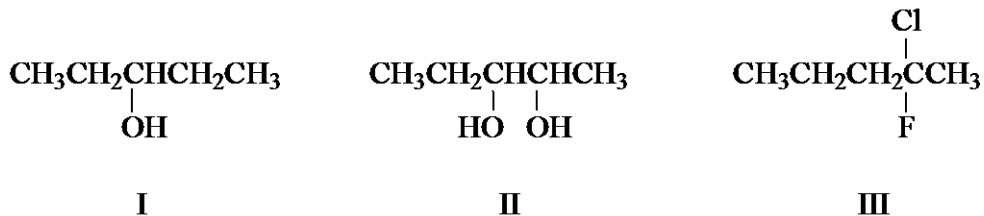


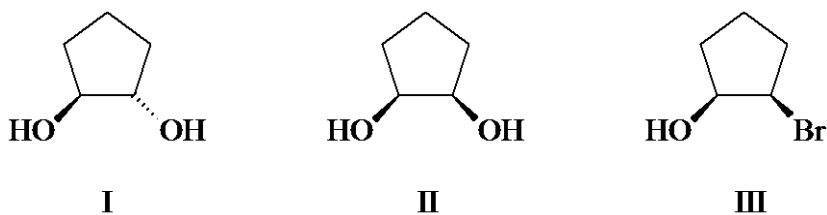
ACS Review Stereochemistry

1. Which of the molecules below are chiral?



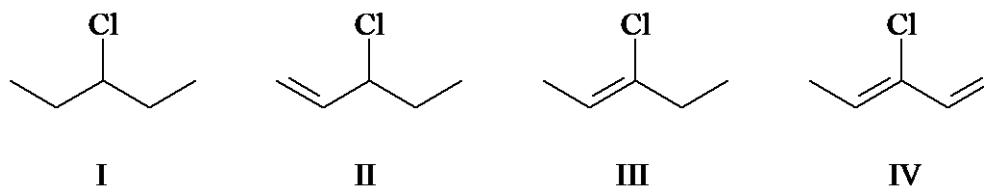
- A. only II
- B. only III
- C. I and III
- D. II and III

2. Which of the molecules below are chiral?



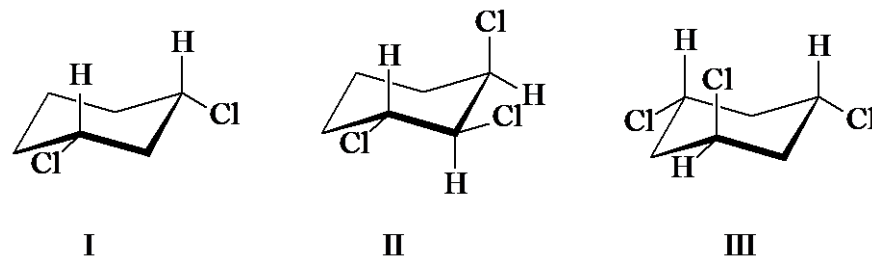
- A. only I
- B. I and III
- C. II and III
- D. I, II, and III

3. Identify the chiral compound(s) below.



- A. only II
- B. II and III
- C. III and IV
- D. I, II, and IV

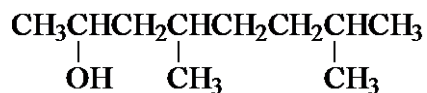
4. Which of the following molecules are chiral?



- A. only II
- B. only III
- C. II and III

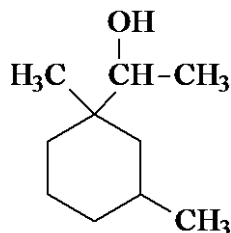
D. I, II, and III

5. How many stereogenic centers are there in the following molecule?



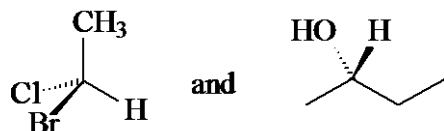
- A. only 1
- B. two
- C. three
- D. four

6. How many stereogenic centers are there in the following molecule?



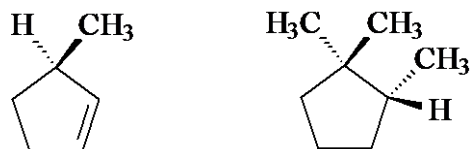
- A. only 1
- B. two
- C. three
- D. four

7. Give the configurations, respectively, of the following two molecules.



- A. R and R
- B. R and S
- C. S and S
- D. S and R

8. Give the configurations, respectively, of the following two molecules.



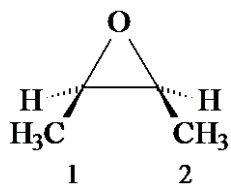
- A. R and R
- B. R and S
- C. S and S
- D. S and R

9. Which one of the following groups has the highest rank as assigned by the Cahn-Ingold-Prelog system for stereogenic carbons?

- A. $-\text{CH}=\text{CH}_2$
- B. $-\text{CH}_2\text{OH}$
- C. $-\text{CH}=\text{O}$

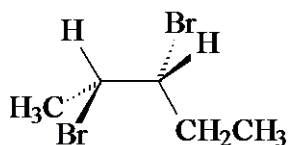
D. $-\text{CH}_2\text{SH}$

10. Give the configurations of carbons 1 and 2, respectively, in the structure shown below.



- A. R and R
- B. R and S
- C. S and S
- D. S and R

11. What is the IUPAC name of the following compound.



- A. (2S, 3S)-2,3-dibromopentane
- B. (2S, 3R)-2,3-dibromopentane
- C. (2R, 3S)-2,3-dibromopentane
- D. (2R, 3R)-2,3-dibromopentane

12. Which of the following statements are true.

- I. If a molecule has a plane of symmetry it is achiral.
- II. If a molecule has a center of symmetry it is achiral.
- III. If a molecule has one stereogenic center it is chiral.

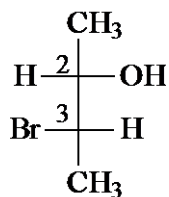
- A. I and II
- B. I and III
- C. II and III
- D. I, II, and III

13. What is the relationship between the following two molecules?



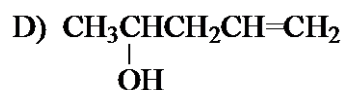
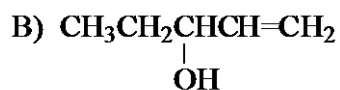
- A. identical
- B. enantiomers
- C. diastereomers
- D. constitutional isomers

14. What are the configurations of carbons 2 and 3 in the Fischer projection below.



- A. 2R, 3R
- B. 2R, 3S
- C. 2S, 3R
- D. 2S, 3S

15. Compound X, $C_5H_{10}O$, is optically active. The compound consumes one equivalent of hydrogen to give $C_5H_{12}O$. The hydrogenation product is also optically active. Which compound below matches the information?

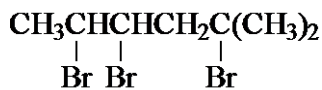


- A. A
- B. B
- C. C
- D. D

16. A pure sample of (S)-phenylalanine has a specific rotation of $+70^\circ$. A mixture of the two enantiomers of phenylalanine has a specific rotation of $+7.0^\circ$. What are the percentages of the S and R enantiomers in the mixture?

- A. 95% S, 5% R
- B. 90% S, 10% R
- C. 55% S, 45% R
- D. 52.5% S, 47.5% R

17. How many stereoisomers are there for the compound shown below?

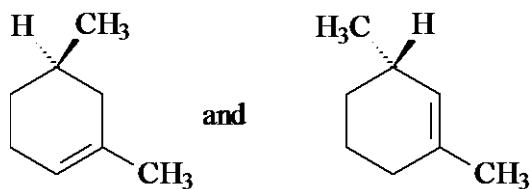


- A. two
- B. four
- C. six
- D. eight

18. Give the total number of stereoisomers of 2,3-dibromobutane.

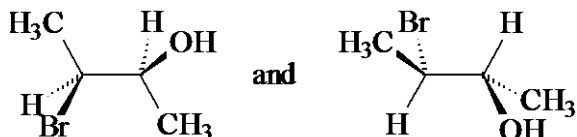
- A. none, only a single structure
- B. two
- C. three
- D. four

19. What is the relationship between the following two compounds?



- and
- A. identical
 B. enantiomers
 C. diastereomers
 D. constitutional isomers

20. What is the relationship between the following two compounds?



- and
- A. different conformations of the same compound
 B. enantiomers
 C. diastereomers
 D. constitutional isomers

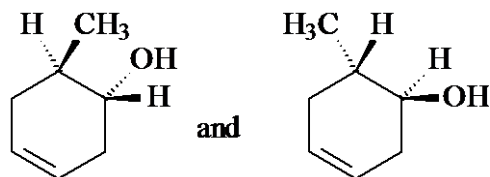
21. (+)-Tartaric acid has a specific rotation of $+12.0^\circ$. What is the specific rotation of a mixture of 75% (+)-tartaric acid and 25% (-)-tartaric acid?

- A. $+4.0^\circ$
 B. $+6.0^\circ$
 C. $+8.0^\circ$
 D. $+9.0^\circ$

22. The addition of bromine, Br_2 , to *trans*-2-butene gives:

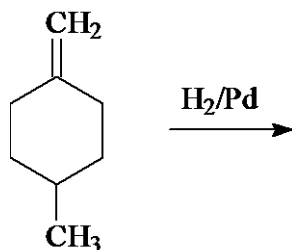
- A. (2R,3R)-2,3-dibromobutane
 B. (2S,3S)-2,3-dibromobutane
 C. a racemic mixture of (2R,3R) and (2S,3S)-2,3-dibromobutane
 D. *meso*-2,3-dibromobutane

23. What is the relationship between the following two compounds?



- and
- A. identical
 B. enantiomers
 C. diastereomers
 D. constitutional isomers

24. In terms of stereochemistry, the following reaction gives:



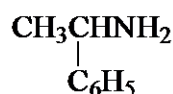
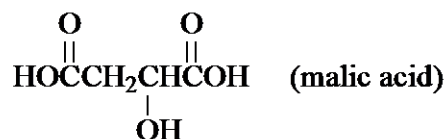
- A. a single enantiomer
- B. a racemic pair of enantiomers
- C. a nonracemic pair of enantiomers
- D. two diastereomers

25. Which of the following has a *meso* stereoisomer?

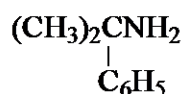
- I. 2,4-dichloropentane
- II. 1,3-dimethylcyclopentane
- III. 2,3-dichloropentane

- A. only I
- B. only II
- C. I and III
- D. I and II

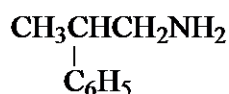
26. Which of the following amines gives a pair of diastereomeric salts when reacted with (S)-(-)-malic acid?



I



II



III

- A. only I
- B. only II
- C. only III
- D. I and III

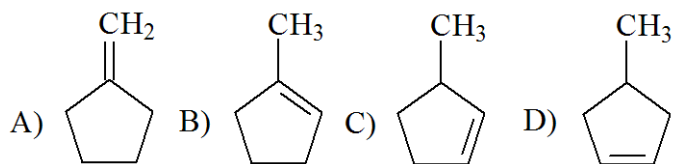
27. Which of the following C_6H_{10} cycloalkenes would give a pair of diastereomeric epoxides when reacted with peroxyacetic acid, $\text{CH}_3\text{CO}_3\text{H}$?

- A. 1-methylcyclopentene
- B. 3-methylcyclopentene
- C. 1,2-dimethylcyclobutene
- D. 3,3-dimethylcyclobutene

28. The addition of HBr to 1-octene gives:

- A. a racemic mixture of 2-bromooctane
- B. a nonracemic mixture of 2-bromooctane
- C. 1-bromooctane
- D. a racemic mixture of 1,2-dibromooctane

29. Compound X, C_6H_{10} , is optically active. Hydrogenation of the compound gives methylcyclopentane. Which compound below is compound X?



- A. A
B. B
C. C
D. D

30. Which of the following is the best method to make a racemic mixture of (+) and (-)-2,3-dibromobutane?

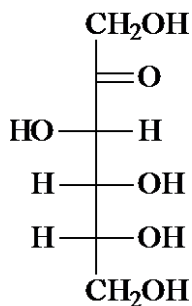
- A. photochemical bromination of 2-bromobutane
B. addition of HBr to racemic 3-bromo-2-butene
C. addition of Br_2 to *cis*-2-butene
D. addition of Br_2 to *trans*-2-butene

31. Which of the following compounds gives a pair of diastereomers upon epoxidation with peroxyacetic acid, CH_3CO_3H ?

- A) $H_2C=CHCH_2CH_2CH_2OH$
B) *cis*- $CH_3CH=CHCH_2CH_2OH$
C) *trans*- $CH_3CH=CHCH_2CH_2OH$
D) $CH_3CH(OH)CH_2CH=CH_2$

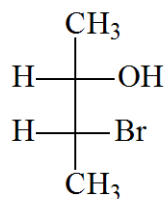
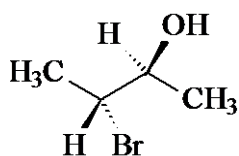
- A. A
B. B
C. C
D. D

32. How many stereoisomers are there of D-fructose(including D-fructose), shown below?

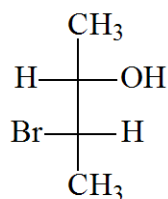


- A. four
B. six
C. eight
D. twelve

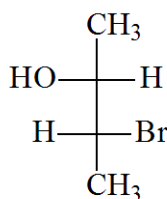
33. Which of the following Fischer projections corresponds to the compound shown below?



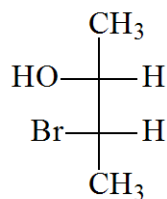
A)



B)



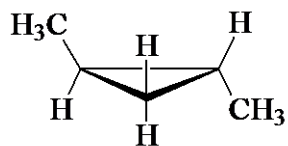
C)



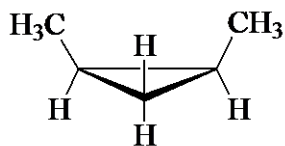
D)

- A. A
B. B
C. C
D. D

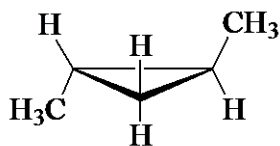
34. The four isomeric dimethylcyclopropanes are shown below. Identify two of the isomers which are related as diastereomers.



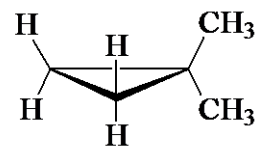
I



II



III



IV

- A. I and III
B. I and IV
C. II and III
D. III and IV

35. How many stereoisomers are there of 1-isopropyl-4-methylcyclohexane?

- A. only 1 structure possible - no stereoisomers
B. two
C. three
D. four

36. Which object below is achiral?

- A. golf club (wood driver)
B. baseball glove
C. tennis shoe
D. baseball bat

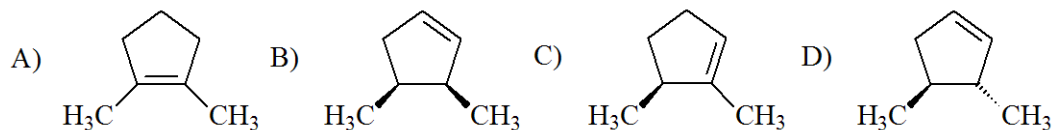
37. Which compound below has a *meso* form?

- A. 1,2-dichlorobutane
B. 1,3-dichlorobutane
C. 2,3-dichlorobutane
D. 1,4-dichlorobutane

38. Which compound below has no stereoisomers?

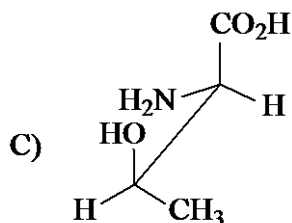
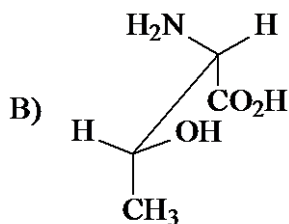
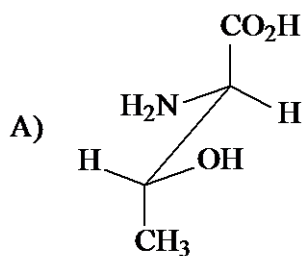
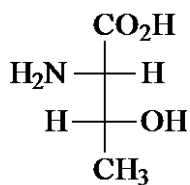
- A. 1,2-dichlorobutane
- B. 1,3-dichlorobutane
- C. 2,3-dichlorobutane
- D. 1,4-dichlorobutane

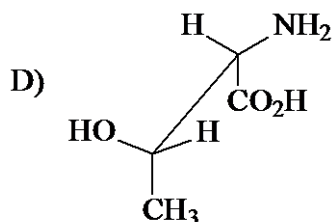
39. Compound X (C_7H_{12}) is optically active. Hydrogenation of compound X gives two isomeric 1,2-dimethylcyclopentanes, one is optically active and the other is optically inactive. Of the following compounds, which is the only one that fits the data?



- A. A
- B. B
- C. C
- D. D

40. Which sawhorse drawing below has the identical conformation as the following Fischer projection?





- A. A
B. B
C. C
D. D

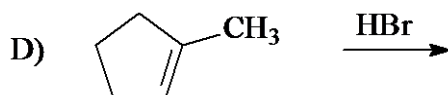
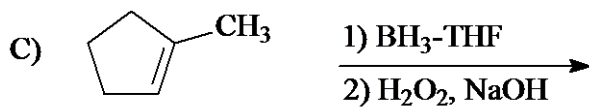
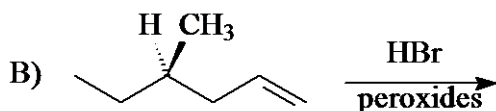
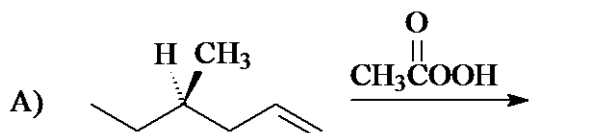
41. Which one of the following is a diastereomer of (R)-4-bromo-*cis*-2-hexene?

- A. (S)-4-bromo-*cis*-2-hexene
B. (R)-5-bromo-*cis*-2-hexene
C. (R)-4-bromo-*trans*-2-hexene
D. (S)-5-bromo-*trans*-2-hexene

42. Which of the following statements is false?

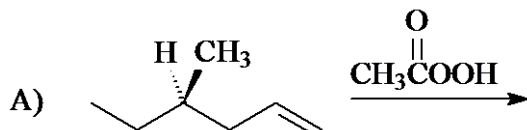
- A. Racemic mixtures are optically inactive.
B. Enantiomers have specific rotations which are equal, but have opposite signs.
C. Achiral molecules are optically inactive.
D. Meso compounds contain equal amounts of enantiomers.

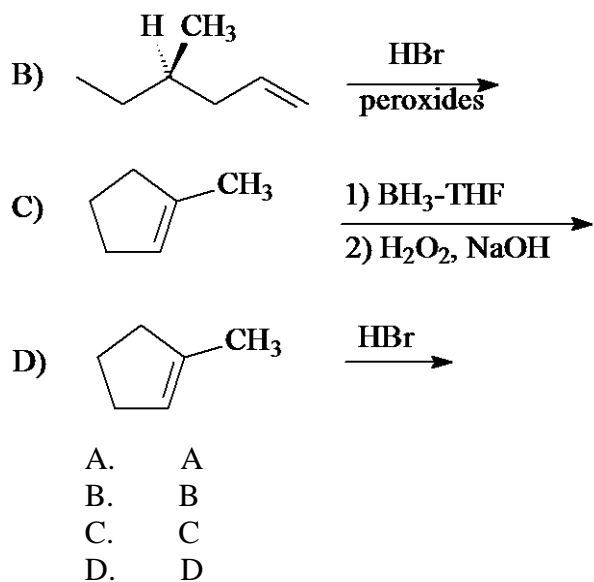
43. Which reaction below gives a single enantiomer of a chiral product?



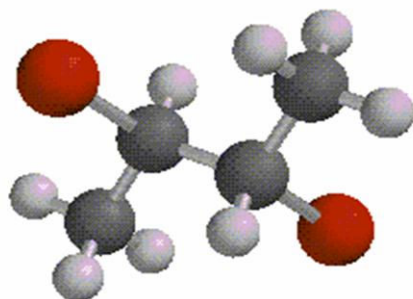
- A. A
B. B
C. C
D. D

44. Which reaction below gives a pair of diastereomers?



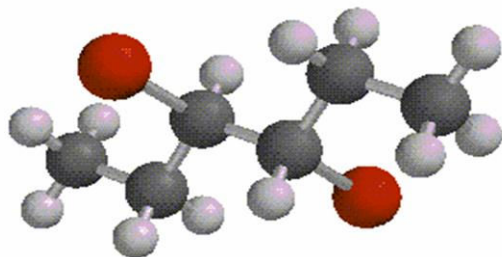


45. Which one of the following isomeric dibromobutanes is shown below?



- A. (2R, 3R)-2,3-dibromobutane
B. (2S, 3S)-2,3-dibromobutane
C. *meso*-2,3-dibromobutane
D. (R)-1,2-dibromobutane

46. The following isomer of dibromohexane can be synthesized by:



- A. addition of Br₂ to *trans*-3-hexene
B. addition of Br₂ to *cis*-3-hexene
C. addition of HBr to *trans*-3-hexene
D. addition of HBr to *cis*-3-hexene

47. What are the configurations of C(1) and C(2), respectively, for the stereoisomer of 2-methylcyclopentanol shown below?



- A. (1R, 2R)
- B. (1R, 2S)
- C. (1S, 2R)
- D. (1S, 2S)

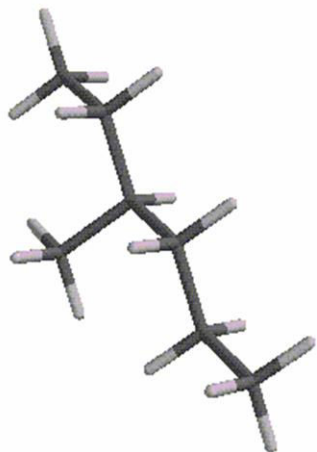
48. Which one of the following is a diastereomer of (2R,3R)-2,3-dibromopentane?

- A. (2S,3S)-2,3-dibromopentane
- B. (2S,3R)-2,3-dibromopentane
- C. R-1,2-dibromopentane
- D. (2R,4R)-2,4-dibromopentane

49. Which of the following is the enantiomer of (2R,3R)-2,3-dibromopentane?

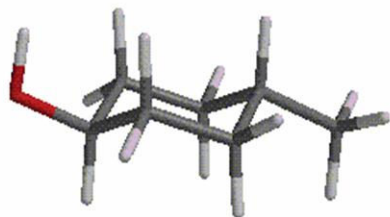
- A. (2S,3S)-2,3-dibromopentane
- B. (2S,3R)-2,3-dibromopentane
- C. (2R,3S)-2,3-dibromopentane
- D. (2R,4R)-2,4-dibromopentane

50. What is the IUPAC name of the following hydrocarbon?



- A. (R)-4-ethylpentane
- B. (S)-3-methylhexane
- C. (S)-2-ethylpentane
- D. (R)-3-methylhexane

51. What is the total number of stereoisomers (including the one shown) for the following alcohol?



- A. zero (none are possible)
- B. two
- C. three
- D. four

52. Which of the following best describes a racemic mixture?

- A. A mixture containing equal amounts of two diastereomers.
- B. A mixture containing a *meso* stereoisomer.
- C. A mixture containing unequal amounts of enantiomers.
- D. A mixture containing equal amounts of enantiomers.

ACS Review Stereochemistry KEY

1. D
2. B
3. A
4. A
5. B
6. C
7. B
8. A
9. D
10. B
11. D
12. D
13. A
14. D
15. D
16. C
17. B
18. C
19. D
20. C
21. B
22. D
23. B
24. D
25. D
26. D
27. B
28. A
29. C
30. C
31. D
32. C
33. A
34. C
35. B
36. D
37. C
38. D
39. C
40. B
41. C
42. D
43. B
44. A
45. C
46. A
47. B
48. B
49. A

50. B

51. B

52. D