



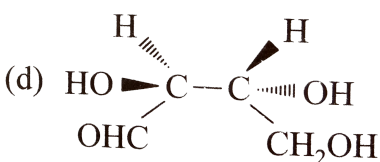
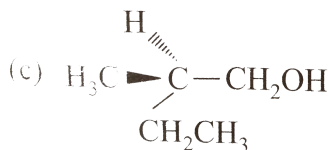
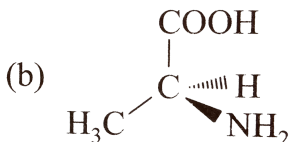
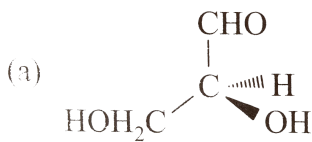
CHEMISTRY

BOOKS - R SHARMA CHEMISTRY (HINGLISH)

STEREOCHEMISTRY

Example

1. Draw Fischer projection formulas for the following molecules:



Strategy: By convention, Fisher projections are written with the main carbon chain extending from top to bottom and with all groups eslipe. in the Fischer formula, the chiral carbon is not drawm, it is at the crossing

of a horizontal and a vertical line. The horizontal lines represent bonds that project out of the plane of the paper, towards the viewer, and the vertical lines represent bonds that project behind the plane of the paper, away from the viewer

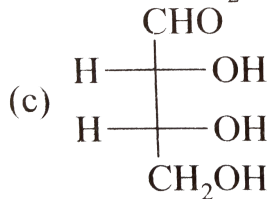
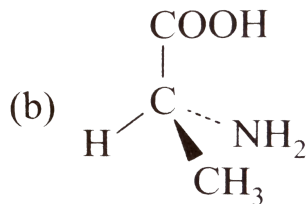
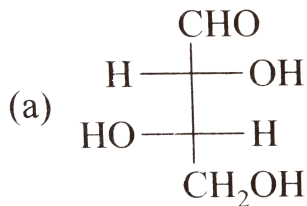
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2. Assign the *R* and *S* configuration to the enantiomers of 2-bromobutane

Strategy: Identify the chiral carbon (stereocentre) and decide the order of priority for the four different ligands using *CIP* rules. Finally orient the molecule and designate the configuration.

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3. Specify the configuration of the following compounds in *D* or *L* designation.



(a)

Strategy: The stereochemical descriptor *D* refers to an arrangement about a centre of chirality that is identical to the three-dimensional arrangement in *D* – (+) – glyceraldehyde in which the *OH* group on the chiral centre is on the right in the Fischer projection. Similarly, the other enantiomer of glyceraldehyde, which has *– OH* group on the chiral centre to the left is given *L* configuration. For carbohydrates (polyhydroxy aldehydes or ketones) the focus should be on the last chiral carbon (from the top) while for amino acids the focus should be on the chiral carbon carrying the *NH*₂ group.



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Follow Up Test 1

1. Isomers are different compounds that have the same

- A. empirical formula
- B. molecular formula
- C. percentage composition
- D. all of these

Answer: B

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Follow Up Test

1. Constitutional isomers are isomers that differ because

- A. their molecules possess different polarities
- B. their molecules possess different colours
- C. their atoms are connected in a different order

D. their atoms have different atomic order

Answer: C



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2. Stereoisomers are isomers that differ because their atoms

A. are arranged differently in space

B. have different radii

C. have different atomic numbers

D. have different number of neutrons

Answer: A



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3. Stereoisomers may be of different types. Stereoisomers that are readily interconvertible by rotation around a σ - bond are known as _____ isomers

- A. geometrical
- B. optical
- C. cis-trans
- D. conformational

Answer: D



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4. Those stereoisomers that are not interconvertible by a simple rotation around a σ -bond are called

- A. configurational isomers
- B. enantiomers

C. diastereoisomers

D. all of these

Answer: D

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5. The spatial orientation of other atoms (or groups) around carbon atoms is_____when a carbon atom is bonded to four other atoms (or groups).

A. pyramidal with a rectangular base

B. pyramidal with a square base

C. tetrahedral

D. plane

Answer: C

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6. Consider CH_2Cl_2 or CH_2BrCl as examples of disubstituted methanes. How many isomers would be possible in each instance if the carbon has a square planar geometry?

- A. Two
- B. Three
- C. Only one
- D. Four

Answer: A

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7. Consider $CHBrClF$ as an example of a trisubstituted methane. How many isomers would be possible if the geometry around carbon atom were square planar?

- A. Four

B. Two

C. Three

D. Only one

Answer: C



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8. Light is an electromagnetic phenomenon. A beam of light consists of _____ mutual perpendicular oscillating fields

A. three

B. two

C. four

D. infinite

Answer: B



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9. Ordinary light oscillates in ___ plane passing through the line of propagation.

- A. infinite
- B. two
- C. four
- D. three

Answer: A



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10. Light whose vibrations take place in only one of the infinite number of planes passing through the line of propagation is called

- A. circularly polarized light
- B. plane polarized light

C. elliptically polarized light

D. all of these

Answer: B



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11. Nicol prism used to convert ordinary light into plane polarized light consists of

A. $MgCO_3$

B. Na_2CO_3

C. K_2CO_3

D. $CaCO_3$

Answer: D



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12. Ordinary light is turned into plane-polarized light by passing it through a lens made of the material known as Polaroid. It consists of

- A. cellulose chloride
- B. cellulose nitrate
- C. cellulose sulphate
- D. cellulose carbonate

Answer: B



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13. An optically active substance is one that _____ the plane of polarized light.

- A. amplifies
- B. destroys
- C. rotates

D. diminute

Answer: C



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14. Which of the following factors affect the value of α_{obs} ?

(i) Solvent (ii) Temperature

(iii) Wavelength (iv) Concentration

A. (ii) and (iv)

B. (ii) and (iii)

C. (i),(ii) and (iii)

D. (i),(ii),(iii) and (iv)

Answer: D



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15. The specific rotation, $[\alpha]$, is expressed as

A. $\frac{\alpha_{obs}}{l \cdot c}$

B. $\alpha_{obs}lc$

C. $\frac{l \cdot c}{\alpha_{obs}}$

D. $\frac{\alpha_{obs}}{l \cdot c^2}$

Answer: A



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16. Calculate the specific rotation of coniine (the toxic component of poison hemlock), if a solution containing 0.75g in 10mL is placed in a 1 – dm polarimeter tube and its observed rotation at 25°C (D line) is +1.2°.

A. +1.6°

B. +16°

C. $+3.2^\circ$

D. $+32^\circ$

Answer: B

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17. The optical activity is the characteristic of

A. gaseous state

B. liquid state

C. crystalline state

D. molecules

Answer: D

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18. The necessary and sufficient condition for a compound to be optically active is that

- A. it must contain asymmetric carbon atoms
- B. its molecule must be nonidentical with its mirror image
- C. it must be symmetric
- D. its molecule must be identical with its mirror image

Answer: B



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19. A carbon atom is chiral when

- A. it has tetrahedral orientation
- B. it is sp^3 hybridized
- C. it has four different ligands
- D. it forms multiple bonds

Answer: C

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20. Which of the following atoms can be a chiral center in a given molecular species?

(i) Carbon (ii) Nitrogen

(iii) Phosphorus (iv) Silicon

A. (i),(ii),(iii),(iv)

B. (ii),(iii),(iv)

C. (iii),(iv)

D. Only (i)

Answer: A

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21. Which of the following objects is chiral?

A. Fork

B. Spoon

C. Hammer

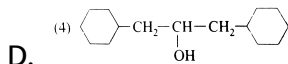
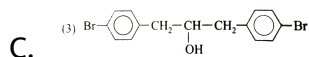
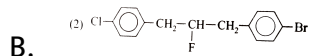
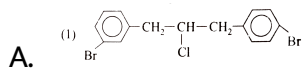
D. Ear

Answer: D



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22. Which of the following compounds possesses a stereocenter?



Answer: B

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23. The number of chiral centres present in 3, 4-dichloropentan-2-ol is

A. 3

B. 4

C. 1

D. 2

Answer: A

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24. Consider a hypothetical planar molecule with the formula A_2B_2X (where X is the central atom). How many elements symmetry (plane of symmetry as well as centre of symmetry) does it have?

A. 5

B. 3

C. 4

D. 2

Answer: C

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25. Which of the following can not be a chiral center?

A. The C^+ of a carbocation

B. The C^\cdot of a radical

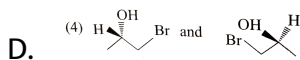
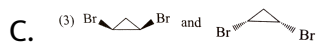
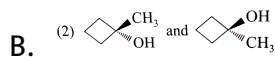
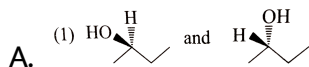
C. The carbonyl carbon in aldehydes

D. All of these

Answer: D

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26. Which of the following pairs of compounds are enantiomers?



Answer: A

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27. Enantiomers have identical

A. medicinal (drug) properties

B. smells

C. tastes

D. melting points

Answer: D

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28. Which of the following statements is not correct?

- A. Enantiomers react with a given chiral reagent at the same rate
- B. Enantiomers react with a given chiral reagent at the same rate
- C. Diastereomers react with a given chiral reagent at different rates
- D. Enantiomers react with a given chiral reagent at different rates

Answer: A

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29. Enantiomerism is shown by

A. malonic acid

B. malic acid

C. maleic acid

D. succinic acid

Answer: B



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30. Which of the following capital letters is achiral?

A. *J*

B. *F*

C. *E*

D. *G*

Answer: C



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31. Which of the following is a racemic mixture?

A. 25 % (+) and 75 % (-)

B. 50 % (+) and 50 % (-)

C. 80 % (+) and 20 % (-)

D. 40 % (+) and 60 % (-)

Answer: B



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32. The process of conversion of an optically pure enantiomer into an optically inactive equimolecular mixture of (+) and (-) enantiomers is called

A. epimerization

B. tautomerization

C. racemization

D. isomerization

Answer: C

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33. The process of separating a racemic mixture into optically pure (+) and (–) enantiomers is known as

A. asymmetric synthesis

B. mutarotation

C. epimerization

D. resolution

Answer: D

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34. Enantiomers can be separated by means of

- A. fractional distillation
- B. fractional crystallization
- C. chromatography
- D. None of these

Answer: D



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35. Dextrorotatory butan-2-ol has a specific rotation $[\alpha]_D^{25} = +13.52^\circ$. A sample of butan-2-ol shows a specific rotation $[\alpha]_D^{25} = +6.72^\circ$. Calculate the enantiomers excess (or optical purity) of the sample?

- A. 60 %
- B. 50 %

C. 70 %

D. 80 %

Answer: B



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36. Dextrorotatory α – pinene has a specific rotation $[\alpha]_D^{20} = + 51.3^\circ$. A sample of α – pinene containing both the enantiomers was found to have a specific rotation value $[\alpha]_D^{20} = + 30.8^\circ$. The percentages of the (+) and (–) enantiomers present in the sample are, respectively,

A. 60 % and 40 %

B. 70 % and 30 %

C. 80 % and 20 %

D. 20 % and 80 %

Answer: C



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37. The specific rotation of a pure enantiomers is $+12^\circ$. What will be its observed rotation if it is isolated form a reaction with 20 % racemization and 80 % retention.

A. $+9.6^\circ$

B. -9.6°

C. $+2.4^\circ$

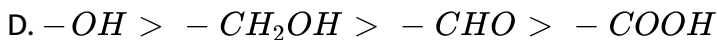
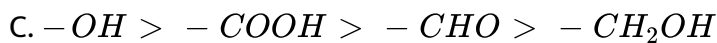
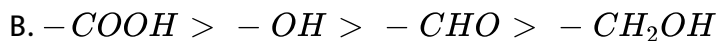
D. -2.4°

Answer: A

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38. According to *CIP* sequence rule, the correct arrangement in order of decreasing priority is

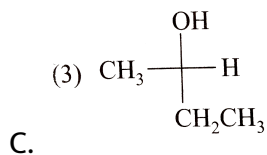
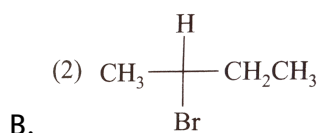
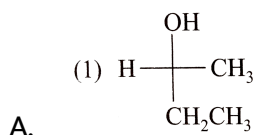
A. $-COOH > -CHO > -CH_2OH > -OH$

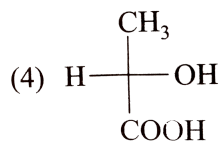


Answer: C

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39. Which of the following structures has the *R*-configuration at the chiral centre?



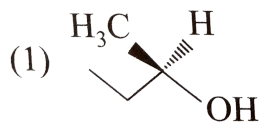


D.

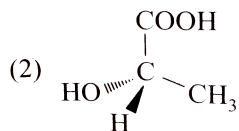
Answer: A

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40. Which of the following structures has the *S* – configuration at the chiral centre?



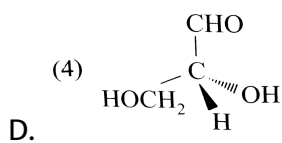
A.



B.



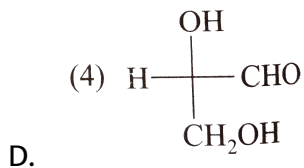
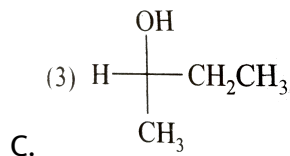
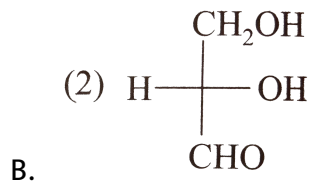
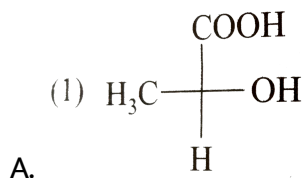
C.



Answer: B

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41. Which of the following structures has the *D*-configuration



Answer: C

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42. Which of the following assignment of priorities is not correct?

A. $(CH_3)_3C -$ has higher priority than $(CH_3)_2CH -$

B. $C_2 = CH -$ has higher priority than $(CH_3)_2CH -$

C. $(CH_3)_3C -$ has higher priority than $HC = C -$

D. $-CH = O$ has higher priority than $HC = C -$

Answer: C

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43. Which of the following ligands has the highest priority according to *CIP* sequence rule?

A. Phenyl

B. Cyclohexyl

C. *t* – Butyl

D. Isobutyl

Answer: A



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44. Which of the following designations are correct for the naturally occurring amino acid, proline?

A. *R, L*

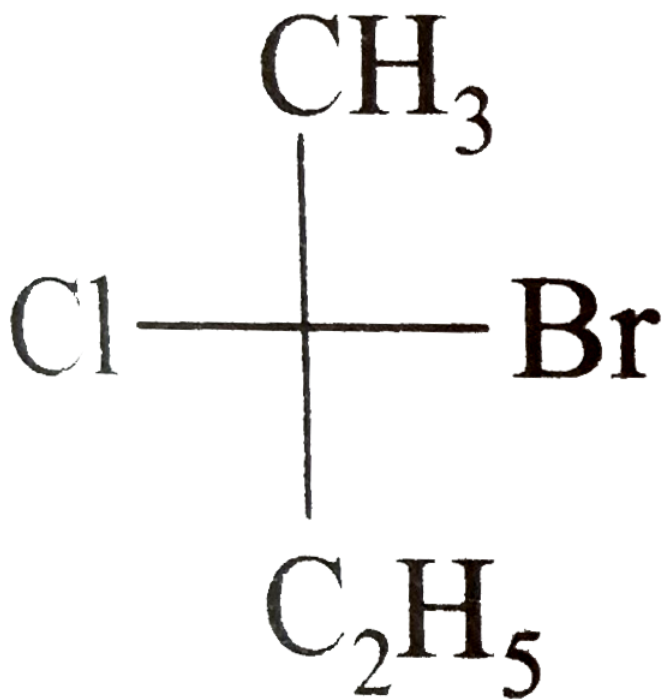
B. *S, L*

C. *S, D*

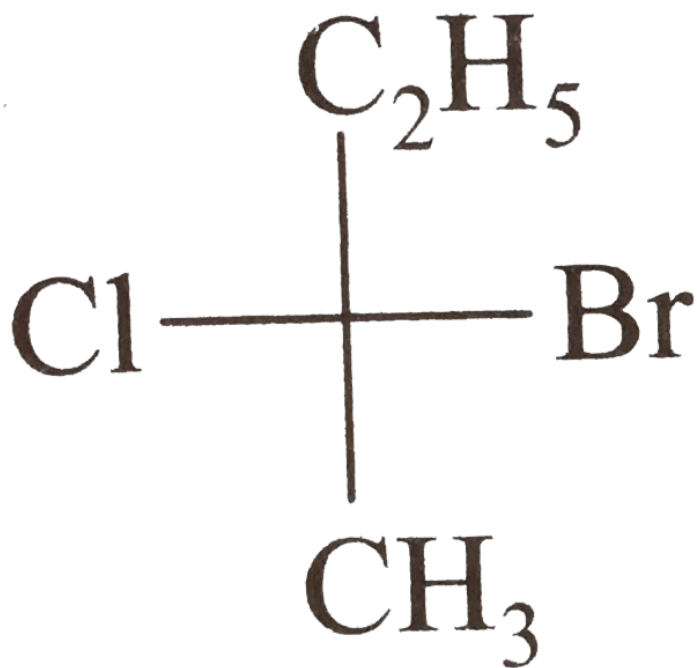
D. *R, D*

Answer: B

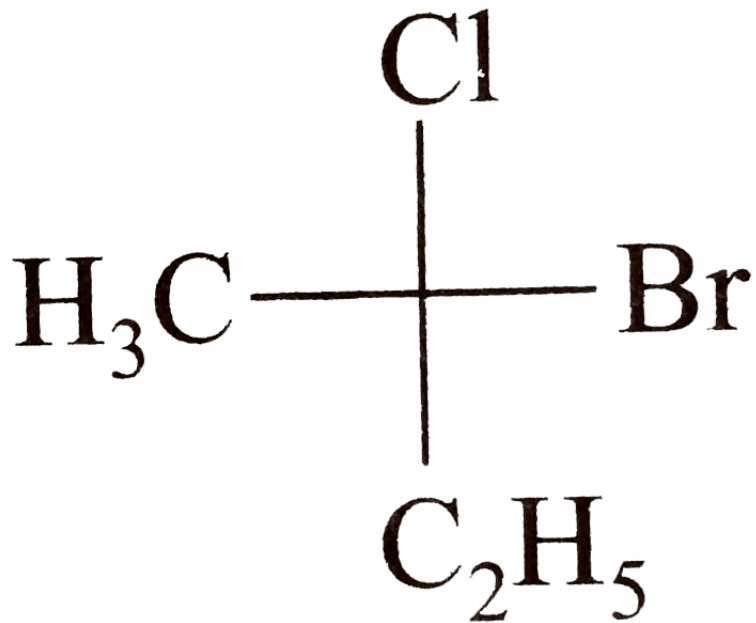
45. Consider the following structures (A), (B), (C) and (D).



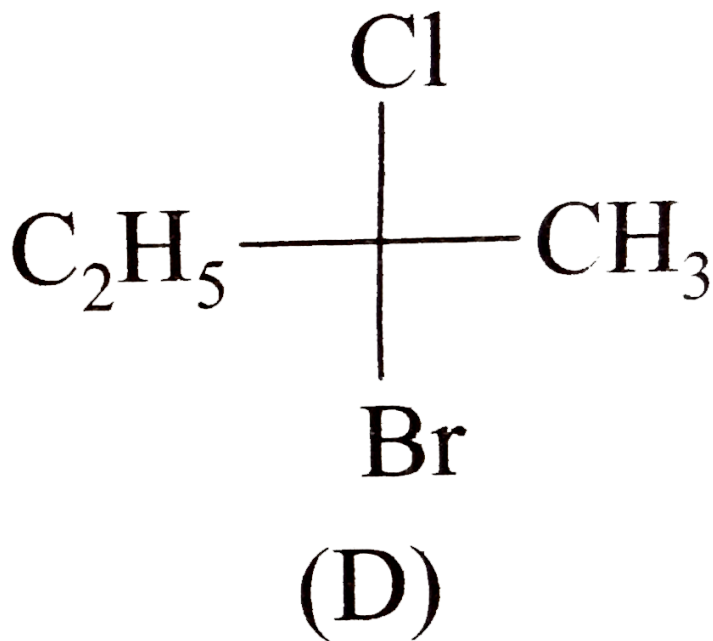
(A)



(B)



(C)



Which of the following statements is not correct?

- A. (A) and (C) are enantiomers
- B. (A) and (B) are enantiomers
- C. (B) and (D) are enantiomers
- D. (B) and (C) are identical

Answer: C

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46. The correct *IUPAC* name of



is

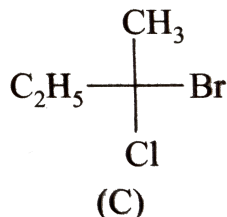
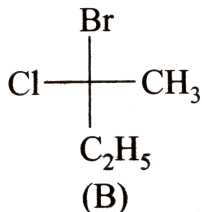
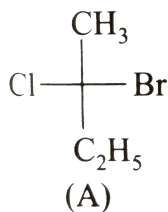
- A. $(2S, 4E)$ – 4 – bromom-2-chlor-2-metyhy1hex-4-enal
- B. $(2R, 4Z)$ – 4 – bromo-2-chlor-2-methy1hex-4-enal
- C. $(2Z, 5R)$ – 3 – bromo-5-chlor-5-formy1hex-2-ene
- D. $(2R, 4E)$ – 4 – bromo-2-chloro-2-methy1hex-4-enal

Answer: B

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47. The interchange of two groups (*Br* and *CH₃* at the chiral centre of the projection formula (*A*) yields the fromula (*B*), while the interchange

of another set of two groups (C_2H_5 and Cl) of (A) yields the projection formula (C).



Which of the following statements is not correct about the structures (A), (B) and (C)?

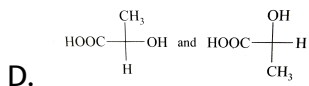
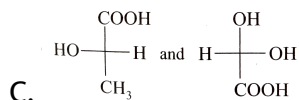
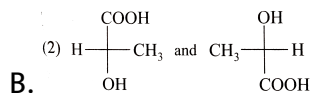
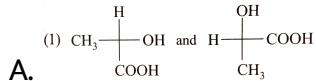
- A. (A) and (B) are enantiomers
- B. (A) and (C) are enantiomers
- C. (B) and (C) are identical
- D. (B) and (C) are enantiomers

Answer: D



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48. Which of the following pairs of structures represent enantiomers?



Answer: A

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49. How many stereoisomers are possible for 3-chloropentan-2-ol?

A. Three

B. Two

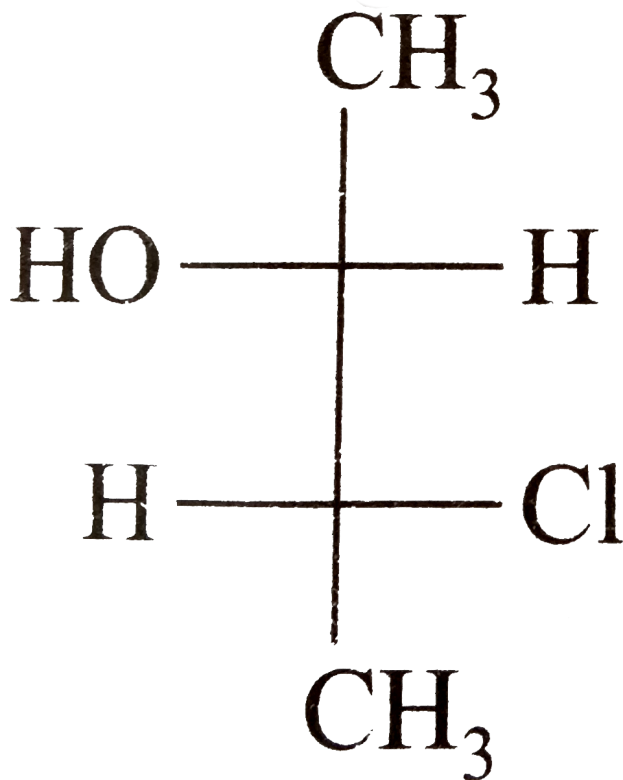
C. Four

D. Infinite

Answer: C



50. In the configuration



the configuration at the chiral centres are

A. $2S, 3S$

B. $2R, 3R$

C. $2R, 3S$

D. $2S, 3R$

Answer: B



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51. How many stereoisomers of butane-2,3-diol,

$CH_3CH(OH)CH(OH)CH_3$, are possible.

A. Two

B. Four

C. Six

D. Three

Answer: D



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52. Which of the following compounds may possess a meso stereoisomer?



Answer: A



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53. Meso butane-2,3-diol is optically inactive because

A. it is an equal mixture of two enantiomers

B. it is an equal mixture of two diastereomers

C. it is an equal mixture of an enantiomer and diastereomer

D. at least one conformer has either a plane or a point of symmetry

which makes it superposable upon its mirror image

Answer: D

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54. Which of the following compounds are known as threose and erythrose?

A. C_4 sugars

B. C_3 sugars

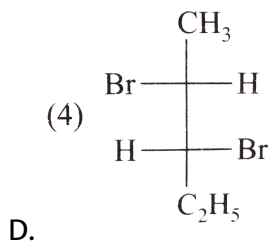
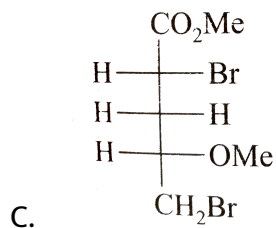
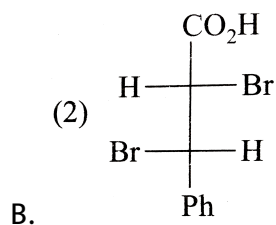
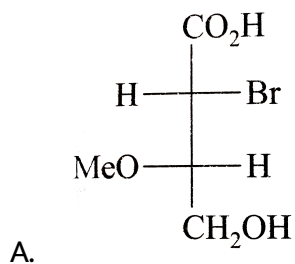
C. C_5 sugars

D. C_6 sugars

Answer: A

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55. Which of the following configuration represents an erythrosteroisomer?



Answer: C



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56. How many optically active isomers of 2, 3 – dibromosuccinic acid are there?

- A. Two
- B. Four
- C. Three
- D. Just one

Answer: A



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57. How many forms to tartaric acid exist in nature?

- A. Three
- B. Two

C. Only one

D. Four

Answer: D

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58. How many enantiomeric forms are possible for 2, 3, 4 – trihydroxypentanedioic acid?

A. Eight

B. Four

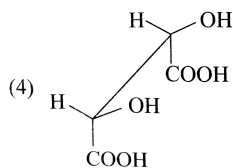
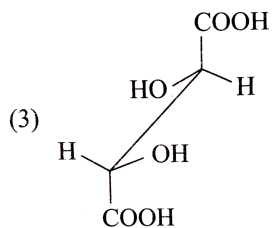
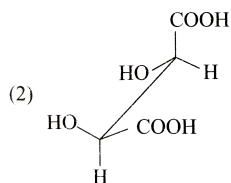
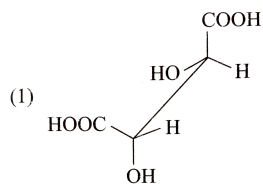
C. Six

D. Two

Answer: B

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59. Which of the following conformations of meso-tartaric acid has a centre of symmetry?



Answer: C



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60. Which of the following compounds does not have diastereomers?

- A. But-2-ene
- B. Butane-2,3-diol
- C. 2,3-Dibromopentane
- D. Butan-2-ol

Answer: D

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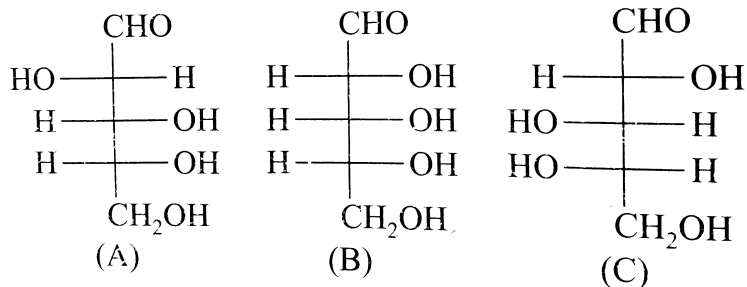
61. Which of the following statements is not correct?

- A. All geometrical isomers are diastereomers
- B. All diastereomers are chiral and optically active
- C. Diastereomers are not necessarily chiral and optically active
- D. Enantiomers are essentially chiral and optically active.

Answer: B

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62. Consider the following compounds



The correct statement about the compounds (A), (B) and (C) is

- A. A and B are epimers
- B. B and C are epimers
- C. A and C are diastereomers
- D. A and C are identical

Answer: A

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63. What is the stereostructure of the monochlorobutanes obtained from the free radical chlorination of butane?

- (i) (+) – 2 – Chlorobutane
- (ii) (–) – 2 – Chlorobutane
- (iii) (±) – 2 – Chlorobutane
- (iv) Achiral – 1 – Chlorobutane

A. (i),(ii),(iii),(iv)

B. (i),(iv)

C. (ii),(iv)

D. (iii), (iv)

Answer: D



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64. Isopentane is allowed to undergo free-radical chlorination and the reaction mixture is separated. How many optically active fractions of formula $C_5H_{11}Cl$ would you expect to collect?

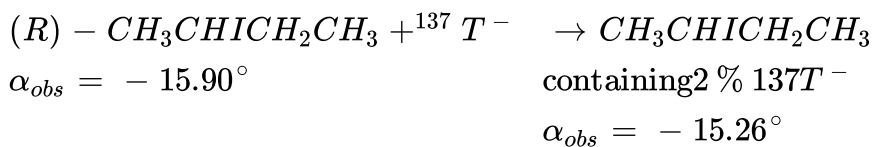
- A. Zero
- B. Two
- C. One
- D. Four

Answer: A



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65. Consider the reaction



The percentage of racemic form in the product is

- A. 10 %

B. 8 %

C. 4 %

D. 12 %

Answer: C

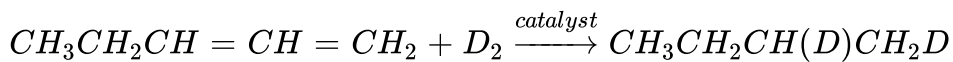
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66. Which of the following reactions occurs with racemization?

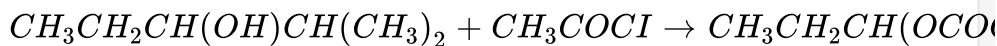
A.



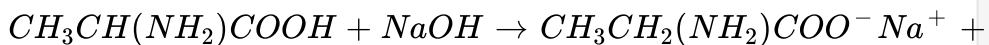
B.



C.



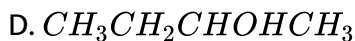
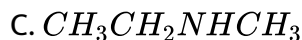
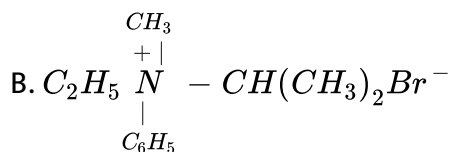
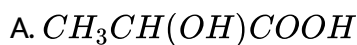
D.



Answer: B

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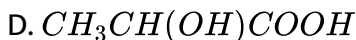
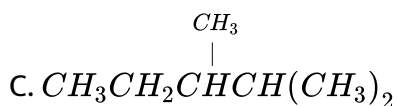
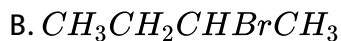
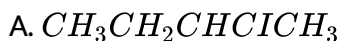
67. Which of the following compounds exists as a nonresolvable racemic mixture?



Answer: C

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68. Which of the following compounds will undergo racemization on prolonged digestion of either of its enantiomers with a dilute acid or base?



Answer: D

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69. What happens when an optically pure (+) - 1 - chlorethylbenzene ($C_6H_5CHClCH_3$) is treated with $SbCl_5$?

A. It forms 1 - phenylethene as the sole product

B. It produces (-) - 1 - chlorethylbenzene

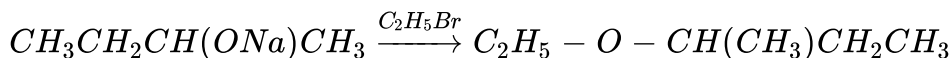
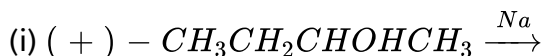
C. If remains unchanged

D. If racemizes

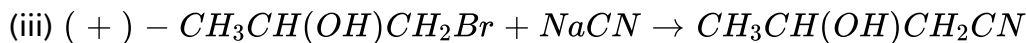
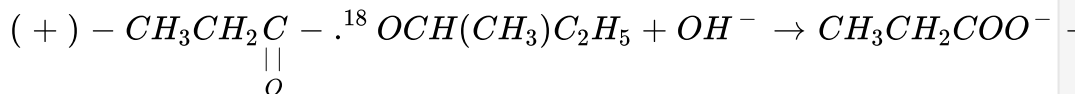
Answer: D

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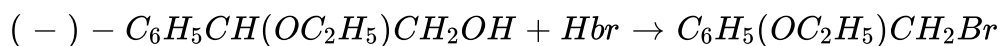
70. Which of the following reaction could safely be used to relate configuration?



(ii)



(iv)



A. (i),(ii),(iii)

B. (i),(ii),(iii),(iv)

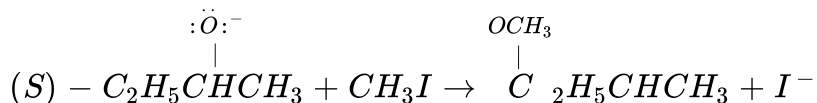
C. (i),(iii)

D. (ii),(iv)

Answer: B

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71. Which of the following is true for the given reaction?



A. The configuration is unchanged and the product is *S*

B. The configuration is changed and the product is *R*

C. The configuration is changed and product is *S*

D. The configuration is unchanged and the product is *R*

Answer: A

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72. Which of the following statements is true?

- A. When a chiral molecule reacts with a chiral molecule the product is always racemic.
- B. In chemical reactions the change from an (*S*) reactant to an (*R*) product always signals an inversion of configuration
- C. An optically inactive substance must be achiral
- D. An achiral compound can have chiral centers

Answer: D



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73. Which of the following statements is false?

- (i) *D* enantiomers rotate the plane of polarized light to the right and an *L* enantiomer to the left

- (ii) Conversion of an erythro to a threo stereoisomer always occurs by inversion at one chiral C .
- (iii) A racemate can be distinguished from a meso or an achiral compound by an attempted resolution
- (iv) Racemization of an enantiomer can only occur by breaking of a least one bond to the chiral center
- (v) A reaction catalyzed by an enzyme always gives an optically active product.

A. (i),(ii),(iii),(iv),(v)

B. (i),(iii),(v)

C. (i),(v)

D. (ii),(iii),(iv)

Answer: C



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74. cis-But-2-ene on reaction with Br_2 in CCl_4 produces mainly

A. (±) - 2, 3 - dibromobutane

B. meso-2, 3 - dibromobutane

C. (+) - 2, 3 - dibromobutane

D. (-) - 2, 3 - dibromobutane

Answer: A

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75. 1, 2 - Dimethylcyclohexene reacts with HBr in CCl_4 to form mainly

A. E - 1 - bromo - 1, 2 - dimethylcyclohexene

B. meso - 1 - bromo - 1, 2 - dimethylcyclohexane

C. (±) Z - 1 - bromo - 1, 2 - dimethylcyclohexane

D. (±) E - 1 - bromo - 1, 2 - dimethylcyclohexane

Answer: C

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76. Addition of HBr to but-1-ene yields

- A. 2-bromobutane
- B. (+)-2-bromobutane
- C. (-)-2-bromobutane
- D. (\pm)-2-bromobutane

Answer: D



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77. Cyclohexene on reaction with $HOCl$ yields

- A. (\pm)-cis-2-chlorocyclohexanol
- B. (\pm)-trans-2-chlorocyclohexanol
- C. 1-chlorocyclohexanol

D. 2 – chlorocyclohexanol

Answer: B

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78. cis-But – 2 – ene on reaction with cold dilute $KMnO_4$ solution yields

A. (+) – butane – 2, 3-diol

B. (–)butane-2, 3-diol

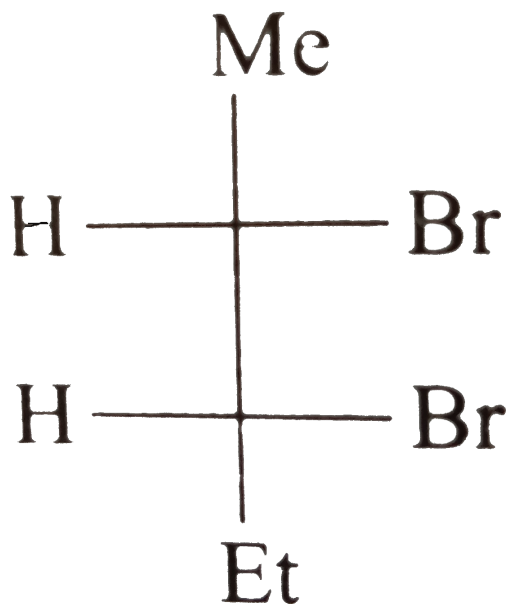
C. (\pm)butane – 2, 3 – diol

D. meso-butane – 2, 3 – diol

Answer: D

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79. An alkene on reaction with Br_2/CCl_4 produces the following products:



and its enantiomer in equal amounts. The alkene is

- A. trans-pent-2-ene
- B. pent-1-ene
- C. cis-pent-2-ene
- D. 2-methylbut-2-ene

Answer: C

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80. cis-But-2-ene reacts with $D-N=N-D$ to yield the major product

- A. meso-2,3-dideuteriobutane
- B. (+)-2,3-dideuteriobutane
- C. (-)-2,3-dideuteriobutane
- D. (+)-2,3-dideuteriobutane

Answer: A

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81. meso-2,3-Dibromobutane is treated with NaI in acetone. The major compound formed is

A. cis-but-2-ene

B. 2-bromo-3-iodobutane

C. trans-but-2-ene

D. meso-2,3-diiodobutane

Answer: C

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Follow Up Test 2

1. The device that is used for measuring the effect of plane polarized light on optically active compounds is known as

A. polariscope

B. polarimeter

C. both(1)and(2)

D. periscope

Answer: C

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Follow Up Test 3

1. Who first observed that crystals with mirror images of each other exist?

- A. Louis Pasteur
- B. Jean Baptiste Biot
- C. Hermann Kolbe
- D. van't Hoff

Answer: A

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Follow Up Test 4

1. Enantiomers are compounds that are __ of each other

- A. mirror images
- B. superposable mirror images
- C. nonsuperposable mirror images
- D. not mirror images

Answer: C



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Follow Up Test 5

1. Which of the following general rules for switching ligands or rotating Fischer structures is incorrect?

- A. An even number of switches results in no change in the configuration

- B. An odd number of switches changes the configuration to that of the enantiomer
- C. The structure cannot be rotated out of the plane of the paper
- D. The structure can be rotated in the plane through 90°

Answer: D

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Follow Up Test 6

1. What is the maximum number of stereoisomers possible for a compound having four different chiral centers?
- A. 16
- B. 8
- C. 4
- D. 10

Answer: A

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Follow Up Test 7

1. What is the following things happens when an enantiomer undergoes a chiral reaction at a site other than the chiral carbon atom?

- A. The reaction occurs with inversion
- B. The reaction proceeds with retention
- C. The reaction takes place with complete racemization
- D. The reaction proceeds with partial racemization

Answer: B

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1. Which of the following capital letters is chiral?

A. *Y*

B. *B*

C. *P*

D. *A*

Answer: C



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2. The priority sequence of the alkyl groups is

A. $CH_3 > 1^\circ > 2^\circ > 3^\circ$

B. $CH_3 > 1^\circ > 3^\circ > 2^\circ$

C. $3^\circ > 2^\circ > 1^\circ > CH_3$

D. $3^\circ > 1^\circ > 2^\circ > CH_3$

Answer: C

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3. *Cis* and *trans* isomers generally

- A. contain a triple bond
- B. contain double bonded carbon atoms
- C. are enantiomers
- D. rotate the plane of plane-polarized light

Answer: B

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4. Geometrical isomers differ in

- A. length of carbon atoms
- B. position of atoms
- C. spatial arrangement of atoms
- D. position of functional group

Answer: C

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5. A similarity between optical and geometrical isomerism is that
- A. they have no similarity
 - B. both are included in stereoisomerism
 - C. if in a compound, one is present then so is the other
 - D. each forms equal number of isomers for a given compound

Answer: B

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6. An organic compound will show optical isomerism if in its molecule

- A. all the ligands bonded to carbon atom are identical
- B. two ligands bonded to carbon atom are different
- C. three groups bonded to carbon atom are different
- D. four groups bonded to carbon atom are different

Answer: D



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7. Optically active isomers but not mirror images are called

- A. mesomers
- B. enantiomers
- C. diastereomers

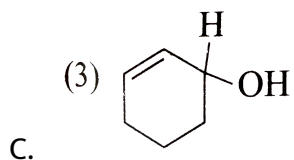
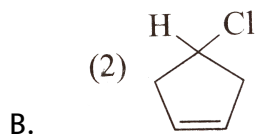
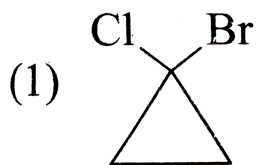
D. tautomers

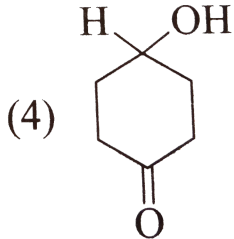
Answer: C

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Level II

1. Which of the following compounds possesses a chiral centre?





Answer: C

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2. In which of the following properties may enantiomers differ?

A. Refractive index

B. Odour

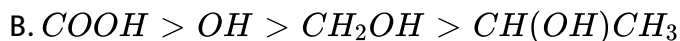
C. Solubility

D. Melting point

Answer: B

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3. According to *CIP* sequence rule, the correct arrangement in order of decreasing priority is



Answer: A



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4. An enantiomer and its racemic form have

A. equal and opposite rotation

B. unequal and opposite rotations

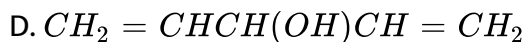
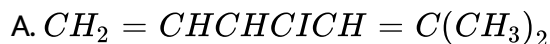
C. equal and identical rotations

D. none of these

Answer: D

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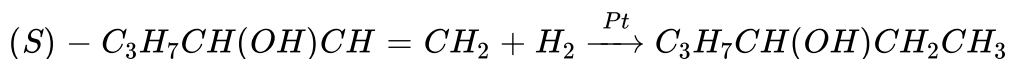
5. Which of the following compounds can exist both as a cis pair of enantiomers and a trans pair of enantiomers?



Answer: C

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6. Which of the following is true for the given reaction?



- A. The configuration is unchanged and the product is R
- B. The configuration is changed and the product is S
- C. The configuration is changed and product is R
- D. The configuration is unchanged and the product is S

Answer: A

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7. trans-But-2-ene on reaction with Br_2 in CCl_4 forms

- A. (+) - 2,3 - dibromobutane
- B. (-) - 2,3 - dibromobutane
- C. (\pm) - 2,3 - dibromobutane
- D. meso-dibromobutane

Answer: D

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8. The alkene that exhibits geometrical isomerism is

- A. but-2-ene
- B. propene
- C. 2-methylbut-2-ene
- D. 2-methylpropene

Answer: A



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9. What type of isomerism is possible for 1-chloro-2-nitroethene?

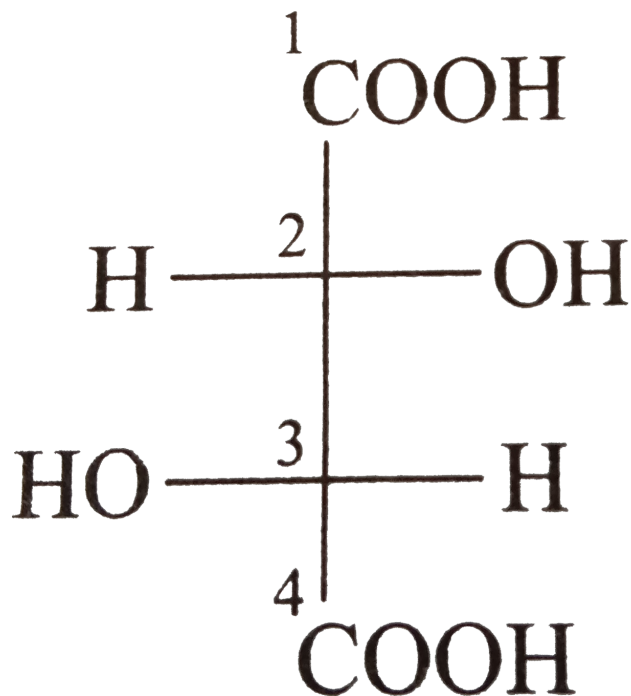
- A. Optical isomerism
- B. *E/Z* isomerism
- C. Position isomerism

D. Functional group isomerism

Answer: B

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10. In the compound



configurations at the chiral carbons are

A. *R, R*

B. *S, S*

C. *S, R*

D. *R, S*

Answer: A

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11. Which of the following does not show geometrical isomerism?

A. 1, 4 – Dichloropent–1 – ene

B. 1, 1 – Dichloropent–1 – ene

C. 1, 3 – Dichloropent–2 – ene

D. 1, 2 – Dichloropent–1 – ene

Answer: B

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12. Which of the following compounds is not chiral?

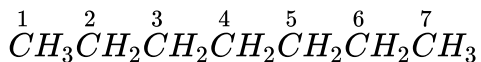
- A. 2 – Chloropentane
- B. 1 – Chloro–2 – methylpentane
- C. 3 – Chloro–2 – methylpentane
- D. 1 – Chloropentane

Answer: D



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13. Consider the following organic compound



To make it a chiral compound, the attack should be on carbon

- A. 7
- B. 3

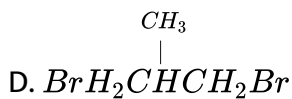
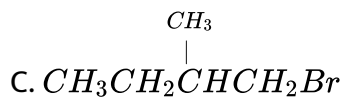
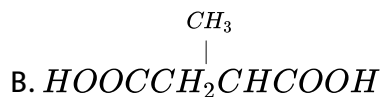
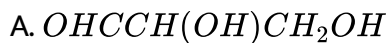
C. 4

D. 1

Answer: B

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14. The compound without a chiral atom is



Answer: D

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15. A molecule is said to be chiral if it

- A. contains no chiral carbons
- B. contains chiral carbons
- C. cannot be superposed on its mirror image
- D. contains a plane of symmetry

Answer: C



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16. Which of the following compounds will show geometric isomerism?

- A. Cyclohexene
- B. Hex-2-ene
- C. Hex-3-yne
- D. 1,1-Diphenylethylene

Answer: B

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17. The most important chemical method of resolve a racemic mixture makes use of the formation of

- A. a meso compound
- B. enantiomers
- C. diastereomers
- D. racemates

Answer: C

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18. The process of separating of a racemic mixture into *d* and *l* enantiomers is called

A. dehydrogenation

B. revolution

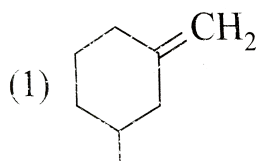
C. dehydration

D. resolution

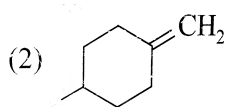
Answer: D

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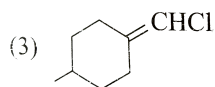
19. The geometrical isomerism is exhibited by



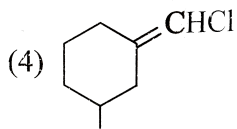
A.



B.



C.



D.

Answer: D

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20. Which of the following is a chiral compound?

A. 2, 3, 4 – trimethylhexane

B. *n* – hexane

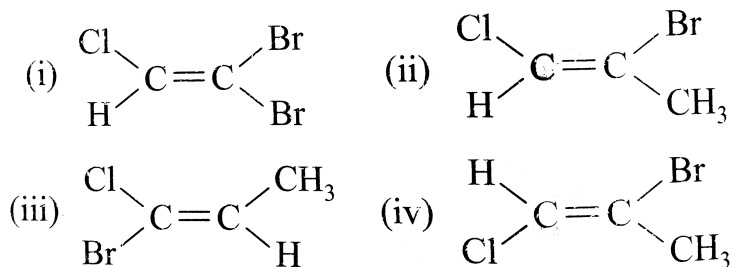
C. methane

D. *n* – butane

Answer: A

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21. Which is a pair of geometrical isomers?



- A. (i) and (ii)
- B. (i) and (iii)
- C. (i) and (iv)
- D. (iii) and (iv)

Answer: C



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22. How many carbon atoms in the molecule



are asymmetric?

A. 1

B. 2

C. 3

D. None of these

Answer: B

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23. Which of the following will exhibit geometrical isomerism?

A. 1 – Phenylbut–2–ene

B. 3 – Phenylbut–1–ene

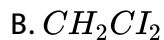
C. 2 – Phenylbut–1–ene

D. 1, 1 – Diphenylprop–1–ene

Answer: A

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24. Which of the following is the chiral molecule?



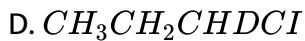
Answer: D



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25. Which of the following compounds is not chiral?





Answer: A

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Level iii

1. Which of the following objects possess a center of symmetry ?

(i) Tree (ii) Six-pointed star

(iii) Five-pointed star (iv) Dumbbell

(v) Nail

A. (ii),(iv)

B. (iv),(v)

C. (i),(ii)

D. (ii),(iii)

Answer: A



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2. Optical isomerism is not exhibited by

- A. tartaric acid
- B. lactic acid
- C. succinic acid
- D. dibromosuccinic acid

Answer: C



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3. (+) - Butan-2-ol has $[\alpha]_D^{20} = +13.9^\circ$. A sample of butane-2-ol containing both the enantiomers was found to have a specific rotation value of -3.5° under similar conditions. The percentages of the (+) and (-) enantiomers present in the mixture are, respectively,

A. 37.4 % and 62.6 %

B. 35.5 % and 64.5 %

C. 42.2 % and 57.8 %

D. 62.6 % and 37.4 %

Answer: A



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4. The specific rotation of a pure enantiomers is $+12^\circ$. What will be its observed rotation if it is isolated form a reaction with 80 % racemization and 20 % inversion.

A. $+2.4^\circ$

B. -9.6°

C. $+9.6^\circ$

D. -2.4°

Answer: D

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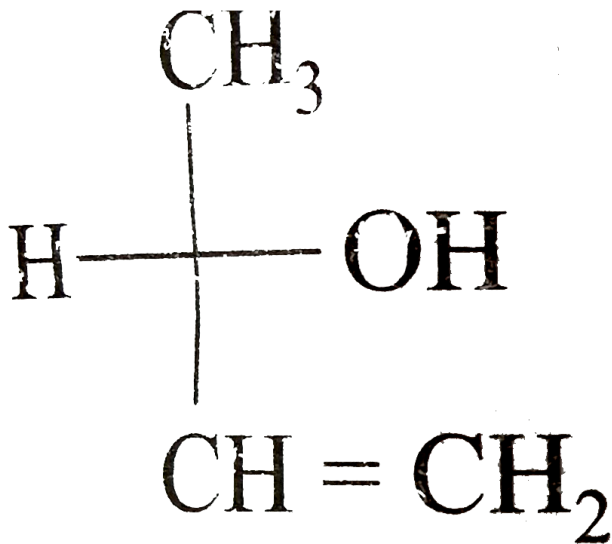
5. Which of the following operations performed on the configuration of (*S*)-butan-2-ol has no effect?

- A. Exchanging ligands across the horizontal bond
- B. Exchanging ligands across the vertical bond
- C. Making both switches (1) and (2)
- D. Exchanging a vertical and horizontal ligand

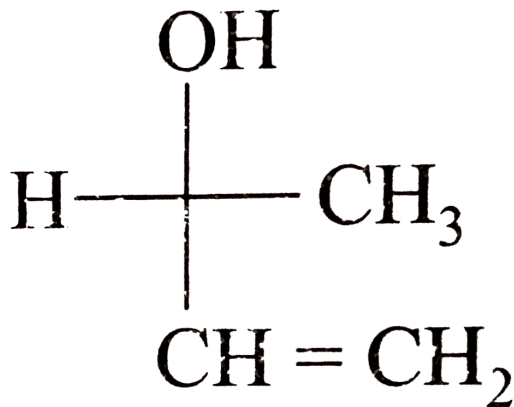
Answer: C

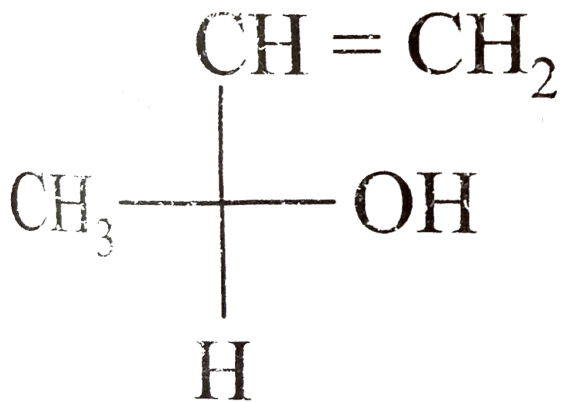
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6. Consider the following configurations (A), (B), (C) and (D)

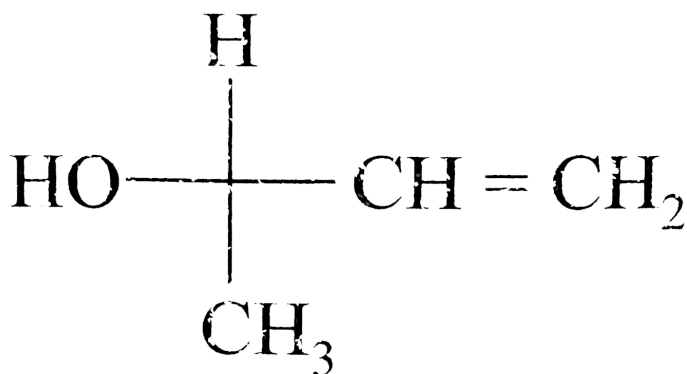


(A)





(C)



(D)

which of the following statements is not correct?

A. (A) and (C) are enantiomers

B. (A) and (B) are enantiomers

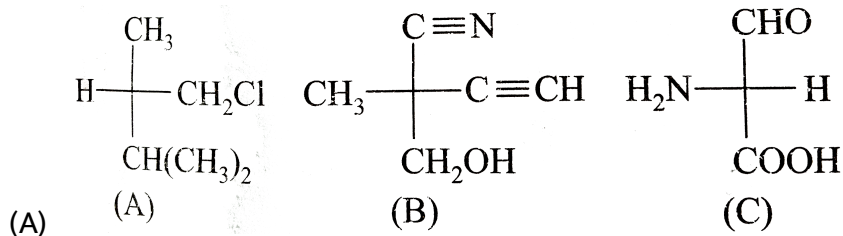
C. (A) and (D) are enantiomers

D. (B) and (D) are identical

Answer: A

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7. Consider the following configuration (A), (B) and (C).



Which of the following statements is correct?

A. (A) and *R* – configuration

B. (C) has *R* – configuration

C. (B) has *R* – configuration

D. All (A), (B) and (C) have (*S*) – configuration

Answer: B



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8. The chemical properties of enantiomer are the same towards achiral

(i) reagents (ii) solvents

(iii) catalysts (iv) conditions

A. (i), (ii), (iii) and (iv)

B. (i),(ii)

C. (i),(iii)

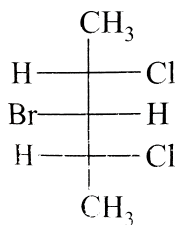
D. (i),(ii) and (iii)

Answer: A

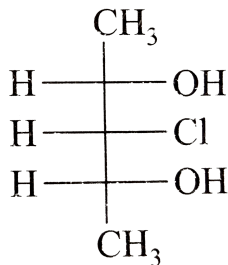


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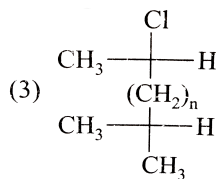
9. Which of the following stereoisomers represent meso compounds?



A.



B.



C.

D. All of these

Answer: D



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10. (*S*)-sec Butyl chloride is subjected to free-radical chlorination followed by fractional distillation to isolate the various isomeric products.

How many frefcations are isolated?

- A. Four
- B. Five
- C. Six
- D. Three

Answer: B



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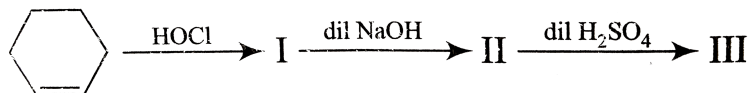
11. Cyclohexene on reaction with Br_2 in CCl_4 yields

- A. meso-1, 2-dibromocyclohexene
- B. (\pm)trans-1, 2 - dibromocyclohexene
- C. cis-1, 2 - dibromocyclohexene
- D. trans-1, 2 - dibromochclohexane

Answer: B

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12. Consider the following reaction sequence



The final product (*III*) is

- A. (±)-trans-1, 2 – cyclohexanediol
- B. epoxy cyclohexane
- C. 2 – chlorocyclohexanol
- D. (±)cis-1, 2 – cyclohexanediol

Answer: A

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13. trans-But-2-ene reacts with cold dilute KMnO_4 solution to yield

A. butane-2, 3 - dione

B. (±)butan-2 - ol

C. meso-butane-2 - , 3 - diol

D. (±)butane-2, 3 - diol

Answer: D

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14. trans-But-2 - ene reacts with D_2 in the presence of Ni as catalyst.

The product formed is

A. meso-2, 3 - dideuterobutane

B. rac-2, 3 - dideuterobutane

C. (+) - 2, 3 - dideuterobutane

D. (-) - 2, 3 - dideuterobutane

Answer: B

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15. Geometrical isomerism is exhibited by

- A. aspartic acid
- B. butyric acid
- C. cinnamic acid
- D. palmiltic acid

Answer: C

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16. The smallest ketone and its next homologue are reacted with H_2NOH to form oxime

- A. all oximers are optically active
- B. three differe oximers are formed

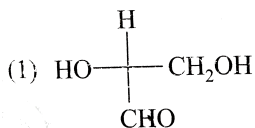
C. two oximers are optially active

D. two different oximers are formed

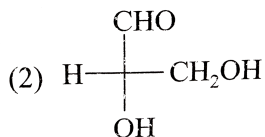
Answer: B

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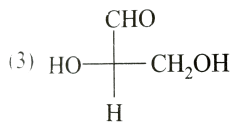
17. Which of the following Fischer's projection formula is identical to *D* – gluceraldehyde?



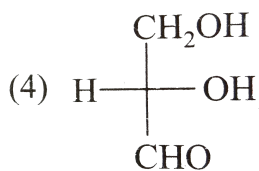
A.



B.



C.

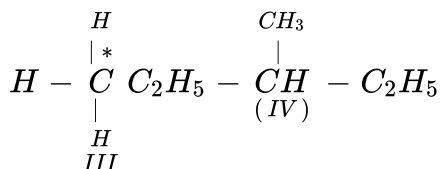
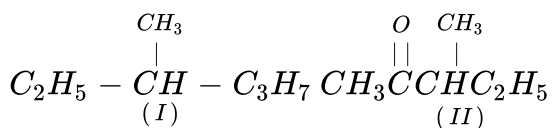


D.

Answer: C

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18. Among the following four structures *I* to *IV*



it is true that

- A. all four are chiral compounds
- B. only *II* and *IV* are chiral compounds
- C. only *III* is a chiral compound
- D. only *I* and *II* are chiral compounds

Answer: D

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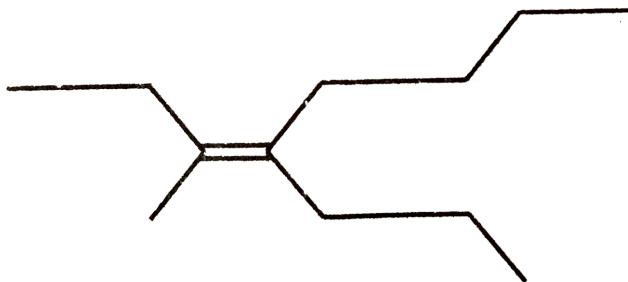
19. The number of isomers for the compound with molecular formula $C_2BrClFI$ is

- A. 5
- B. 4
- C. 6
- D. 3

Answer: C

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20. Give the *IUPAC* name of the alkene



- A. *Z* - 3 - Methyl - 4 - propyloct - 3 - ene
- B. *E* - 3 - Methyl - 4 - propyloct - 3 - ene
- C. *E* - 4 - Butyl - 3 - Methylhept - 3 - ene
- D. *E* - 2 - Ethyl - 3 - propylhept - 2 - ene

Answer: A



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21. When NH_2OH reacts with an usymmetrical ketone then numver of products formed is

A. 4

B. 3

C. 2

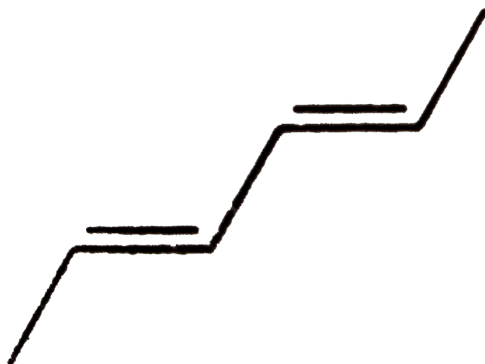
D. 1

Answer: C



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22. The name of the formed



is

A. (2Z, 4Z)hexa-2, 4 – diene

B. (2*Z*, 4*E*)hexa-2, 4 - diene

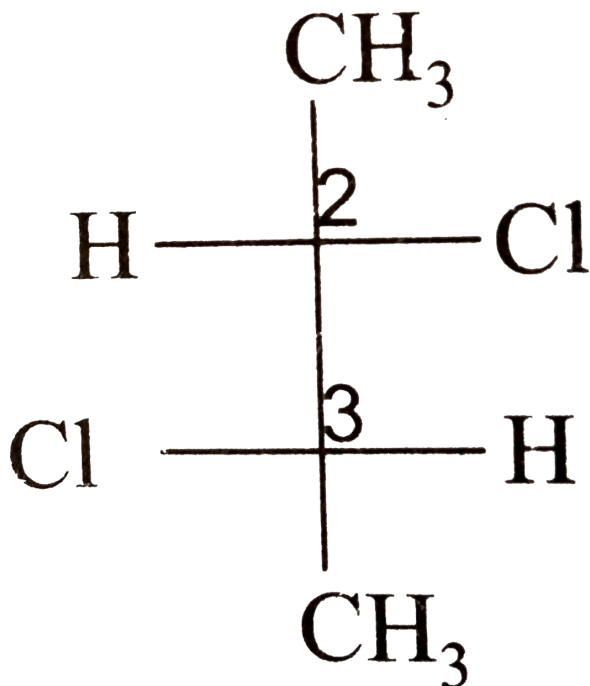
C. (2*E*, 4*Z*)hexa-2, 4 - diene

D. (2*E*, 4*E*)hexa-2, 4 - diene

Answer:

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23. The absolute configuration of the configuration compound



is

A. $2S, 3R$

B. $2S, 3S$

C. $2R, 3S$

D. $2R, 3R$

Answer: B

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24. The prefixes syn and anti are used to denote

A. structural isomers

B. conformational

C. geometrical isomers

D. optical isomers

Answer: C

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25. The number of optical isomers of the compound $CH_3CHBrCHBrCOOH$ is

- A. 0
- B. 1
- C. 3
- D. 4

Answer: D



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Level IV

1. Which of the following is not correct?

- A. A tertiary amine ($R^1R^2R^3N:$) exists as a pair of enantiomers

B. A carbonion ($R^1R^2R^3C^-$) exists as a pair of enantiomers

C. both (1) and (2)

D. Tricovalent S and P compounds can be isolated as enantiomers

Answer: C



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2. Which of the following is incorrect?

A. The naturally occurring amino acids, the building blocks of proteins, are all D -amino acids

B. The D, L method for assigning relative configurations (used mainly for sugars) uses glyceraldehyde as the reference molecule.

C. Esterification of $(-)$ -Lactic acid with methanol gives $(+)$ -methyl lactate.

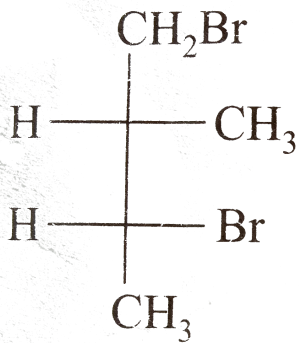
D. sign of rotation is a molecular property unrelated to configuration

Answer: A

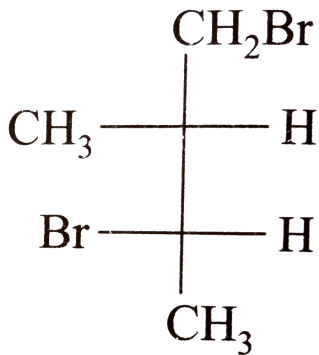


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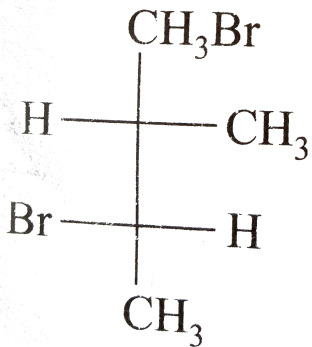
3. The compound 1, 3-dibromo-2-methyl butane, $CH_3CHBrCH(CH_3)CH_2Br$, has two dissimilar chiral carbons ($C - 2$ and $C - 3$). Its four stereoisomers are shown below



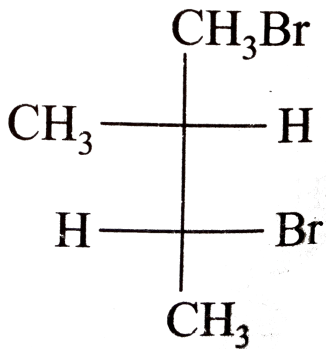
I



II



III



IV

Which of the following has $(2R, 3R)$ designation?

A. I

B. II

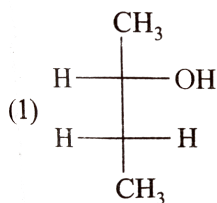
C. III

D. IV

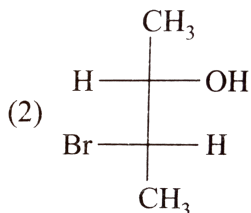
Answer: D



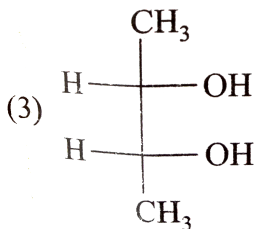
4. Which of the following configuration represents a theroisomer?



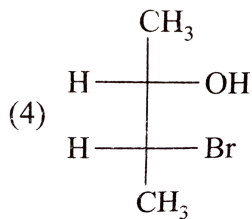
A.



B.



C.



D.

Answer: B



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5. Which of the following molecules possesses a pseudoasymmetric carbon atom?



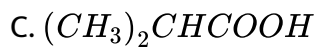
Answer: C



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6. Which of the following molecules has a pro-chiral centre?





Answer: A

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7. How many 2, 3, 4, 5-tetrahydroxyadipic acids are possible?

A. Eight

B. Six

C. Ten

D. Four

Answer: C

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8. How many optically active stereoisomers are possible for tri-sec-butylmethane?

A. Eight

B. Four

C. Six

D. Two

Answer: B



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9. How many stereoisomers are possible for tetra-sec-butyl methane?

A. Five

B. Six

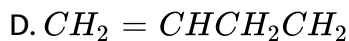
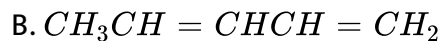
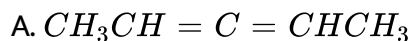
C. Seven

D. Eight

Answer: A

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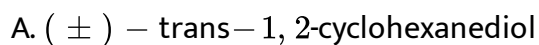
10. Which of the following molecules is chiral?



Answer: A

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11. Cyclohexene on reaction with cold dilute $KMnO_4$ solution gives



B. 1, 2 – cyclohexanediol

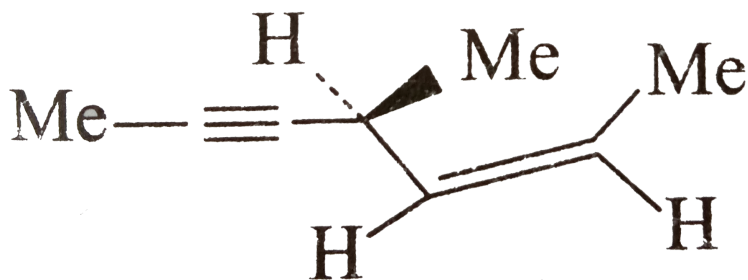
C. cis– 1, 2 – cyclohexanediol

D. trans`-1,2-cyclohexanediol

Answer: C

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12. Hydrogenation of the compound



with H_2 in the presence of Lindle catalyst gives

A. an optically inactive compound

B. an optically active compound

C. a diastomeric mixture

D. a racemic mixture

Answer: A

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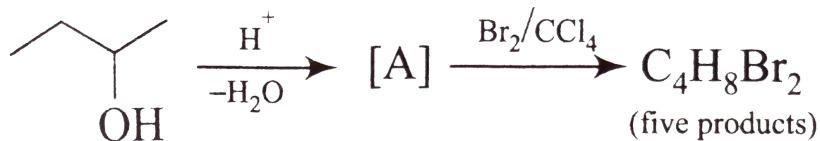
13. Cyclohexene on reaction with *m* – chloroperoxybenzoic acid forms a compound (*X*) which on treatment with dilute H_2SO_4 produces a compound (*Y*). The compound (*Y*) is

- A. (+) – cis – 1, 2-cyclohexanediol
- B. (±) trans – 1, 2 – cyclohexanediol
- C. cyclohexanol
- D. cyclohexanone

Answer: B

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14. Consider the following sequence of reactions



How many structures of [A] are possible?

A. 6

B. 5

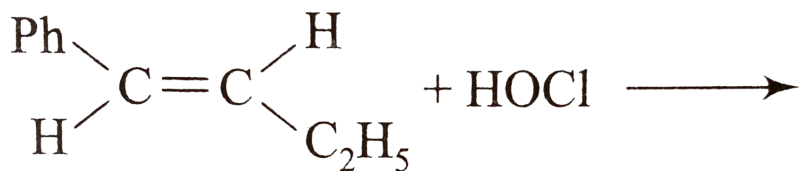
C. 2

D. 3

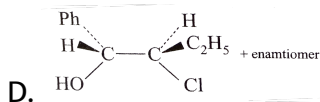
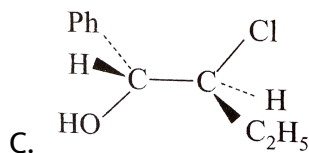
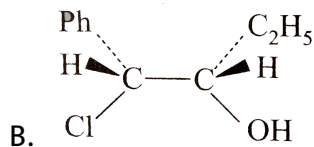
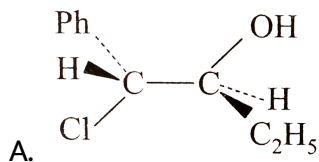
Answer: D

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15. In the reaction



the major product formed is



Answer: C

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16. Which one of the following conformations of cyclohexane is chiral?

A. Chiral

B. Twist boat

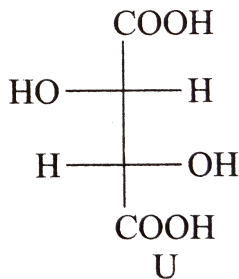
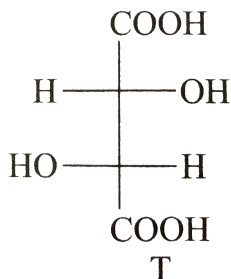
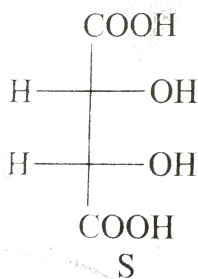
C. Boat

D. Rigid

Answer: B

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17. P and Q are isomers of dicarboxylic acid $C_4H_4O_4$. Both decolorize Br_2/H_2O . On heating, P forms the cyclic anhydride. Upon treatment with dilute alkaline $KMnO_4$, P as well as Q could produce one or more than one forms S , T and U .



Compounds

formed from P and Q are, respectively

A. optically inactive pair (T , U) and optically inactive S

- B. optically active pair (T, U) and optically active S
- C. optically inactive S and optically inactive pair (T, U)
- D. optically active S and optically inactive pair (T, U)

Answer: C

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18. Which of the following is correct?

- (i) The smallest alkene which can show optical isomerism possesses 7 carbon atoms
- (ii) The smallest alkanes which can exist in the enantiomeric forms are – 2 – methylhexane and 2, 3 – dimethylpentane
- (iii) The smallest alkane which has a meso stereoisomer possesses 6 carbons
- (iv) 3, 4-Dimethylhexane has a meso stereoisomer.

A. (i) and (iii)

B. (ii) and (iv)

C. (i),(ii),(iii),(iv)

D. (i),(ii),(iv)

Answer: C



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19. The total number of acyclic isomers (including stereoisomers) of C_4H_7Cl is

A. 10

B. 9

C. 12

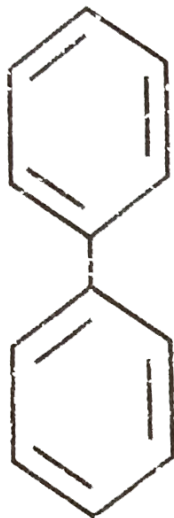
D. 13

Answer: C

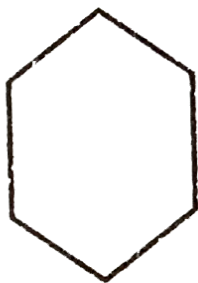


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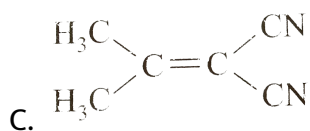
1. In which of the following molecules, all atoms are coplanar?



A.

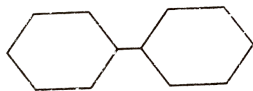


B.



C.

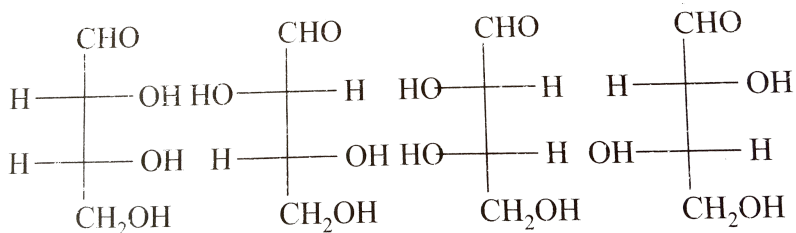
D.



Answer: A

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2. The correct corresponding order of names four aldoles with configuration given below



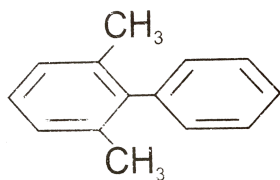
respectively, is

- A. *L* – erythrose, *L* – threose, *L* – erythrose, *D* – threose
- B. *D* – threose, *D* – erythrose, *L* – threose, *L* – erythrose
- C. *L* – erythrose, *L* – threose, *D* – erythrose, *D* – threose
- D. *D* – erythrose, *D* – threose, *L* – erythrose, *L* – threose

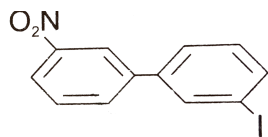
Answer: D

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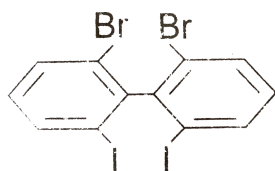
3. Which of the following bihphenyls is optically active?



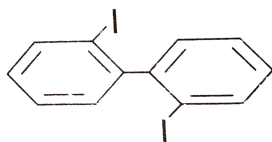
A.



B.



C.



D.

Answer: C

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4. Two possible stereo-structures of $CH_3CHOHCOOH$, which are optically active are called

- A. enantiomers
- B. mesomers
- C. diastereomers
- D. atropisomers

Answer: A

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5. In an S_N1 reaction on chiral centres, there is

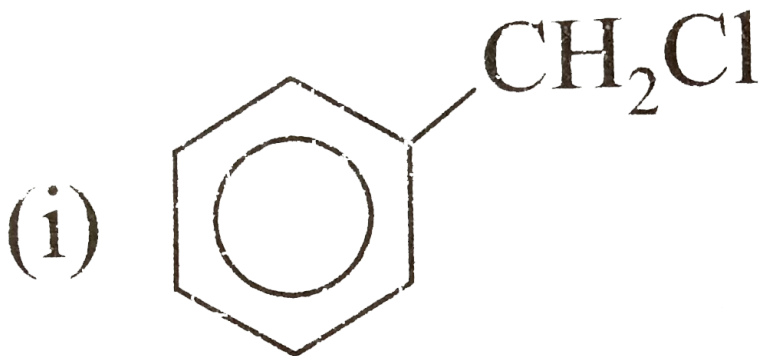
- A. 100 % retention
- B. 100 % inversion
- C. 100 % racemisation

D. inversion more than retention leading to partial racemisation

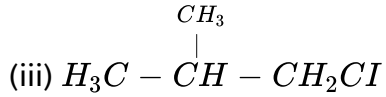
Answer: D

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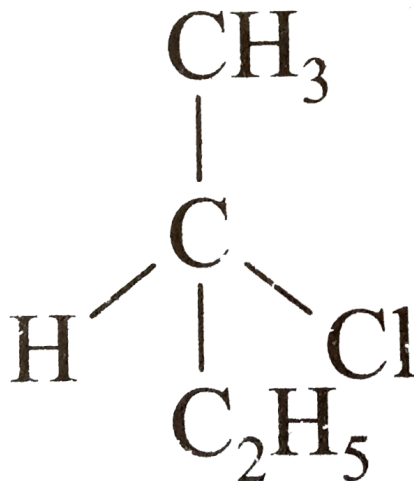
6. Which of the following compounds will undergo racemisation when solution of KOH hydrolyses?



(ii) $CH_3CH_2CH_2Cl$



(iv)



- A. (i) and (ii)
- B. (ii) and (iv)
- C. (iii) and (iv)
- D. (iv)

Answer: D



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7. Which of the following acids does not exhibit optical isomerism?

- A. Maleic acid
- B. α -aminoacids
- C. Lactic acid
- D. Tartaric acid

Answer: A



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8. How many stereoisomers does this molecules have?



- A. 2
- B. 4
- C. 6
- D. 8

Answer: B

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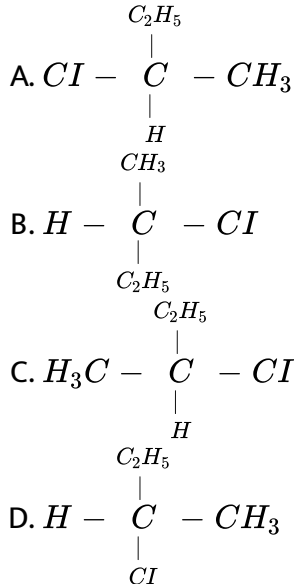
9. If there is no rotation of plane polarized light by a compound in a specific solvent, through to be chiral, it may mean that:

- A. there is no compound in the solvent
- B. the compound may be a racemic mixture
- C. the compound is certainly a chiral
- D. the compound is certainly meso

Answer: D

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10. $CH_3 - CHCl - CH_2 = CH_3$ has a chiral centre. Which one of the following represents its *R* configuration?



Answer: A

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11. Which of the following is not chiral?

A. 2 – Hydroxypropanoic acid

B. 2 – Butanol

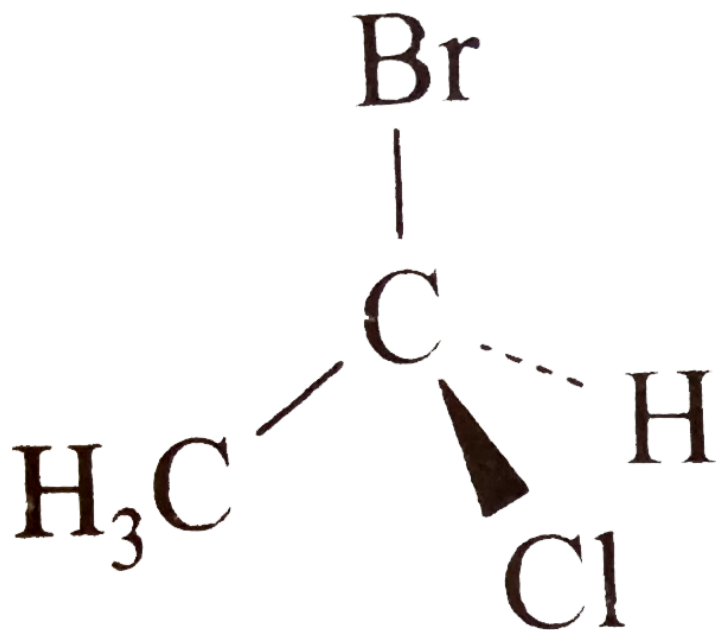
C. 2, 3 – Dibromopentane

D. 3 – Bromopentane

Answer: D

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12. The chirality of the compound



is

A. (*R*)

B. (*S*)

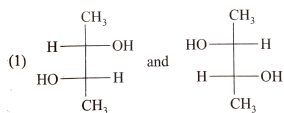
C. (*Z*)

D. (*E*)

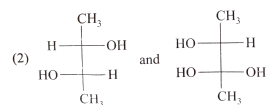
Answer: A

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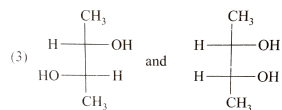
13. Which of the following pairs of compounds are enantiomers?



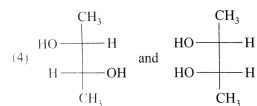
A.



B.



C.



D.

Answer: A

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14. Which one of the following pairs represents stereoisomerism?

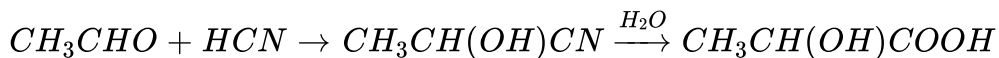
- A. Chain isomerism and rotational isomerism
- B. structural isomerism and geometrical isomerism
- C. Kinkage isomerism and geometrical isomerism
- D. optical isomerism and geometrical isomerism

Answer: D



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15. In the reaction



an asymmetric carbon is generated. The acid obtained would be

- A. *D* – isomer
- B. *L* – isomer
- C. 50 % *D* and 50 % *L* isomer

D. 20 % *D* and 80 % *L* isomer

Answer: C

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16. A compound with molecular formula C_7H_{16} shows optical isomerism, the compound will be

- A. 2, 3 – dimethylpentane
- B. 2, 2 – dimethylpentane
- C. 2 – methylheptane
- D. none of these

Answer: A

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17. *R* and *S* pairs of enantiomers differ from one another in

A. optical rotation of polarized light

B. solubility in racemic mixture

C. reaction with racemic mixture

D. none of these

Answer: A



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