

ISOMERISM

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NEET SYLLABUS

Ε

Isomerism (Conformational, Geometircal and Optical Isomerism) :

OBJECTIVES

After studying this unit, we will be able to :

• recognise and write structures of isomers of alkanes, alkenes, alkynes and aromatic

hydrocarbons;

- understand the concept of molecular and structural formula;
- draw and differentiate between various conformations of ethane;
- understand the concept of restrited rotation and optical rotation;

"Dream is not that which you see while sleeping it is something that; does not let you sleep."

A.P.J. Abdul Kalam, Wings of Fire : An Autobiography

ISOMERISM

Two or more than two compounds having the same molecular formula but different physical/chemical or both properties are called isomers and the phenomenon is called isomerism.



2.1 Structural Isomerism

2.1.1 Chain Isomerism (C.I.)

The compounds which have same molecular formula, same functional group but different arrangement of carbon chain (Parental or side chain) show chain isomerism.

Ex.
$$CH_3 - CH_2 - CH_2 - CH_3$$
 $CH_3 - CH - CH_3$
 CH_3 Butane (4C)2-Methyl propane (3C)Ex. $CH_3 - CH_2 - CH_2 - CH_2 - OH$ $CH_3 - CH - CH_2 - OH$
 CH_3 I-Butanol (4C)2-Methyl-1-propanol (3C)Ex. \Box
Methylcyclobutane $Cyclopentane$

2.1.2 Position Isomerism (P.I.)

The compounds which have same molecular formula, same functional group, same parent carbon chain but different position of functional group or multiple bond or substituents, show position isomerism.

Ex.	$CH_2 = CH - CH_2 - CH_3$	$CH_3 - CH = CH - CH_3$
	But-1-ene	But-2-ene
Ex.	$CH_3 - CH_2 - CH_2 - CH_2 - OH$	$CH_3 - CH_2 - CH - CH_3$ OH
	1–Butanol	2–Butanol
Ex.		Br
	1-Bromo-2-chlorocyclopropane	1-Bromo-1-chlorocyclopropane

Example of CI and PI :

(ii)

(i) $C_5 H_{12}$ has three structural isomers :

(iii) C₃H₆Cl₂ has 4 isomers : Position of chlorine atom is different in all the structure, so these are position Isomers.

a.
$$H_{3}C - CH_{2} - CH - CI$$

$$1,1-Dichloropropane$$
b.
$$H_{2}C - CH_{2} - CH_{2} - CI$$

$$1,3-Dichloropropane$$
c.
$$H_{3}C - C - CH_{3}$$

c.
$$H_{3}C - CH_{3}$$

2,2-Dichloropropane

How many structural isomers of $C_7 H_{\rm 16}$ are possible ? Ex. Ans. (9)

> 1. \leftarrow CH₃—CH₂—CH₂—CH₂—CH₂—CH₂—CH₃ Heptane $\longrightarrow CH_{3}-CH_{2}-CH_{2}-CH_{2}-CH_{2}-CH_{3}-CH_{3} - CH_{3} + CH$ 2. 3. \longrightarrow CH₃-CH₂-CH₂-CH₂-CH₃ 2,2-Dimethyl pentane 4. ĊH₃

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2.1.3 Ring chain isomerism (RCI)

Same molecular formula but different mode of linking (open chain & closed chain) of carbon atoms.

$$C_{3}H_{6}$$
 $CH_{3}-CH=CH_{2}$ [open chain]
 $C_{3}H_{6}$ CH_{2} [closed chain or ring]

GOLDEN KEY POINTS

- Alkenes with cycloalkane and alkynes and alkadienes with cycloalkenes show Ring-chain Isomerism.
- Ring-chain Isomers are also Functional Isomers but priority must be given to Ring-chain Isomers.

2.1.4 Functional Isomerism

Same molecular formula but different functional groups.

Following compounds show Functional isomerism, as they have same molecular formula and different functional group.

(i)	Alcohol and Ether	\longrightarrow	$CH_3 - CH_2 - OH$ and	CH ₃ —O—CH ₃
(ii) Aldehydes and Ketones	>	$CH_3 - CH_2 - C - H$ and $\parallel O$	$CH_3 - C - CH_3$
(ii	i) Acids and Ester	\longrightarrow	$CH_3 - C - OH$ and $\parallel O$	$\begin{array}{c} H - C - O - CH_{3} \\ \parallel \\ O \end{array}$
(iv	v) Cyanide and Isocyanide	\longrightarrow	CH ₃ -CH ₂ -CH ₂ -CN	and CH_3 — CH_2 — CH_2 — NC
(v) Nitro and Nitrite	\longrightarrow	$CH_3 - CH_2 - N \bigvee_O^{\not = O}$ and	CH ₃ CH ₂ ON=-O

(vi) 1° , 2° , 3° Amines

(i)
$$CH_3 - CH_2 - CH_2 - NH_2$$
 (ii) $CH_3 - NH - CH_2 - CH_3$ (iii) $CH_3 - N - CH_3$

(vii) Alcoholic and Phenolic compounds :

$$\bigcirc CH_2OH \qquad \qquad \bigcirc CH_2OH \qquad \qquad \bigcirc CH_3$$

(viii) Alkyl halides do not show Functional isomerism.

(ix) $CH_3-C \equiv CH$ propyne and $CH_2=CH=CH_2$ allene

2.1.5 Metamerism

Same molecular formula, same polyvalent Functional group but different alkyl groups attached to polyvalent Functional group.

Polyvalent Functional group [Which have more than one valency] are :

Examples Based on Structural Isomerism :-

Ex. 1 $C_4H_{10}O$ Structural isomers \Rightarrow 7 [4 alcohol and 3 ethers] total 7 structural isomers are possible. **Alcohol :** $CH_3-CH_2-CH_2-OH$ $CH_3-CH_2-CH_3-OH$



BEGINNER'S BOX-1

1.	Structures CH ₃ -CH ₂ -	-CH=CH $_2$ and CH	I₃−C=CH₂ are :-		
			CH ₃		
	(1) Chain isomers		(2) Position isome	rs	
	(3) Both chain & posit	ion isomers	(4) Not isomers		
2.	How many minimum ca	rbons required for Ch	hain isomerism and F	Position isomeris	m in alkanes ?
	(1) 4, 5 (2)	3, 5	(3) 4, 6	(4) 4, 4	
3.	How many minimum ca	rbons required for Ch	hain isomerism and F	Position isomeris	m in alkenes ?
	(1) 4, 5 (2)	3, 4	(3) 4, 4	(4) 5, 5	
4.	How many minimum ca	rbons required for Cl	hain isomerism and F	Position isomeris	m in alkynes ?
	(1) 5, 4 (2)	5, 3	(3) 4, 6	(4) 4, 4	
5.	CH ₃ -CH=CH-CH ₃	and $CH_2 - CH_2$	are :-		
		$CH_2 - CH_2$			
	(1) Ring-chain Isomers	(2) Chain Isomers	s (3) Function	al Isomers	(4) Position Isomers
	O		O		
6.	$CH_3 - CH_2 - CH_2 - CH_2 - CH_2$	-OH and CH ₃ —CH ₂	2 - CH - CH - H are		
			 ОН		
	(1) Position isomers	(2) Functional iso	mers (3) Identical		(4) Chain isomers
7.	CH ₃ —S—CH ₂ —CH ₃	and CH ₃ —CH ₂ -	—S—CH ₃ are –		
	(1) Ring-chain Isomers	(2) Chain Isomers	s (3) Function	al Isomers	(4) Identical
	O O 	O II	O II		
8.	CH_3 — \ddot{C} — O — \ddot{C} — C_6 H	I_5 and C_6H_5 — \ddot{C} — C)— \ddot{C} — CH_3 are –		
	(1) Metamers	(2) Chain Isomers	s (3) Identical		(4) Position Isomers

2.2 Stereo Isomerism

Two or more than two compounds having same molecular formula, same structural formula but different arrangements of atoms or groups in space.

- (A) Configurational Isomerism : Stereo isomers which have following characteristics.
 - (a) Stereo isomer which cannot interconvert at room temperature due to restricted rotation known as Geometrical isomerism.
 - (b) Stereo isomers which have different behaviour towards plane polarised light are known as optical isomers.

(B) Conformational Isomerism

2.2.1 Geometrical isomerism (G. I) :

(i) Alkenes (>C=C<), oximes (>C= N—OH) and azo compounds [—N=N—] etc., show G. I. due to restricted rotation about double bond and (ii) cycloalkanes show G. I. due to restricted rotation about single bond in ring.

G. I. IN ALKENES :

Reason : Restricted rotation about double bond :

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Condition for Geometrical isomerism :

Only those alkenes show G. I. in which "Each sp² carbon individually have different atoms or groups"



HP - High priority and LP - Low priority

Priority Rules [CIP Sequence Rule] :

Rule I: Priority is proportional to atomic number of atom which is directly attached to sp² carbon.



Rule II : If rule-I is failed then consider the atomic number of next atom and so on.



Rule III :- If multiple bond is present then consider them as :-



Rule IV : If isotopes are present then consider atomic weight.

$$\begin{array}{c} H \\ H \\ D \end{array} C = C \begin{pmatrix} CH_3 \\ CH_2 - CH_3 & HP \\ T \end{pmatrix}$$

BEGINNER'S BOX-2

Assign correct E, Z configuration to following molecules :-1.



GEOMETRICAL ISOMERS IN OXIMES [>C = N-OH] :

- Oximes show G. I. due to restricted rotation about double bond.
- Only those oximes show Geometrical isomerism in which sp² carbon have two different groups.

$$= O + H_2 N - OH \longrightarrow CH_3 - CH = N - OH (oxime)$$

Ex. Acetaldoximes has two Geometrical isomers -

$$\begin{array}{ccc} CH_{3}-C-H & CH_{3}-C-H \\ \parallel & & \parallel \\ N-OH & HO-N \end{array}$$
syn anti

syn

When H and OH are on the same side.

When H and OH are on the opposite side

Ex. Benzaldoxime
$$\begin{array}{ccc} Ph-C-H & Ph-C-H \\ \parallel \\ N-OH & HO-N \\ [Syn.] & [Anti] \end{array}$$

1.

2.

GEOMETRICAL ISOMERS IN AZO COMPOUNDS : (-;;-)



GEOMETRICAL ISOMERS IN CYCLOALKANES : Cycloalkanes show Geometrical isomerism due to restricted rotation about single bond. Only those cyclo alkanes show Geometrical isomers in which atleast two different carbons have two different groups.



NUMBER OF GEOMETRICAL ISOMERS IN POLYENES :

 R_1 -CH=CH-CH=CH....CH=CH- R_2 If $R_1 \neq R_2$ then number of Geometrical isomers = 2^n (a) [n = number of double bonds which show G.I.]CH₃-CH=CH-CH=CH-CH₂CH₃ Ex. As n = 3, number of Geometrical isomers $= 2^3 = 8$ If $R_1 = R_2$ then number of Geometrical isomers = $2^{n-1} + 2^{p-1}$ (b) where $p = \frac{n}{2}$ (when n is even) and $p = \frac{n+1}{2}$ (n is odd) CH_3 -CH=CH-CH=CH-CH_3 [n = 3] Ex. Number of Geometrical isomers = $2^2 + 2^1$ = 4 + 2 = 6**BEGINNER'S BOX-3** Which of the following shows Geometrical isomerism -(b) $H_2C = N - OH$ (a) CH_3 — CH_2 —CH=N—OH(c) $CH_3 - C - CH_3$ (d) $CH_3 - C - CH_2CH_3$ \parallel N - OH(1) a, c (2) c, d (3) a, d (4) b, c Which of the following show Geometrical isomerism -(1) 1,1–Diphenyl–1–butene (2) 1,1-Diphenyl-2-butene (4) 3-Phenyl–1–butene (3) 2,3-Dimethyl-2-butene 26





2.2.2 OPTICAL ISOMERISM :

Optical isomers : Two or more than two compound have same molecular formula, same structural formula but different behaviour towards PPL (plane polarised light).



Optical activity : Tendancy to rotate plane of PPL in a particular direction. If a compound rotates plane of PPL in clockwise direction then it will be dexterorotatory or d or (+) and if a compound rotates plane of PPL in anticlockwise direction then it will be leavorotatory or ℓ or (-).



Chiral carbon : Carbon which is bonded to four different atoms or groups.



Chiral molecule : (i) A molecule having only one chiral centre then it will be always chiral. Except flipping



(ii) A molecule having atleast two chiral carbons and no symmetry then it will be chiral molecule.



Essential and sufficient condition for optical activity is :

"Molecule should be **chiral**" or

"Molecule should be **unsymmetrical**"

or

"Nonsuperimposable mirror images"

Absolute Configuration (R, S configuration) :

The actual three dimensional arrangement of groups in a molecule containing asymmetric carbon is termed as **absolute configuration**.

(R) (S) nomenclature is assigned as follows :

1. Each group attached to stereocentre is assigned a priority on the basis of CIP sequence rule.

Example : $F - \begin{array}{c} Cl & 3 \\ | & | \\ C - I & \equiv 4 - \begin{array}{c} - C \\ | & | \\ Br & 2 \end{array}$

2. After assigning priorties, the least priority group is written at remotest valency (going away).



• Now the order from top priority to second priority and then to the third priority is determined. If it gives a clockwise direction then it is termed R configuration and if the anticlockwise direction is obtained then it is assigned S configuration. For example.





H₃C COOH



R-configurationS-configurationR-configurationS-configuration(clockwise from top priority)(Anti clockwise from top priority)(clockwise from top priority)(Anti clockwise from top priority)

Enantiomers :

Stereoisomers which are mirror images to each other and not superimpose to each other. Nonsuperimposable mirror images are called as enantiomers.





- (i) Enantiomers have chiral structures.
- (ii) Enantiomers are optically active substances. They rotate the plane polarized light in opposite directions but to the equal extent.

Diastereomers : Stereoisomers which are not mirror images of each others.



EXAMPLES OF OPTICAL ISOMERISM



(1) and (2) are diastereomers.

Example :

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Example :

I and II are identical

Meso compounds : Compounds having atleast two chiral carbons and plane of symmetry/cos/symmetry is called meso compounds. It is optically inactive due to internal compensation.



Racemic mixture : Equimolar mixture of d and ℓ enantiomers is called as racemic mixture. (d ℓ or \pm).



"Racemic mixture is optically inactive due to external compensation.

Pre-Medical : Chemistry

BEGINNER'S BOX-4 1. Which of the following molecule is chiral :-(1) Isobutane (2) Neopentane (3) Sec. butylchloride (4) All 2. Which of the following molecule has chiral carbon :-(1) $Cl \xrightarrow{Cl} CH_3$ (2) $HO \xrightarrow{C_2 + 45} H$ (3) $H \xrightarrow{Ll} Me$ (4) $I \xrightarrow{Cl} Br$ H C_2H_5 H Cl3. How many chiral carbon atoms are present in following molecule :- $CH_{3} - CH - CH - CH - CH_{3}$ $CH_{3} - CH - CH - CH_{3}$ I CI CH_{3} (2) 2 (3) 3 (4) 4 (1) 1Number of stereoisomers : S.N. Nature of No. of meso Total no. of No. of optically active isomers (a) compounds (m) Stereoisomer (a + m) compounds 0 2ⁿ $(2^n + 0)$ 1 Compounds having dissimilar ends (n = No. of chiral centre)2 Compounds having $(2^{n-1}+2^{\frac{n}{2}-1})$ $2^{\frac{n}{2}-1}$ 2n-1 similar ends with even chiral centres 3 Compounds having $2^{n-1} - 2^{\frac{n-1}{2}}$ $2^{\frac{n-1}{2}}$ similar ends with 2^{n-1} odd chiral centres

Optical Isomerism in cyclic compounds :

(i)

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 CH_2 CH_2 No chiral carbon, Molecule is achiral

Molecule is optical inactive Special Point :

1. Chiral nitrogen containing/tertiary/open chain amine does not show optical isomerism Reason :- Rapid umbrella inversion.



Energy required for this interconversion is available at room temperature. So I and II are interconvertible.



(ii)

Chiral carbon, Chiral molecule, Optically active

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2. Chiral C containing carbanion does not show optical isomerism. Reason :- Rapid umbrella inversion.



Energy required for this interconversion is available at room temperature. So I and II are interconvertible. Note :- Only 2^{nd} period elements show flipping.

3. Substituted Allenes do not have chiral carbons but molecule is chiral, so show optical isomerism.

 $\begin{array}{cccc} CH_2 = C = CH_2 & \longrightarrow & X \\ Allene & & Y \end{array} C = C = C \begin{pmatrix} X \\ Y \end{pmatrix}$

(No chiral C but molecule is chiral)

(4) 1

(4)

CH₃

 $(2) CH_2 = C = CH_2$

·Ме

Only those substituted allenes will be optically active in which "each sp² C have different atoms or group".

4. Ortho substituted biphenyl compounds do not have any chiral carbon but due to chiral molecule, they are optically active.



BEGINNER'S BOX-5

1. Calculate total number of optical isomers in following compound :-

$$\begin{array}{c} CH_{3}-CH-CH-CH_{3} \\ I \\ OH OH \end{array}$$
(1) 4 (2) 3 (3) 2

2. Calculate total number of optical isomers in following compound :-

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

3. Which of the following is optically active :-





- 4. Which of the following is not optically active (1) CH_3 —CH=C=CH— CH_3
 - (3) $\underset{Br}{\overset{Cl}{\rightarrow}} C = C = C \overset{Cl}{\underset{Br}{\leftarrow}} Br$
- 5. Which of the following has 'S' configuration :-



(4)

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(B) Conformational Isomerism

The different arrangement of atoms in space that result from the free rotation around single bond, are called conformations. The phenomenon is called conformational isomerism



IV (Anti or staggered) : In this form distance between 2 methyl groups is maximum so minimum repulsion or maximum stable.

Stability order : IV > II > III > I

AL	len			Pre-Medical : Chemistry
		BEGINN	ER'S BOX-6	
1.	Which of the following	ng shows conformational i	somerism.	
	(a) H H H	(b) H H H	(c) H H	(d) H
	(e) H H H H H (e) H			
	(1) b, d, e	(2) a, b, c, e	(3) b, c, d	(4) c, d, e
2.	Most stable conforma	ation of butane is :-		
	(1) Partial eclipsed	(2) Full eclipsed	(3) Staggered	(4) Gauche
3.	Which of the followir	ng is not a pair of isomers	5 :	
	(1) Propyne and Cycl	opropene	(2) Propyne and P	ropadiene
	(3) Propene and Cycl	opropene	(4) 1-Propanol and	l Methoxy ethane
4.	What is dihedral angl	e in staggered form of eth	nane :-	
	(1) 30°	(2) 45°	(3) 75°	(4) 60°

ANSWER KEY

BEGINNER'S BOX-1	Que.	1	2	3	4	5	6	7	8
DECIMALA O DOA-1	Ans.	1	3	3	1	1	2	4	3
REGINNER'S ROX-2	Que.	1	2	3	4				
DEGINNER O DOA 2	Ans.	Z	Ε	Ε	Ε				
REGINNER'S ROX-3	Que.	1	2	3	4				
DECIMIER 5 DOX-5	Ans.	3	2	1	4				
REGINNER'S ROX-4	Que.	1	2	3					
DECIMIENO DON 4	Ans.	3	4	2					
BEGINNER'S BOX-5	Que.	1	2	3	4	5			
DECIMIEN O DOA-5	Ans.	2	2	3	2	3			
BEGINNER'S BOX-6	Que.	1	2	3	4				
BEOINNER 3 BOX-0	Ans.	1	3	3	4				

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E	XERCISE-I (Conceptual Questions)		Build Up Your Understanding
STR	UCTURAL ISOMERISM CH ₂ CHOHCH ₂ CHO and CH ₂ CH ₂ CH ₂ COOH	8.	Which are metamers :-
	 constitute a pair of :- (1) Position isomers (2) Metamers (3) Optical isomers (4) Functional isomers 		(1) $CH_3^-O-C_2H_2CH_2CH_3$, $CH_3^-CH_2^-O-CH_2^-CH_3^-$ (2) $C_2H_5^-O-C_2H_5$, $CH_3CH_2CH_2CH_2OH$ (3) $CH_3^-O-C_2H_5$, $CH_3^-CH_2^-O-CH_3$ (4) $CH_3^-C-CH_3$, $CH_3^-CH_2^-C-H_1^-$
2.	The minimum number of carbon atoms present in an organic compound to show chain isomerism is (1) 2 (3) 3 (3) 5 (4) 4	9.	Which similarity is necessary for isomerism– (1) Molecular formula (2) Structure formula
3.	The minimum number of carbon atoms present in an organic compound to be able to show position isomerism is :-	10	(3) Physical formula(4) Chemical formula
4 .	(1) 3 (2) 4 (3) 2 (4) 5 Which of the following compound is isomeric with	10.	(1) 3 (2) 4 (3) 5 (4) 6
	(1) $CH_3 - C - OC_2H_5$ O (2) $CH_2 - CH_2 - C - H$ OH OH	GEC 11.	$\begin{array}{c} H_{3}C \\ H_{3}C \\ H_{3}C \\ H_{3}C \\ \end{array} \xrightarrow{C=C} H \\ H_{3}C \\ COOH \\ \end{array} $ Exhibits :-
5.	 (3) CH₃—CH(OH)—CH₃ (4) CH₃O—CH₂—CH₂OH CH₂—NH—C₂H₅ and (CH₃)₂N show which type 		 (1) Tautomerism (2) Optical isomerism (3) Geometrical isomerism
	of isomerism :- (1) Position (2) Functional (3) Chain (4) None	12 .	(4) Geometrical and optical isomerism The isomerism shown by Benzaldoxime
6.	$CH_{3}-CH-CH_{2}-C=O \text{ and}$ $\downarrow \qquad \downarrow \qquad \downarrow \\ Cl \qquad H$ $CH_{3}-CH_{2}-CH_{2}-C-Cl$ $\downarrow \qquad \qquad$	13.	 (1) Optical (2) Geometrical (3) Metamerism (4) All of these Which of the following has Z-configuration :
	are constitute a pair of :- (1) Position isomers (2) Metamers (3) Optical isomers (4) Functional group isomers		(1) $ \begin{array}{c} H_{3}C \\ H \end{array} C = C < \begin{array}{c} C_{2}H_{5} \\ H \end{array} $ (2) $ \begin{array}{c} Br \\ HOCH_{2} \end{array} C = C < \begin{array}{c} CH(CH_{3})_{2} \\ CH_{2} - CH_{3} \end{array} $
7. 34	The minimum number of carbon atoms in ketone to show position isomerism :- (1) 3 (2) 4 (3) 5 (4) 6		(3) $\underset{\text{Br}}{\overset{\text{Cl}}{\succ}} = C < \underset{\text{D}}{\overset{\text{Tl}}{\square}}$ (4) All the above

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14. Which of the following has E-configuration :-

(1)
$$H_{3}C \sim CHO CH_{2}OH$$







15. Which is a pair of geometrical isomers :-



16. Which can show 'Geometrical isomerism' :-

(1)
$$\begin{array}{c} CH_{3} \\ CH_{3} \end{array} C = C \begin{array}{c} H \\ H \end{array}$$
 (2) $\begin{array}{c} H \\ H \end{array} C = C \begin{array}{c} CH_{3} \\ H \end{array}$

- (3) $H > C = C < H (4) H > C = C < CH_3$
- 17. Geometrical isomerism is shown by :



18. The simplest alkanol exhibiting optical activity
(1) n-butyl alcohol
(2) Isobutyl alcohol
(3) s-butyl alcohol
(4) t-butyl alcohol

19. Meso-tartaric acid $\begin{bmatrix} & COOH \\ H & & OH \\ H & & OH \\ COOH \end{bmatrix}$ is optically

inactive due to the presence of :-

- (1) Molecular symmetry
- (2) Molecular asymmetry
- (3) External compensation
- (4) Two asymmetric carbon atoms
- 20. Which is optically active molecule :-

(1)
$$C_6H_5-C-OH$$

(2) $CH_3-CH-C_2H_5$
OH
(3) $C_6H_5-CH-OH$
(4) $C_6H_5-CH-CH_3$
H
(4) $C_6H_5-CH-CH_3$

- 21. The number of stereo isomers of glucose (a six carbon sugar) is :(1) 8 (2) 12 (3) 16 (4) 24
- **22**. Number of chiral carbon atoms in the compound X, Y and Z respectively would be :

$$\begin{array}{c} X \Rightarrow \overbrace{Me}^{Me} \\ Me \end{array}$$

$$\begin{array}{c} Y \Rightarrow \overbrace{Me}^{Me} \\ \hline Z \Rightarrow \overbrace{Me}^{Me} \end{array}$$

- (1) 2, 1, 1(2) 1, 1, 1(3) 2, 0, 2(4) 2, 0, 1
- **23.** Identify R configuration :



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- **24.** The following two compounds are $H \xrightarrow{Cl}_{Br} F$ and $F \xrightarrow{Br}_{H} Cl$ (1) Enantiomers (3) Identical (4) Epimers
- **25.** If optical rotation produced by the compound [A] is +65°, then produced by the compound [B] is-



26. Among the following structure I to III

$$\begin{array}{cccc} C_2H_5-CH-C_3H_7, CH_3-C-CH-C_2H_5, & C_2H_5-CH-C_2H_5\\ & & & \\ CH_3 & O & CH_3 & CH_3\\ & & & \\ (I) & & (II) & & (III) \end{array}$$

It is true that :-

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- (1) All three are chiral compounds
- (2) Only I and II are chiral compounds
- (3) Only II is chiral compound
- (4) Only I and III are chiral compounds
- **27.** The absolute configuration of the compound is :



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









30. Amongst the following, which one could be the structure of an optically inactive monosaccharide having the molecular weight 150 :-



31. The correct configuration assigned for compounds (I) and (II) respectively are :-



T Z.\NODE02\B0AI-B0\TARGET\CHEM\ENG\WODULE-3\02.ISOMERISM\02-EXERCISE.P65

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CONFORMATIONAL ISOMERISM

33. The pair of structures represents :-





- (1) Enantiomers (3) Conformers
- (2) Position isomers (4) None

- Rotational angle require to get maximum stable 34. conformer from minimum stable conformer in n-butane is : (1) 360° (2) 180°
 - (3) 120° (4) 240°
- **35**. Which conformation of butane will have the minimum energy :-
 - (1) Gauche
 - (2) Anti/staggered
 - (3) Eclipsed
 - (4) None

E	XERC	CISE-	I										ANS	WER	KEY
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	4	4	3	2	2	4	3	1	1	3	2	2	4	4	3
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	3	2	3	1	2	3	4	3	1	3	2	3	4	3	4
Que.	31	32	33	34	35			-		_		-	-		
Ans.	1	2	2	2	2										
		-		-		-									.37



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Pre-Medical : Chemistry

AIPMT Mains-2011

12. The IUPAC name of the following compound



- (1) cis-2-chloro-3-iodo-2-pentene
- (2) trans-2-chloro-3-iodo-2-pentene
- (3) cis-3-iodo-4-chloro-3-pentene
- (4) trans-3-iodo-4-chloro-3-pentene

Re-AIPMT-2015

- Two possible stereo-structures of CH₃CHOH.COOH, which are optically active, are called :-
 - (1) Enantiomers
 - (2) Mesomers
 - (3) Diastereomers
 - (4) Atropisomers
- 14. The number of structural isomers possible from the molecular formula C_3H_9N is :
 - (1) 2 (2) 3
 - (3) 4 (4) 5

NEET-I 2016

15. Which of the following biphenyls is optically active?









- **16.** The **correct** statement regarding the comparison of staggered and eclipsed conformation of ethane, is :-
 - (1) The staggered conformation of ethane is less stable than eclipsed conformation, because staggered conformation has torsional strain
 - (2) The eclipsed conformation of ethane is more stable than staggered conformation, because eclipsed conformation has no torsional strain
 - (3) The eclipsed conformation of ethane is more stable than staggered conformation even through the eclipsed conformation has torsional strain
 - (4) The staggered conformation of ethane is more stable than eclipsed conformation, because staggered conformation has no torsional strain.

NEET-II 2016

17. The **correct** corresponding order names of four aldoses with configuration given below



respectively, is :-

L-erythrose, L-threose, D-erythrose, D-threose
 D-erythrose, D-threose, L-erythrose, L-threose
 L-erythrose, L-threose, L-erythrose, D-threose
 D-threose, D-erythrose, L-threose, L-erythrose
 AIIMS 2016

18. Give sawhorse representation for following compound



(4) 3



Find out relation in above structures

- (1) I and II are identical
- (2) II and III are identical
- (3) I and III are enantiomer
- (4) II and III are enantiomer
- **20.** Which of the following statement is incorrect?
 - (1) It is possible to separate eclipsed and staggered form of ethane at room temprature.
 - (2) Eclipsed form has torsional strain.
 - (3) Ethane has infinite number of confomer.
 - (4) Energy difference between staggered form and eclipsed form of ethane is 12.5 kJ/mole.

NEET(UG) 2017

- 21. With respect to the conformers of ethane, which of the following statements is true ?
 - (1) Bond angle changes but bond length remains same
 - (2) Both bond angle and bond length change
 - (3) Both bond angles and bond length remains same
 - (4) Bond angle remains same but bond length changes

AIIMS 2017

22. How many total number of stereo isomers are possible in following compound :-

(2) 2

(1) 4

AIIMS 2018

(3) 6

23.
$$\underset{H}{\overset{H_5C_6}{\longrightarrow}}C=C\overbrace{H}{\overset{C_6H_5}{\longrightarrow}}H \xrightarrow{H_5C_6}C=C\overbrace{H}{\overset{C_6H_5}{\longleftarrow}}H$$

Compare the melting point (MP) and dipole moment (µ) of the above compounds :-

- (1) MP and dipolemoment of b > a
- (2) MP of b > a but dipolemoment of b < a
- (3) MP and dipolemoment both of b < a
- (4) MP of a > b but dipolemoment of b > a
- 24. Which of the following isomers are not pair of enantiomers:-



EX	ERC	ISE-I	l (Pre	vious	Year	Quest	ions)	ANSWER KEY					KEY		
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	2	3	2	3	2	3	3	2	3	3	2	1	3	2
Que.	16	17	18	19	20	21	22	23	24						
Ans.	4	2	1	4	1	3	1	2	2						
40		-		-	-	-		-		-					



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Pre-Medical : Chemistry

9. Which of the following shows optical isomerism:-

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

- (4) All the above
- **10.** How many isomers of $C_5H_{11}OH$ will be primary alcohols (exclude stereoisomers) :- (1) 2 (2) 3 (3) 4 (4) 6
- 11. The minimum number of carbon atoms in ketone to show metamerism :(1) 3
 (2) 4
 (3) 5
 (4) 6
- **12.** Which is incorrect statement :-



are conformations





are Geometrical isomers





EX	(ERC	ISE-I	II (An	alytic	al Que	estion	s)						ANS	NER	KEY
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	4	4	4	4	2	3	1	3	4	3	3	1	1	4	4
Que.	16	17		-	•	•		•	•	•	-	•	-		<u>.</u>
Ans.	4	4													
42															

E	XERCISE-IV (Assertion & Reason)		Target AIIMS
	Directions for Asse	rtion	& Reason questions
T	nese questions consist of two statements each, p these Questions you are required to choos	orinted se any	as Assertion and Reason. While answering one of the following four responses.
(A)	If both Assertion & Reason are True & the Reas	son is a	a correct explanation of the Assertion.
(B)	If both Assertion & Reason are True but Reason	n is not	a correct explanation of the Assertion.
(C)	If Assertion is True but the Reason is False.		
(D)	If both Assertion & Reason are false.		
1.	Assertion :- The melting point of fumaric acidis higher than that of maleic acid.Reason :- The molecules of fumaric acid are moresymmetric than those of maleic acid and hence itgets closely arranged in the crystal lattice.(1) A(2) B(3) C(4) D	6.	Assertion :- The boiling point of cis 1, 2-dichloro ethene is higher than that of corresponding trans- isomer. Reason :- Cis- 1,2-dichloro ethene has higher dipole moment as compared to that of the trans- isomer. (1) A (2) B (3) C (4) D
2.	Assertion :- trans-1-chloro propene has higher dipole moment than cis-1-chloro propene. Reason :- The resultant of two vectors in trans-1-chloropropene is more than in cis-1-chloro propene. (1) A (2) B (3) C (4) D	7. 8.	 (1) A (2) B (3) C (4) D Assertion :- Meso tartaric acid is optically inactive. Reason :- Its optically inactivity is due to external compensation. (1) A (2) B (3) C (4) D Assertion :- 1,2-propadiene exhibits optical
3.	Assertion :- Trihydroxyglutaric acid (COOH—CHOH—CHOH—CHOH—COOH) exists in four stereoisomeric forms, two of which are optically active while the other two are meso- forms. Reason :- It contains two asymmetric and one pseudo-asymmetric carbon atom.	9.	isomerism. Reason :- Its mirror image is non-superimposable. (1) A (2) B (3) C (4) D Assertion :- Ethanol cannot show position isomerism. Reason :- Ethanol cannot show isomerism. (1) A (2) B (3) C (4) D A (2) B (3) C (4) D
4.	(1) A (2) B (3) C (4) D Assertion :- All meso form of compound are optical isomer. Reason :- Meso form is optically inactive. (1) A (2) B (3) C (4) D	10. 11.	Assertion :- CH ₃ -CH ₂ -Br and CH ₃ -CH ₂ -I are Functional isomers. Reason :- The above compounds are homologues. (1) A (2) B (3) C (4) D Assertion :- Neopentyl bromide and 2-bromo-2-methyl butane are enantiomers.
5.	Assertion :- Benzaldehyde forms two oximes on reacting with NH ₂ OH. Reason :- The two oximes arise due to geometrical isomerism around C=N bond. (1) A (2) B (3) C (4) D	12.	Reason :- Both nave same molecular formula as well as structure formula. (1) A (2) B (3) C (4) D Assertion :- Organic compounds which do not contain chiral carbon atoms can be optically active. Reason :- Presence of chiral carbon is an essential condition for optical activity.

(1) A (2) B (3) C (4) D

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		Н		C.H.	15.	Assertion	ı :- All hydr	ogen atoms is	$CH_2 = C = CH_2$
				2 5		lie in one p	lane.		
13.	Assertion :	- Cl	-CH ₃	H—————————————————————————————————————		Reason :	- All the c	arbon atoms	in it are ${\rm sp}^2$
						hybridised.			
		C ₂	H _s	CH ₃		(1) A	(2) B	(3) C	(4) D
		Compo	und - I	Compound - II	16.	Assertio	n :- 4-N	Methylhex-2	-ene shows
	Compound-I	and II are	enantiom	ers.		stereoisome	erism.	<i>,</i>	
	Reason :- N	lon superin	nposable m	hirror images are		Reason :-	It can show	w Geometrica	l isomerism.
	enantiomers.					(1) A	(2) B	(3) C	(4) D
	(1) A	(2) B	(3) C	(4) D					
14.	Assertion : stable than it	- cis-3-bronts ts trans for	mopropen rm.	oic acid is more					
	Reason :- [Dipole mor	nent of cis	form is greater					
	than trans fo	orm							
	(1) A	(2) B	(3) C	(4) D					

E	EXERCISE-IV (Assertion & Reason) ANSWER KE														
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	1	1	2	1	1	3	4	3	4	4	3	1	4	4
Que.	16														
Ans.	2														
44								_							