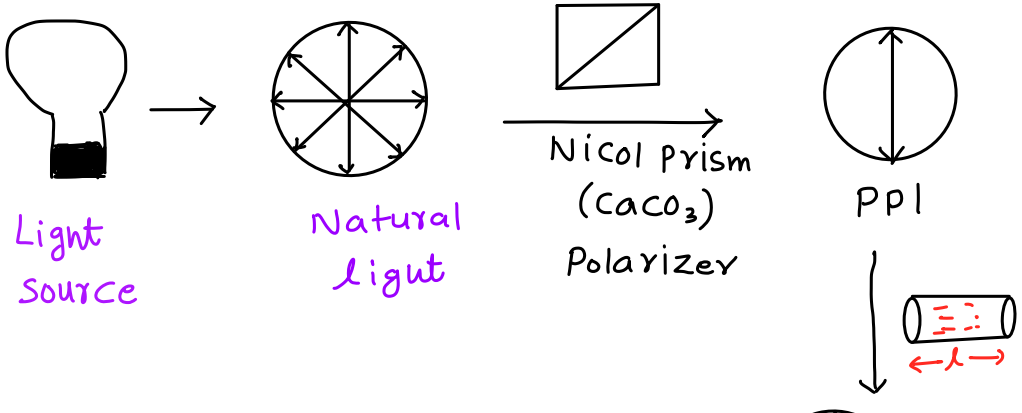
8 – 10 C ⇒ Cis > Trans

11 – above ⇒ Trans > Cis

Optical Isomerism → Same molecular formula

Same structural formula

but different behaviour towards plane polarised light (PPL)



θ → observed angle of rotation (measured by Polarimeter)

$\theta \propto l$ (l → length of tube (in dm))

$\theta \propto c$ ($c \rightarrow$ conc. of sample in tube ($\frac{gm}{ml}$ or $\frac{gm}{cm^3}$))

$\Rightarrow \quad \theta \propto l \cdot c$

$\theta = [\alpha] \cdot l \cdot c$

$[\alpha]_T^{\lambda} = \frac{\theta}{l \times c}$ (at const. temp. at const. wavelength)

where α = specific rotation

If $l = 1$ dm, $c = 1$ gm/ml

$\Rightarrow [\alpha] = \theta$

* α doesn't depend on θ, l and c

Q. The observed Rotation of a sample of conc. 2 gm/ml placed in a Polarimeter with sample tube of length 1 dm is $+70^\circ$. What is the specific rotation of sample?

Soln → $\alpha = \frac{\theta}{l \times c} = \frac{+70^\circ}{1 \times 2} = +35^\circ$ → dextrorotatory

Note→ If $\theta, \alpha = 0$ (optically inactive comp.)

If $\theta, \alpha \neq 0$ (optically Active comp.)

A molecule will be optically active/chiral If it is unsymmetrical/dissymmetrical/ Asymmetrical.

Symmetry elements →

(1) Plane of symmetry

(2) Centre of symmetry

(3) Axis of symmetry

(4) Alternating axis of symmetry

* Axis of symmetry is not associated with optical activity.

* Generally If P.O.S., C.O.S. is absent then A.A.O.S. is also absent.

Plane of symmetry or Reflection of symm. (σ)→

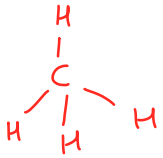
It is an imaginary plane which bisects the molecule into two equal halves which are mirror images of each other.

Centre of symmetry (centre of Inversion), i →

It is an Imaginary Point in a molecule from which if draw a line in opposite direction then it meets with same atom or same group of atom.

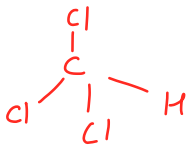
Q. Find P.O.S, C.O.S. in the following molecules ——

(1)



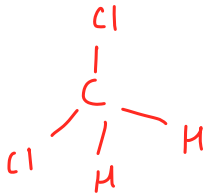
6 P.O.S.
NO C.O.S.
Achiral

(2)



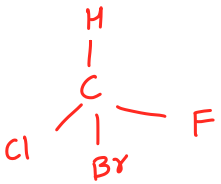
3 P.O.S.
NO C.O.S.
Achiral

(3)



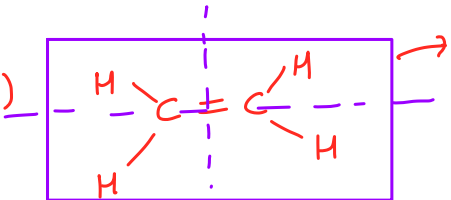
2 P.O S.
NO C.O.S.
Achiral

(4)



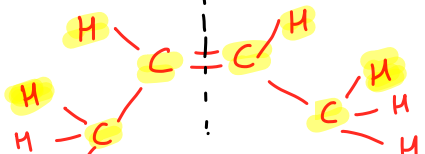
NO P.O.S.
NO C.O.S.
Chiral / optically active

(5)



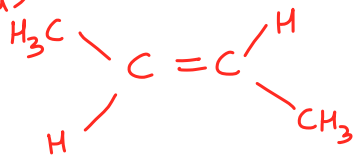
6 atoms are in Same Plane
3 P.O.S.
C.O.S. ✓
Achiral

(6)



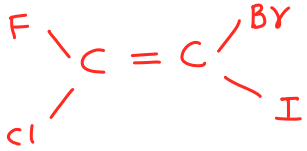
2 P.O.S., C.O.S. ✗
Achiral
8 atoms are in Same Plane

(7)



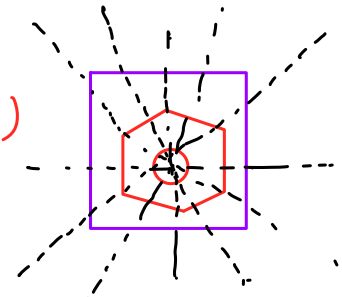
1 P.O.S
C.O.S. ✓
Achiral

(8)



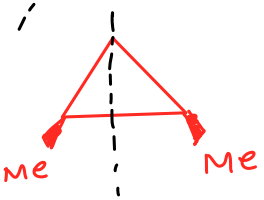
1 P.O.S.
C.O.S. ✗
Achiral

(9)



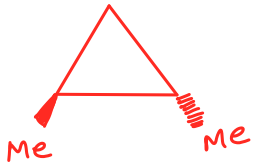
7 P.O.S.
C.O.S. ✓
Achiral

(10)



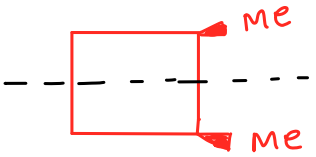
1 P.O.S.
C.O.S. ✗
Achiral

(11)



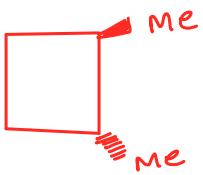
P.O.S. ✗
C.O.S. ✗
chiral

(12)



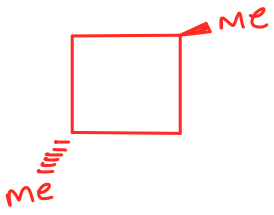
P.O.S. ✓
C.O.S. ✗
Achiral

(13)



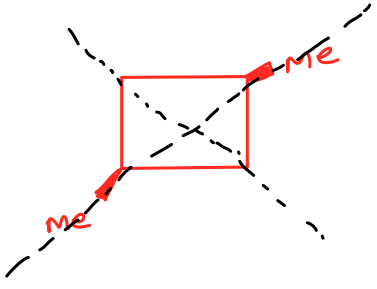
P.O.S. X
C.O.S. X
Chiral

(14)



1 P.O.S.
C.O.S. ✓
Achiral

(15)

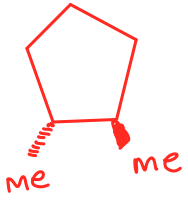


2 P.O.S.
C.O.S. X
Achiral

(16)

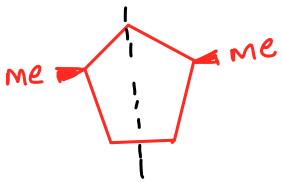
1 P.O S.
C.O.S. X
Achiral

(17)



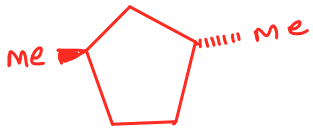
P.O.S. X
C.O.S. X
Chiral

(18)



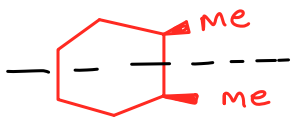
1 P.O.S.
C.O.S. X
Achiral

(19)



P.O.S. X
C.O.S. X
Chiral

(20)

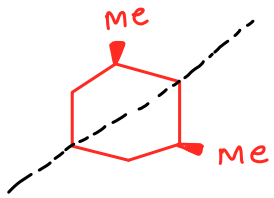


1 P.O.S.
C.O.S. X
Achiral

(21)

P.O.S. X
C.O.S. X
Chiral

(22)

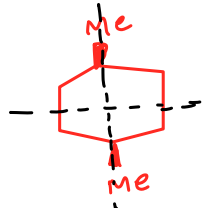


1 P.O.S.
C.O.S X
Achiral

(23)

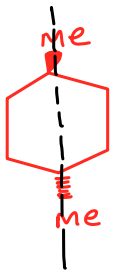
P.O.S. X
C.O.S. X
Chiral

(24)



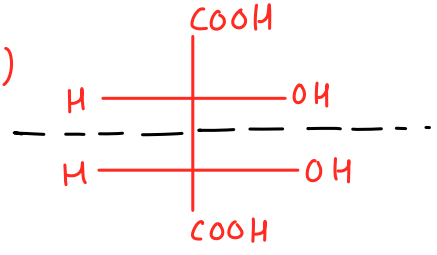
2 P.O.S.
C.O.S. X
Achiral

(25)



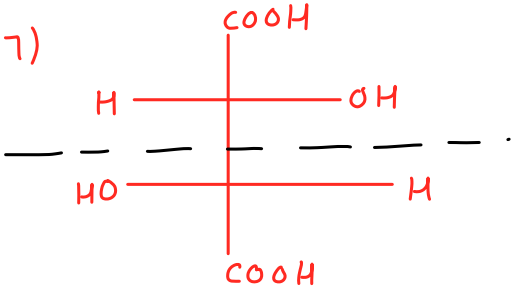
1 P.O.S.
C.O.S. ✓
Achiral

(26)



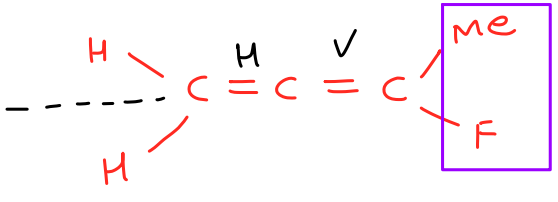
P.O.S. ✓
C.O.S. X
Achiral

(27)



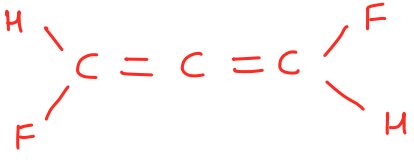
P.O.S. X
C.O.S. X
Chiral

(28)

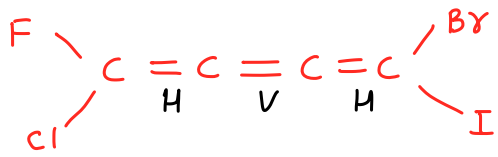


P.O.S. ✓
C.O.S. X
Achiral

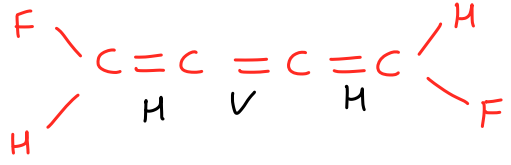
(29)



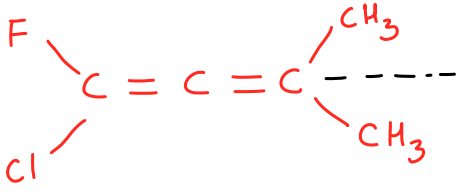
NO P.O.S.
C.O.S X
Chiral

(30) 

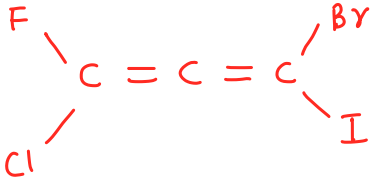
P.O.S. ✓
C.O.S. ✗
Achiral

(31) 

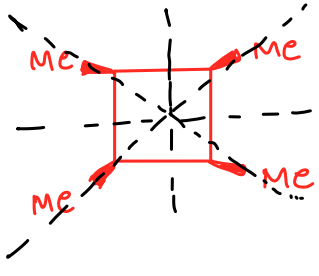
P.O.S. ✓
C.O.S. ✓
Achiral

(32) 

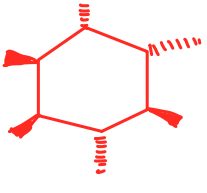
P.O.S. ✓
C.O.S. ✗
Achiral

(33) 

P.O.S. ✗
C.O.S. ✗
Chiral

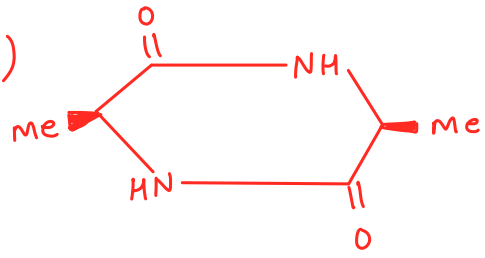
(34) 

4 P.O.S.
C.O.S. ✗
Achiral

(35) 

P.O.S. ✗
C.O.S. ✗
Chiral

(36)

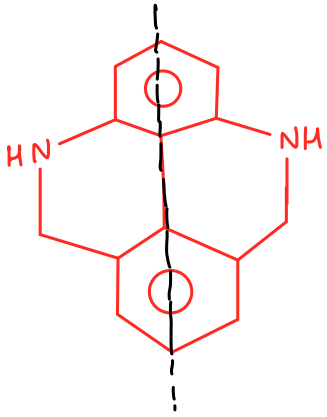


P.O.S. X

C.O.S. X

Chiral

(37)

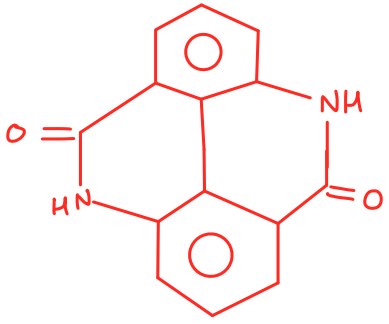


1 P.O.S.

C.O.S X

Achiral

(38)

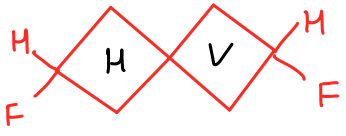


P.O.S. X

C.O.S. ✓

Achiral

(39)

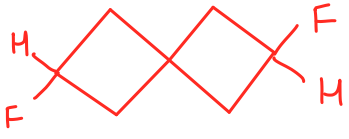


P.O.S. X

C.O.S. X

Chiral

(40)

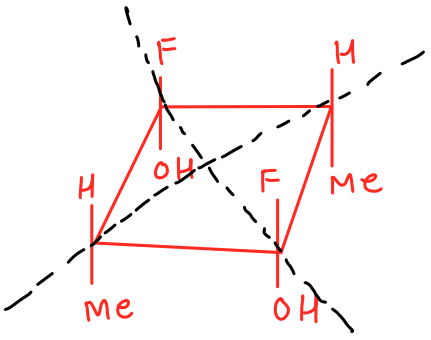


P.O.S X

C.O.S. X

Chiral

(41)

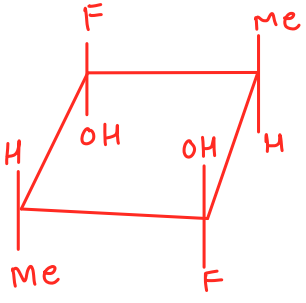


2 P·O·S.

C.O.S. X

Achiral

(42)



NO P·O·S. X

C.O.S. ✓

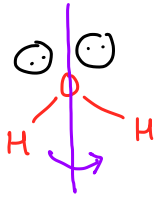
Achiral

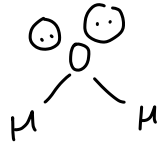
Axis of symmetry or Proper axis of symmetry (C_n) →

An imaginary axis along which if molecule is rotated by $\theta°$ then original picture of molecule reappears then It is said to be C_n axis of sym.

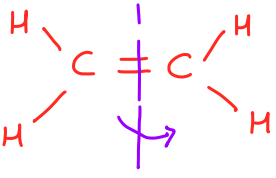
Where $n = \frac{360°}{\theta}$

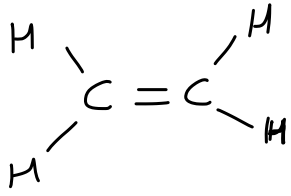
Ex.



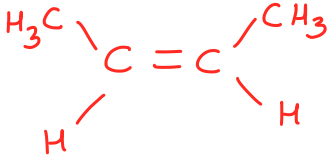


(C_2)

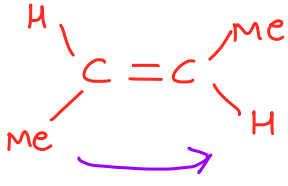


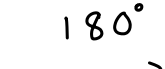


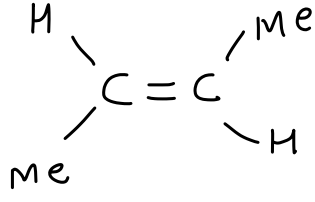
(C_2)



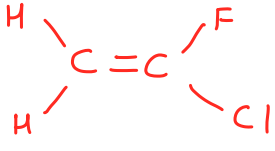
(C_2)



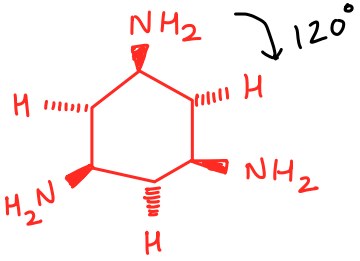




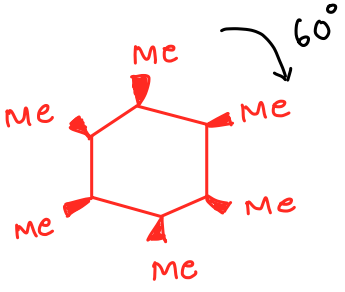
(C_2)



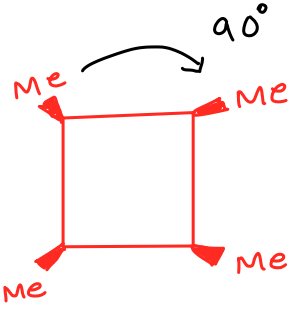
(C_1)



(C_3)



(C_6) , (C_3) , (C_2)



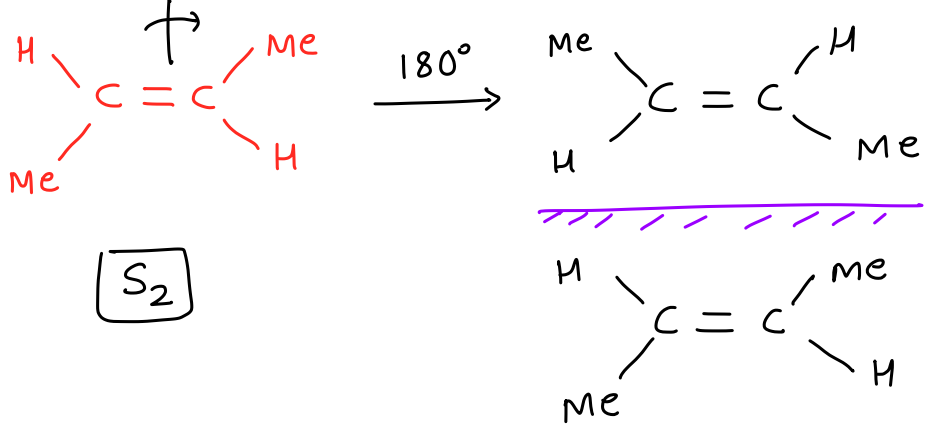
(C_4)

Alternating Axis of symm. or Rotational reflection A.O.S. or Improper A.O.S. (S_n) →

It is a line passing through the molecular structure around which if molecule is rotated by angle θ followed by reflection on a mirror placed at right angle to the axis produces the original picture of molecule.

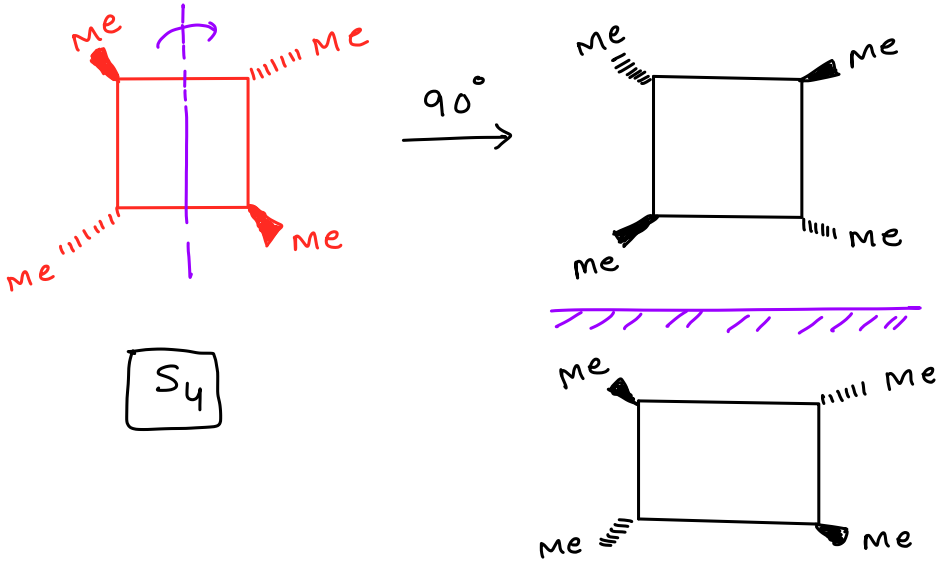
where $n = \frac{360^\circ}{\theta}$

Ex.



S_2

Ex.

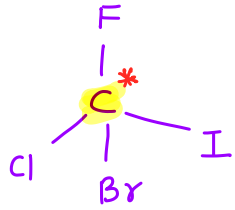


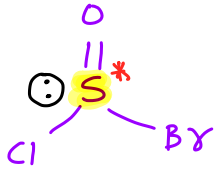
S_4

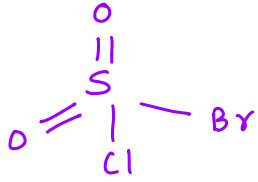
Chiral centre ⟶ An sp^3 hybridised atom which has 4 different valency groups is known as chiral centre.

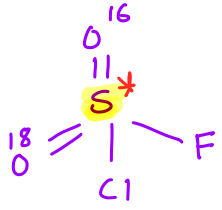
lp is also considered as different valency.

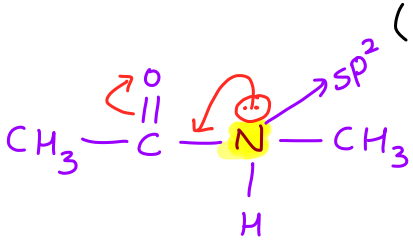
Ex.



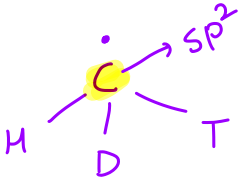


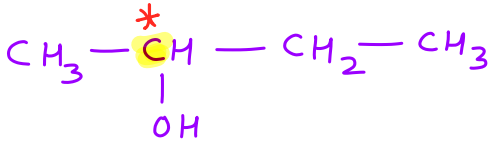


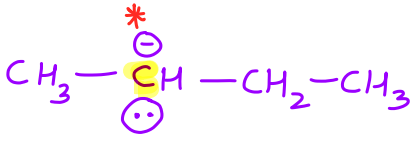


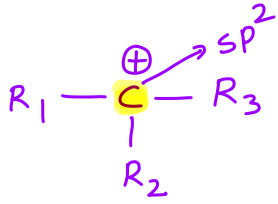


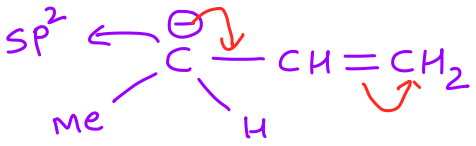
(Not a chiral centre)





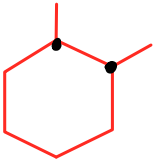




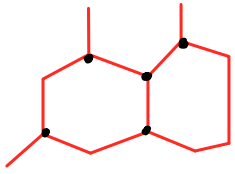


Q. Calculate total no. of chiral centres and Chiral carbon atoms :

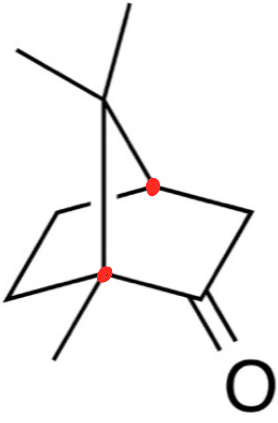
(i)



(ii)

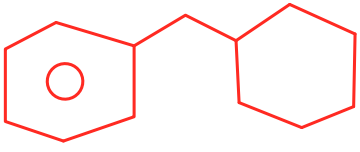


(iii)

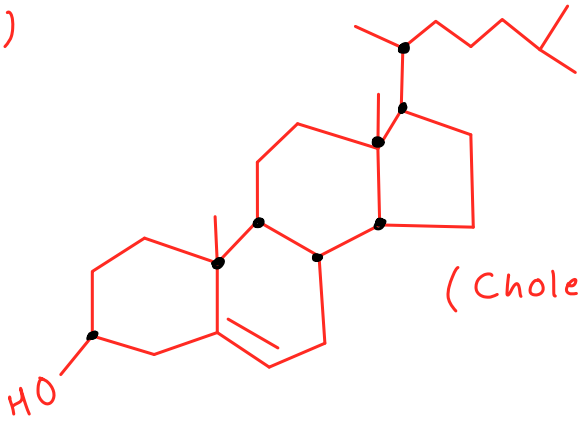


(Camphor)

(iv)

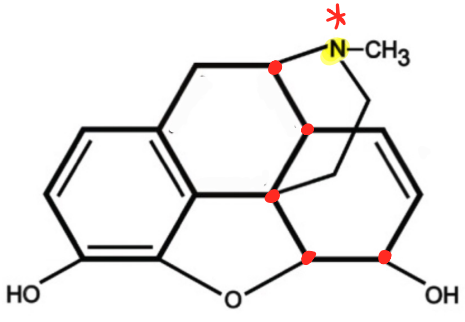


(v)



(Cholestrol)

(vi)

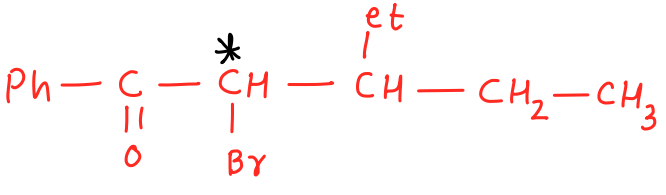


5 chiral carbon

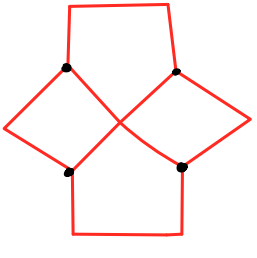
1 chiral – N

(Morphine)

(vii)

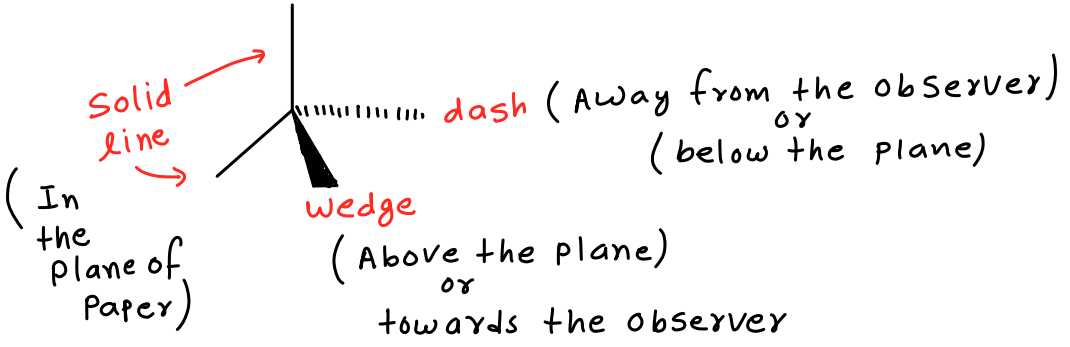


(viii)

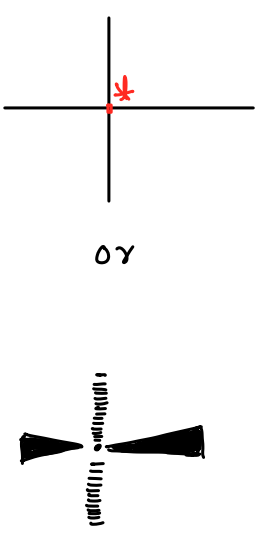


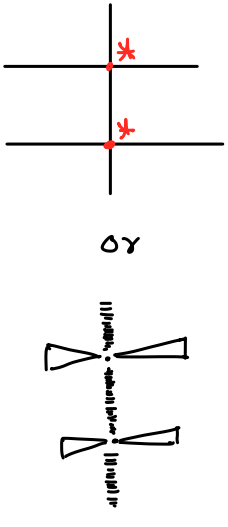
Projection formula → 2-D representation of a molecule

(1) Perspective Projection / Dash-wedge formula / flying wedge projection →

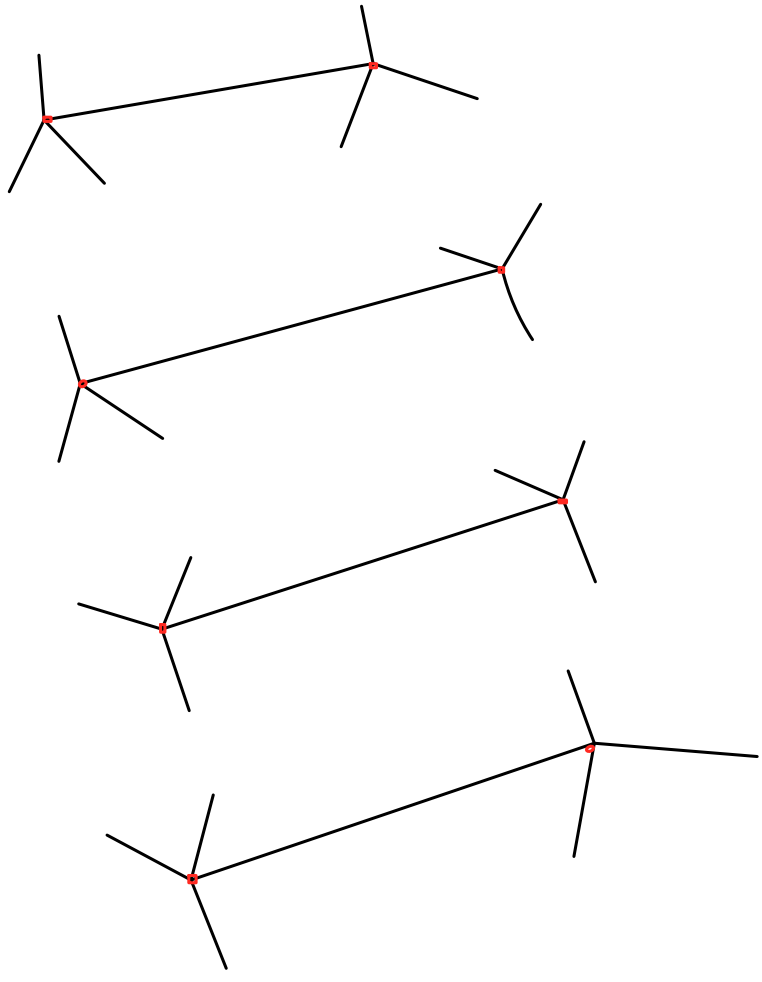


(2) Fischer Projection →

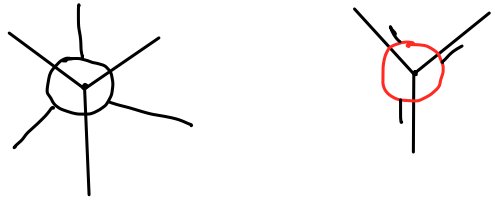




(3) Saw horse projection →

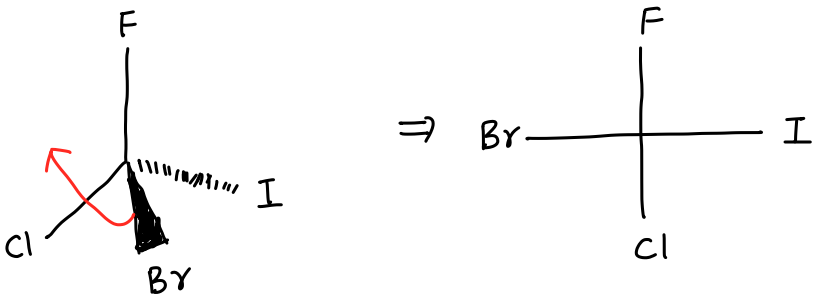


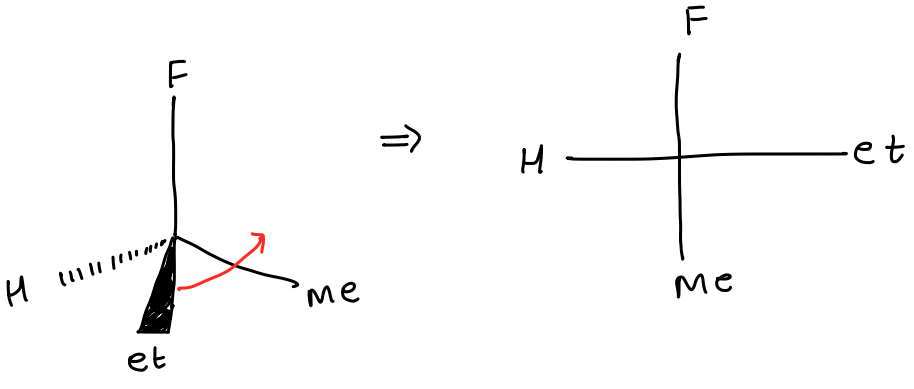
(4) Newmann Projection →

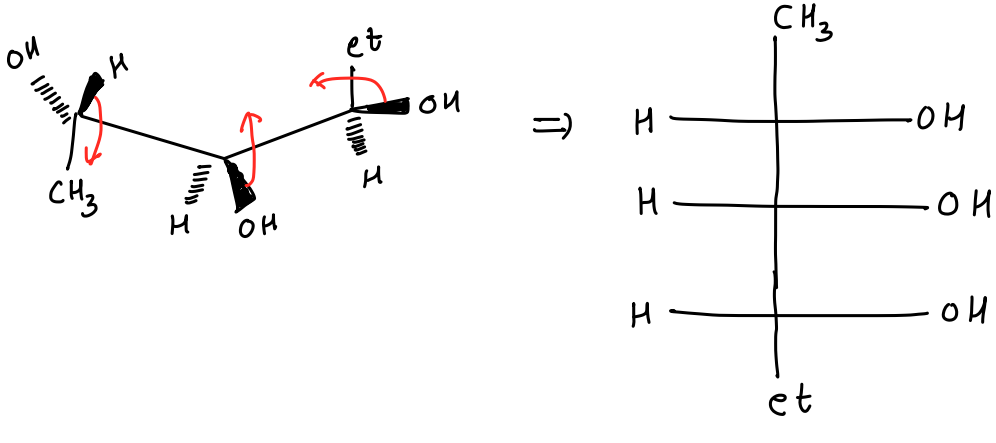


Interconversion of Projection formula →

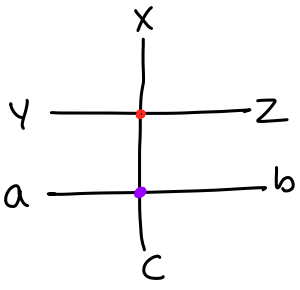
(1) Perspective to Fischer →

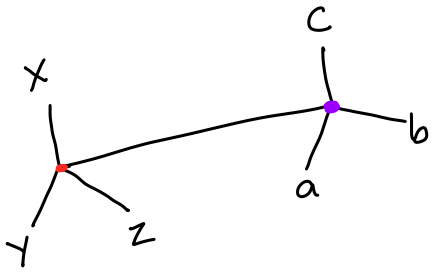


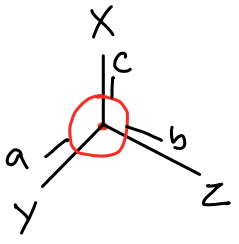


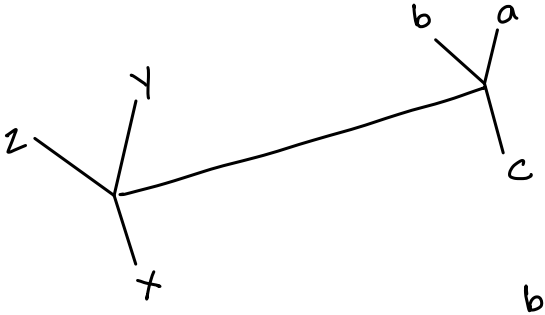


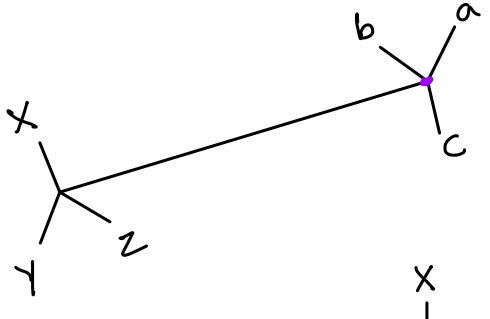
(2) Fischer to Saw horse to Newmann →

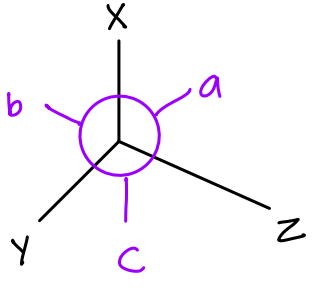












Homework

DTS-1-11
Q.43,44,47,48,112,128
JEE MAIN
Q.6,29,41
JEE ADVANCED
Q.19,23