16.STEREO ISOMERISM - CIS TRANS ISOMERISM

SOLUTIONS

TEACHING TASK

JEE MAINS LEVEL QUESTIONS

1. Geometrical isomerism arises due to:
   A) Free rotation around C–C bond
   B) Restricted rotation around C=C bond
   C) Presence of chiral carbon
   D) Different molecular formula

Answer:B

Solution:Geometrical isomerism (cis/trans) arises because the double bond prevents free rotation.

2. Which compound shows geometrical isomerism?
   A) Prop-1-ene B) 2-Butene C) 2-Methylprop-1-ene D) Ethene

Answer:B

Solution:2-Butene ($CH_3CH=CHCH_3$) has different groups on each C of the double bond and shows cis/trans isomer.

3. Which condition is essential for geometrical isomerism?
   A) Presence of triple bond
   B) At least one carbon of C=C carries two identical groups
   C) Each carbon of C=C must have two different groups
   D) Presence of chiral carbon

Answer:C

Solution: Geometrical isomerism occurs when there is restricted rotation around a double bond, and for this to be possible, each carbon atom in the double bond must be attached to two different groups.

4. Which does not show geometrical isomerism?
   A) CHCl=CHCl B) $CH_2=CHCl$ C) $CH_3CH=CHCH_3$ D) CHBr=CHI

Answer:B

Solution:The left carbon (CH_2) has two identical H atoms, so no cis/trans possible

5. 1,1-dichloroethene does not show G.I. because:
   A) Both groups are identical on same carbon
   B) Rotation around double bond is free
   C) Double bond absent
   D) It is symmetrical

Answer:A

Solution:1,1-Dichloroethene ($CH_2=CCl_2$) has two identical groups on one carbon, so

no geometrical isomerism.

6. Maleic acid is more soluble in water than fumaric acid because: **(FA & SA- 3Marks/4 Marks)**

A) Maleic acid is trans
B) Maleic acid is polar (cis)
C) Maleic acid has higher molecular weight
D) Fumaric acid is unstable

Answer:B

Solution:Maleic acid is the cis isomer (polar, can hydrogen-bond with water) → more soluble than trans (fumaric).

7. In E/Z system, priority is decided by: **(FA & SA - 2 Marks)**

A) Atomic mass B) Atomic number
C) Number of bonds D) Polarity

Answer:B

Solution:CIP priority (E/Z) is decided by the atomic numbers of the atoms directly bonded to the double-bonded carbons

8. Which compound needs E/Z nomenclature?

A) But-2-ene B) $CH_3CH=CHCl$ C) CHBr=CHI D) 1,2-Dichloroethene

Answer:C

Solution:CHBr=CHI.

When all four substituents are different (or when simple cis/trans is ambiguous) you must use E/Z (apply CIP rules)

9. If higher priority groups are on same side of double bond, it is:

A) E B) Z C) Cis D) Anti

Answer:B

Solution:If the higher-priority groups are on the same side, the configuration is Z (from German zusammen = together).

10. Which compound shows syn/anti isomerism?

A) Alkanes B) Oximes C) Alkenes D) Alkynes

Answer:B

Solution:Oximes (C=N–OH) show syn/anti due to restricted C=N rotation.

11. Syn/anti isomerism is due to restricted rotation of:

A) C=C B) C=N C) C–C D) C=C

Answer:B

Solution:Syn/anti in oximes arises from restricted rotation about the C=N double bond

12. Which cycloalkane can show cis/trans isomerism?

A) Cyclopentane B) 1,2-Dimethylcyclopropane
C) Cyclohexane (unsubstituted) D) Cyclobutane

Answer:B

Solution:Small cycloalkanes with substituents on two ring carbons (like 1,2-dimethylcyclopropane) can exist as cis/trans stereoisomers

13. Which does not show G.I. in cycloalkanes?
    A) 1,2-disubstituted cyclopropane
    B) 1,1-disubstituted cyclopropane
    C) 1,2-disubstituted cyclobutane
    D) 1,3-disubstituted cyclohexane

Answer:B

Solution:1,1-disubstituted cyclopropane: both substituents on the same carbon $\rightarrow$no geometrical isomerism.

14. How many geometrical isomers possible for $CH_3–CH=CH–CH=CH–CH_3$ (unsym metrical diene)? **(FA & SA- 5 Marks/8 Marks)**
    A) 2 B) 3 C) 4 D) 6

Answer:C

Solution:Double bonds at 2-3 and 4-5; each double bond can be E or Z independently, but no symmetry, so 2 × 2 = 4 isomers.

15. Number of geometrical isomers for $CH_3–CH=CH–CH=CH–CH=CH–CH_3$ (sym triene):
    A) 4 B) 6 C) 8 D) 10

Answer:C

Solution:Three independent double bonds $\rightarrow 2^3=8$ geometrical isomers.

16. Which compound shows maximum G.I.?
    A) But-2-ene B) Hex-2-ene
    C) Octa-2,4,6-triene D) Prop-1-ene

Answer:C

Solution:Octa-2,4,6-triene (three double bonds) gives the largest number of possible geometrical isomers

JEE ADVANCED LEVEL QUESTIONS

Multicorrect Answer Type:

1. Which of the following compounds can exhibit geometrical isomerism?
    A) 2-Butene B) 1,2-Dichloroethene
    C) Prop-1-ene D) 2,3-Dimethyl-2-butene

Answer:A,B

Solution:A yes — each C of the C=C has two different groups (cis/trans possible).
B yes — 1,2-dichloroethene has cis and trans isomers.
C no — prop-1-ene has CH_2 on one carbon (two H's) so no cis/trans.
D no — in 2,3-dimethyl-2-butene each double-bond carbon has two identical

alkyl groups (no geometrical isomerism).

2. Which of the following statements are correct about E/Z isomerism?
A) It occurs due to restricted rotation around a C=C bond.
B) It can also be observed in oximes (C=N).
C) Priority of groups is decided based on mass of atoms.
D) Z-isomer means higher priority groups are on the same side.

Answer:A,B,D

Solution:A True — E/Z arises from restricted rotation about a double bond.
B True — C=N (oxidimes, imines, etc.) can show analogous E/Z (syn/anti) stereochemistry.
C False — priority is decided by atomic number (CIP rules), not simply by atomic mass (mass only used for isotopic cases).
D True — Z (zusammen) means the higher-priority groups are on the same side.

3. Which of the following cycloalkanes can exhibit geometrical (cis/trans) isomerism?
A) 1,2-Dimethylcyclopropane B) 1,1-Dimethylcyclobutane
C) 1,2-Dimethylcyclohexane D) 1,3-Dimethylcyclobutane

Answer:A,C,D

Solution:A) 1,2-Dimethylcyclopropane — yes (cis and trans possible).
B) 1,1-Dimethylcyclobutane — no (both substituents on same carbon $\rightarrow$no relative cis/trans).
C) 1,2-Dimethylcyclohexane — yes (cis/trans stereoisomers exist).
D) 1,3-Dimethylcyclobutane — yes (1,3 disubstitution on cyclobutane can be cis or trans)

Comprehension Type:

Geometrical isomerism is a kind of stereoisomerism which is present in the compounds containing a double bond
(C = C, C = N, N = N) and arise due to the restricted or frozen rotation about the double bond. The atoms or groups attached to the doubly bonded carbons must be different. In aldoximes, the isomer is named as syn if hydrogen and hydroxyl groups are on the same side of C = N bond and if these are on opposite sides, the isomer is named as anti. In ketoximes, the prefixes syn and anti indicate which group of ketoxime is syn or anti to hydroxyl group.

4. Which of the following does not show geometrical isomerism?
A) 1, 2-Dichloropent-1-ene B) 1,3- Dichloropent-2-ene
C) 1,1-Dichloropent-1-ene D) 1,4-Dichloropent-2-ene

Answer:C

Solution:1,1-Dichloropent-1-ene has Both chlorine atoms are on the same double-bond carbon (C-1), so that carbon has two identical substituents $\rightarrow$no cis/trans.

5. On treating with NH_2OH, which can form two products?
   A) Acetaldehyde B) Acetone
   C) Formaldehyde D) Benzophenone

Answer:A

Solution:NH_2OH reacts with carbonyls (aldehydes/ketones) to form oximes (RR'C=N–OH).
Two products means syn/anti isomers possible if the oxime has two different groups on C=N.
A) Acetaldehyde (CH_3CHO) $\rightarrow$ Aldoxime: CH_3–CH=N–OH. C of C=N has CH_3, H $\rightarrow$ two different groups $\rightarrow$ syn/anti possible (two products).
B) Acetone (CH_3COCH_3) $\rightarrow$Ketoxime: $(CH_3)_2C$=N–OH. C of C=N has CH_3, CH_3 $\rightarrow$ two identical groups $\rightarrow$ no syn/anti isomerism$\rightarrow$ one product.
C) Formaldehyde (HCHO) $\rightarrow$Aldoxime: H–CH=N–OH. C of C=N has H, H $\rightarrow$identical $\rightarrow$one product.
D) Benzophenone (Ph_2C=O) $\rightarrow$Oxime: Ph_2C=N–OH. C of C=N has Ph, Ph $\rightarrow$symmetrical $\rightarrow$one product.
So only acetaldehyde gives two stereoisomeric oxime

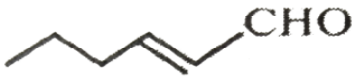
6. Number of stereoisomers of the compound 2-chloro-4-methylhex-2-ene is/are
   A) 1 B) 2 C) 4 D) 16

Answer:C

Solution:The C2=C3 double bond gives E/Z (2) and C-4 is an sp^3 stereogenic centre (chiral) giving 2 configurations $\rightarrow$ total 2×2=4 stereoisomers.

7. The correct structure of trans-2-hexenal is –

A) 

B) 

C) 

D) 

Answer:B

Solution:

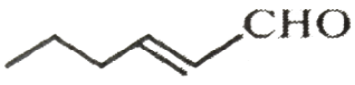
$$CH_3-CH_2-CH_2-CH=CH-CHO$$

$$H \qquad\qquad CHO$$

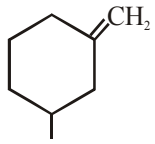
$$\backslash \quad C=C \quad /$$

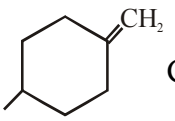
$$/ \qquad\qquad \backslash$$

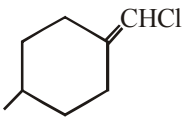
$$CH_3-CH_2-CH_2 \qquad\qquad H$$

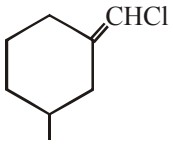


8. The geometrical isomerism is shown by :

A) 

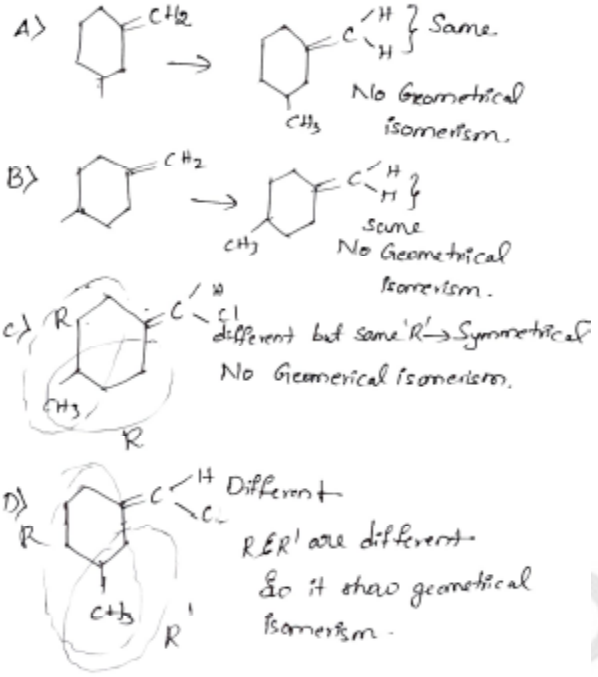
B) 

C) 

D) 

Answer:D

Solution:



Assertion and Reason Type:

A) Both the assertion and reason are true, and the reason is the correct explanation of the assertion.

B) Both the assertion and reason are true, but the reason is not the correct explanation of the assertion.

C) The assertion is true, but the reason is false.

D) Both the assertion and reason are false.

9. **Assertion (A)** : 2-Butene shows geometrical isomerism.
   Reason (R) : Rotation around a double bond is restricted.

Answer:A

Solution:2-Butene has cis/trans isomers because rotation about the C=C is restricted

10. **Assertion (A)** : 1-Butene does not show geometrical isomerism.
    Reason (R) : Both groups attached to one of the double-bonded carbons are identical (two H atoms).

Answer:A

Solution:1-Butene has CH_2 on one double-bond carbon — two identical H's — so no geometrical isomerism.

Integer Type:

11. How many geometrical isomers are possible for 2,3-dimethyl-2-butene?

Answer:0

Solution:2,3-Dimethyl-2-butene has identical substituents (methyl groups) on each double-bond carbon, so no cis/trans (no geometrical) isomerism.

12. How many stereoisomers (optical + geometrical) are possible for 2-chloro-3-methylpent-2-ene?

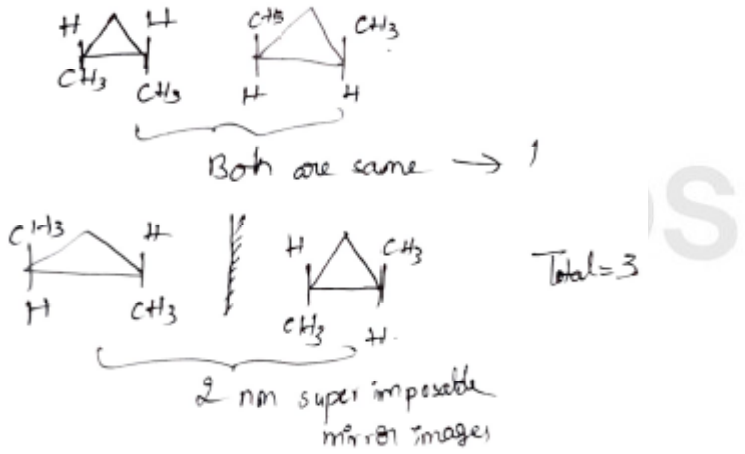
Answer:2

Solution:2-Chloro-3-methylpent-2-ene has a C2=C3 double bond with different groups on each double-bond carbon $\rightarrow$ E/Z possible $\rightarrow$2 stereoisomers. (No chiral sp^3 centre elsewhere.)

13. How many geometrical isomers are possible for 1,2-dimethylcyclopropane ?

Answer:3

Solution:



Matrix Matching Type

14.

Column I (Compound)	Column II (Type of Geometrical Isomerism)
A) $CH_3–CH=CH–CH_3$	(p) E/Z (Polyene)
B) $CH_3–CH=CH–CH=CH–CH_3$	(q) Cis/Trans (Alkene)
C) $CH_3–CH=CH–CH=N–OH$	(r) Syn/Anti (Azo compound)
D) Ph–N=N–Ph	(s) Syn/Anti (Oxime)

Answer:A–q, B–p, C–s, D–r

Solution:

A) $CH_3–CH=CH–CH_3$	(q) Cis/Trans (Alkene)
B) $CH_3–CH=CH–CH=CH–CH_3$	(p) E/Z (Polyene)
C) $CH_3–CH=CH–CH=N–OH$	(s) Syn/Anti (Oxime)

D) Ph–N=N–Ph (r) Syn/Anti (Azo compound)

LEARNERS TASK

CONCEPTUAL UNDERSTANDING QUESTIONS

1. Which of the following alkenes shows geometrical isomerism?
   A) $CH_2=C(CH_3)_2$ B) $CH_3–CH=CH–CH_3$ C) $CH_2=CH_2$ D) $CH_2=CH–CH_3$

Answer:B

Solution:s:2-butene has different groups on each C of the C=C and so shows cis/ trans

2. Which of the following will exhibit geometrical isomerism?
   A) 2-Butene B) 2-Methylprop-1-ene
   C) Prop-1-ene D) 1,1-Dichloroethene

Answer:A

Solution:2-Butene: Has a double bond between the second and third carbon atoms, with each carbon having a different substituent (methyl group and hydrogen), making it capable of geometrical isomerism.

3. Which of the following has highest dipole moment?
   A) cis-1,2-dichloroethene B) trans-1,2-dichloroethene
   C) Ethene D) Propene

Answer:A

Solution:Cis-1,2-dichloroethene — the dipoles of the two C–Cl bonds add in the cis isomer, giving a larger net dipole

4. Which has the lowest boiling point?
   A) cis-But-2-ene B) trans-But-2-ene
   C) cis-1,2-dichloroethene D) trans-1,2-dichloroethene

Answer:B

SolutionHydrocarbons have lower b.p. than chlorinated ones; trans is less polar than cis so lowest b.p.

5. Which form of fumaric acid/maleic acid is more stable?
   A) Maleic acid (cis) B) Fumaric acid (trans)
   C) Both equal D) Depends on solvent

Answer:B

Solution:Fumaric acid (trans) is more thermodynamically stable due to less steric strain between –COOH groups

6. Which one cannot be represented by cis/trans notation but only by E/Z?
   A) 2-Butene B) 1,2-Dichloroethene C) CHBr=CHI D) Maleic acid

Answer:C

Solution:CHBr=CHI — when all four substituents on the C=C are different, cis/trans is ambiguous, so you must use E/Z (CIP rules)

7. According to Cahn–Ingold–Prelog (CIP) rules, priority is given to the substituent with:
   A) Higher polarity
   B) Higher atomic number
   C) Higher molecular mass
   D) More number of atoms

Answer:B

Solution:The CIP rules assign priority to substituents based on the atomic number of the atom directly attached to the chiral center, with the higher atomic number receiving higher priority.

8. Which of the following oximes is capable of showing syn/anti isomerism?
   A) Acetone oxime
   B) Acetaldoxime
   C) Acetophenone oxime
   D) Both B and C

Answer:D

Solution:acetaldoxime and acetophenone oxime have different groups on the C of C=N, so they show syn/anti; acetone oxime has identical groups (two CH_3) so it does not.

9. Which compound shows geometrical isomerism due to ring structure?
   A) Cyclohexane
   B) 1,2-Dimethylcyclohexane
   C) 1,1-Dimethylcyclohexane
   D) Cyclopentane

Answer:B

Solution:1,2-Dimethylcyclohexane — ring substitution (1,2- relative positions) gives cis/trans stereoisomers (axial/equatorial dispositions), whereas 1,1-disubstitution or unsubstituted rings do not give cis/trans in that manner.

10. Which among the following is NOT an example of geometrical isomerism?
   A) Oximes
   B) Azo compounds
   C) Cyclopropane derivatives
   D) Alcohols

Answer:D

Solution:Ordinary alcohols are not examples of geometrical isomerism (unlike oximes, azo compounds, and suitably substituted cyclopropanes.

11. The maximum number of geometrical isomers possible for 2,4-hexadiene (un symmetrical diene) is:
   A) 2 B) 3 C) 4 D) 6

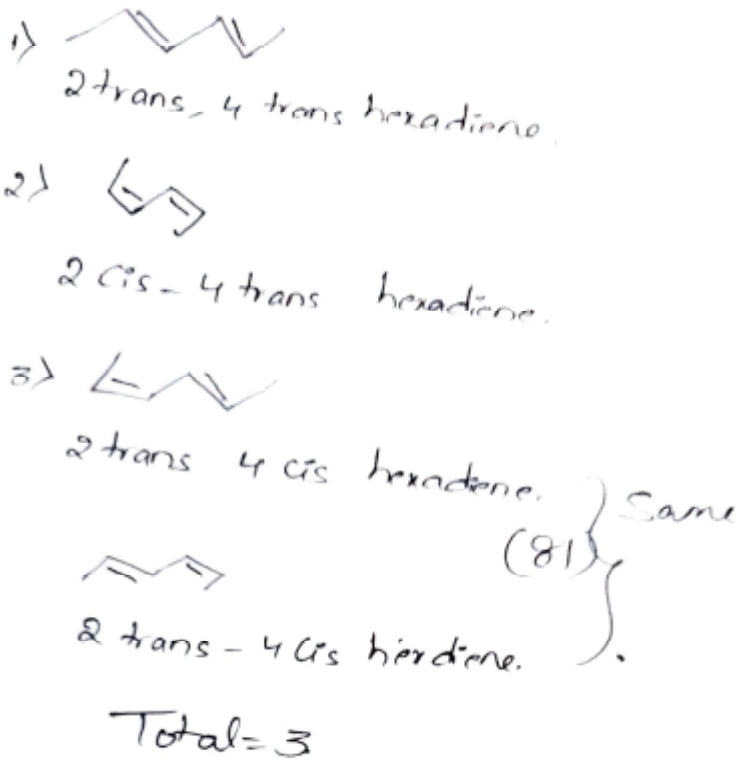
Answer:C

Solution:2,4- hexadiene has two double bonds. Number of possible geometrical isomers are $2^2=4$

12. The number of geometrical isomers possible for 2,4-hexadiene if it is symmetrical would be:
   A) 2 B) 3 C) 4 D) 5

Answer:B

Solution:Symmetry makes one of the four combinations identical to another, so only 3 distinct isomers remain.



13. Which among the following statements is correct?
A) cis isomers always have higher melting point than trans
B) trans isomers are generally more stable than cis
C) cis and trans always have equal polarity
D) cis and trans have identical solubility

Answer:B

Solution:A) False — trans often higher m.p. due to better packing.
B) True — trans generally more stable due to less steric repulsion.
C) False — cis usually more polar.
D) False — solubility differs due to polarity.

14. In polyenes, the number of geometrical isomers decreases if:
A) The molecule is unsymmetrical
B) The molecule is symmetrical
C) Number of double bonds increases
D) The substituents are different

Answer:B

Solution:Symmetry reduces the number of unique isomers because some become equivalent.

15. Which of the following isomer pairs is a correct cis–trans example?
A) cis- and trans-But-1-ene B) cis- and trans-2-Butene
C) cis- and trans-Ethene D) cis- and trans-Propene

Answer:B

Solution:But-2-ene has two different substituents on each C of the double bond so cis/trans exist; the others do not.

JEE MAINS LEVEL QUESTIONS

1. Which of the following compounds exhibits geometrical isomerism?
A) CH_2=CH–CH_3 B) 2-Methylprop-2-ene
C) CH_3–CH=CH–CH_2–CH_3 D) Ethene

Answer:C

Solution:A) CH_2=CH–CH_3 (propene) $\rightarrow$C1 has two H's $\rightarrow$ no G.I.
B) 2-Methylprop-2-ene $\rightarrow$ $(CH_3)_2C=CH_2$ $\rightarrow$$C_2$ has two CH3's, C1 has two H's $\rightarrow$no G.I.
C) CH_3–CH=CH–CH_2–CH_3 (pent-2-ene) $\rightarrow$ C2 has CH_3, H; C_3 has H, CH_2– CH_3 $\rightarrow$both different $\rightarrow$ yes G.I.
D) Ethene $\rightarrow$no G.I.

2. Which of the following statements about cis/trans isomers is correct?
A) Cis isomers are always less polar than trans
B) Trans isomers usually have lower melting points than cis
C) Cis isomers have higher dipole moment than trans
D) Cis and trans isomers have identical physical properties

Answer:C

Solution:Cis isomers generally have higher dipole moment than the corresponding trans (when polar substituents are present).

3. Which alkene can show geometrical isomerism around the double bond?
A) $CH_3CH=CHCH_3$ B) CH_2=CH–CH_2CH_3 C) $CH_2=CH_2$ D) $CH_3CH=CH_2$

Answer:A

Solution:2-Butene has two different groups on each double-bond carbon$\rightarrow$geometrical isomerism.

4. Which of the following oximes can show syn/anti isomerism?
A) Acetone oxime B) Acetaldoxime
C) Formaldehyde oxime D) Propionaldehyde oxime

Answer:B,D

Solution:Both have C=N with two different substituents on C, so syn/anti (E/Z-like) isomers; acetone/formaldehyde oximes do not.

5. In a disubstituted cycloalkane, cis/trans isomerism is possible only if:
(FA & SA- 3Marks/ 4 Marks)
A) Both substituents are on the same carbon
B) Ring size is less than 4
C) Substituents are on two different carbons
D) Substituents are identical

Answer:C

Solution:Substituents must be on two different carbons of the ring for cis/trans to be defined.

6. Which of the following alkenes cannot be represented by cis/trans notation but only by E/Z system?
   A) 2-Butene B) CHBr=CHI C) trans-2-Pentene D) cis-But-2-ene

Answer:B

Solution:Cis/trans requires at least one identical substituent on each double-bond carbon. CHBr=CHI has H on each C, so cis/trans possible (cis=both H's same side). But because priorities of Br vs I differ, E/Z is more precise, and many exam questions treat this as "cannot use cis/trans" if substituents are all different — but in CHBr=CHI, H's are identical, so cis/trans works fine in common usage

7. Which of the following compounds has a higher boiling point due to cis geometry?
   A) trans-1,2-Dichloroethene B) cis-1,2-Dichloroethene
   C) Ethene D) Propene

Answer:B

Solution:The cis form has a net dipole (higher intermolecular attraction) $\rightarrow$higher b.p.

8. For the compound CH_3–CH=CH–CH=CH–CH_3, the total number of geometrical isomers is: **(FA & SA- 5 Marks/8 Marks)**
   A) 2 B) 3 C) 4 D) 5

Answer:B

Solution:each double bond can be E or Z $\rightarrow 2^2=4$ algebraic combinations: (E,E), (E,Z), (Z,E), (Z,Z).
Because the molecule is symmetric (CH_3–CH=CH–CH=CH–CH_3), the (E,Z) and (Z,E) arrangements are identical by reflection/rotation, so there are only 3 distinct geometrical isomers: (E,E), (Z,Z), and the mixed one.

9. Which of the following compounds shows geometrical isomerism due to restricted rotation around C=N bond?
   A) Acetone B) Acetaldoxime C) Butanal D) Ethanol

Answer:B

Solution:Oximes (C=N–OH) show restricted rotation about C=N$\rightarrow$ syn/anti (geometrical) isomerism

10. The trans isomer of 1,2-dichlorocyclopropane is more stable than cis isomer because: **(FA & SA - 2 Marks)**
    A) Trans isomer has higher dipole moment
    B) Trans isomer has less steric strain
    C) Cis isomer is more symmetric
    D) Trans isomer has stronger hydrogen bonding

Answer:B

Solution:In cyclopropane, cis substituents on adjacent carbons are closer (eclipsed) → more steric strain. Trans has less steric interaction.

JEE ADVANCED LEVEL QUESTIONS

Multicorrect Answer Type:

1. Which of the following compounds can exhibit geometrical isomerism?
   A) 2-Butene
   B) 2-Methylbut-2-ene
   C) 1,2-Dichloroethene
   D) Prop-1-ene

Answer:A,C

Solution:A Yes — both sp^2 carbons carry two different groups → cis/trans possible.
C Yes — 1,2-dichloroethene has distinct cis and trans forms.
2-Methylbut-2-ene does not (one sp^2 carbon has two identical methyl-type substituents), Prop-1-ene does not (one sp^2 carbon is CH_2).

2. Which of the following statements about cis/trans isomers are correct?
   A) Cis isomers are usually more polar than trans
   B) Trans isomers are generally more stable than cis
   C) Cis isomers always have higher melting points than trans
   D) Trans isomers have higher symmetry than cis

Answer:A,B,D

Solution:A) Cis isomers are usually more polar than trans →True (dipole moments add in cis, often cancel in trans).
B) Trans isomers are generally more stable than cis →True (less steric/ electrostatic repulsion).
C) Cis isomers always have higher melting points than trans → False (trans often pack better → higher m.p., not always but often reverse).
D) Trans isomers have higher symmetry than cis → True (trans usually has a plane/center of symmetry cis lacks).

3. Which of the following cycloalkanes can exhibit cis/trans isomerism?
   A) 1,2-Dimethylcyclopropane
   B) 1,1-Dimethylcyclobutane
   C) 1,2-Dimethylcyclohexane
   D) 1,3-Dimethylcyclobutane

Answer:A,C,D

Solution:
A) 1,2-Dimethylcyclopropane → Yes (two different ring carbons, substituents can be same or opposite sides).
B) 1,1-Dimethylcyclobutane → No (both methyls on same carbon ? no cis/ trans).
C) 1,2-Dimethylcyclohexane → Yes.
D) 1,3-Dimethylcyclobutane → Yes (substituents on C1 and C3 are on different carbons).

Comprehension Type:

But-2-ene (CH_3–CH=CH–CH_3) exists in two forms due to restricted rotation

around the C=C bond. In the cis form, the two methyl groups are on the same side; in the trans form, they are on opposite sides.

4. Which property explains the higher melting point of trans-But-2-ene compared to cis?
   A) Higher dipole moment
   B) Greater symmetry $\rightarrow$ tighter crystal packing
   C) Higher molecular mass
   D) Hydrogen bonding

Answer:B

Solution:Trans-but-2-ene is more symmetrical, allowing molecules to pack efficiently in the solid state $\rightarrow$ higher melting point.

5. Which type of stereoisomerism is exhibited by But-2-ene?
   A) Optical B) Conformational C) Geometrical D) Structural

Answer:C

Solution:But-2-ene exists as cis and trans isomers $\rightarrow$ classic geometrical isomerism.

Assertion and Reason Type:

A) Both the assertion and reason are true, and the reason is the correct explanation of the assertion.
B) Both the assertion and reason are true, but the reason is not the correct explanation of the assertion.
C) The assertion is true, but the reason is false.
D) Both the assertion and reason are false.

6. **Assertion (A)** : Allene (C_3H_4) does not show geometrical isomerism.
   Reason (R) : In allenes, the two terminal carbon atoms lie in mutually perpendicular planes.

Answer:A

Solution:Allene (C_3H_4) lacks cis/trans about a single double bond in the usual sense; its terminal substituent planes are perpendicular because the central carbon is sp-hybridised with two orthogonal π-systems.

7. **Assertion (A)** : Cyclohexane-1,2-dimethyl can exist as cis and trans isomers.
   Reason (R) : Free rotation about single bonds in cycloalkanes allows interconversion of cis and trans forms.

Answer:C

Solution:Cyclohexane-1,2-dimethyl does have cis and trans isomers. But those isomers are not interconverted by free rotation about single bonds in the ring — rotation is restricted by the ring; interconversion would require bond-break ing (ring inversion can change conformations, not interchange true cis/trans stereochemistry).

8. **Assertion (A)** : E/Z isomerism is possible only when all groups attached to double bond are different.
   Reason (R) : If identical groups are present on the same carbon of the double bond, isomerism is not possible.

Answer:D

Solution:E/Z isomerism does not require all four substituents to be different — it only requires each double-bond carbon to bear two different groups. The reason is correct: if identical groups are attached to the same sp^2 carbon (e.g. CH_2=CHX), no geometrical isomerism about that double bond is possible.

Integer Type:

9. How many geometrical isomers are possible for 3-chloro-2-pentene_____

Answer:2

Solution:Structure of 3-chloro-2-pentene:

CH_3–CH = C(Cl)–CH_2–CH_3

At C-2: substituents = CH_3 and H $\rightarrow$ different

At C-3: substituents = Cl and CH2CH3 $\rightarrow$ different

Both double-bonded carbons have two different groups $\rightarrow$ geometrical (E/Z) isomerism possible.

Only E and Z forms.

Matrix Matching Type

10.

Column I (Isomer)	**Column II (Property Observation)**
A) cis-1,2-Dichloroethene	(p) More symmetric, lower boiling point
B) trans-1,2-Dichloroethene	(q) Lower melting point, higher boiling point
C) cis-But-2-ene	(r) Lower dipole moment, higher melting point
D) trans-But-2-ene	(s) Higher dipole moment, more soluble in water

Answer:A-s,B-p,C-q,D-r

Solution:

A $\rightarrow$ s: cis-1,2-dichloroethene is polar, so it has a higher dipole moment and is more water-soluble.

B$\rightarrow$ p: trans-1,2-dichloroethene is more symmetric and nonpolar, giving a lower boiling point than the cis isomer.

C $\rightarrow$ q: cis-but-2-ene has poorer packing (lower melting point) and slight polarity (higher boiling point).

D $\rightarrow$r: trans-but-2-ene has a lower dipole moment (˜0) and better crystal packing, so a higher melting point

KEY

				TEACHING TASK					
			JEE MAINS LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
B	B	C	B	A	B	B	C	B	B
11	12	13	14	15	16				
B	B	B	C	C	C				
			JEE ADVANCED LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
A,B	A,B,D	A,C,D	C	A	C	B	D	A	A
11	12	13	14						
0	2	3	A–q, B–p, C–s, D–r						
				LEARNERS TASK					
			CONCEPTUAL UNDERSTANDING QUESTIONS						
1	2	3	4	5	6	7	8	9	10
B	A	A	B	B	C	B	D	B	D
11	12	13	14	15					
C	B	B	B	B					
			JEE MAINS LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
C	C	A	D	C	B	B	B	B	B
			JEE ADVANCED LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	
A,C	A,B,D	A,C,D	B	C	A	C	D	2	
10-A-s,B-p,C-q,D-r									