ESSAY. Write your answer in the space provided or on a separate sheet of paper.

1) Is the molecule shown below chiral or achiral?

(CH₃)₃CCH(CH₃)₂

2) Is the molecule shown below chiral or achiral?

CH₃CH₂CH(CH₃)CH₂CH₃

3) Is the molecule shown below chiral or achiral?

4) Is the molecule shown below chiral or achiral?

5) Is the molecule shown below chiral or achiral?

6) Is the molecule shown below chiral or achiral?

7) Is the molecule shown below chiral or achiral?
8) Is the molecule shown below chiral or achiral?

9) Is the molecule shown below chiral or achiral?

10) Is the molecule shown below chiral or achiral?

11) Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound?

12) Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound?

13) Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound?
14) Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound?

15) Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound?

16) Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound?

17) Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound?

18) Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound?

19) Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound?
20) Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound?

21) Label each asymmetric carbon in the compound below as R or S.

22) Label each asymmetric carbon in the compound below as R or S.

23) Label each asymmetric carbon in the compound below as R or S.

24) Label each asymmetric carbon in the compound below as R or S.

25) Label each asymmetric carbon in the compound below as R or S.

26) Draw the structure of (2R,3S)-2,3-dichloropentane. Take particular care to indicate three-dimensional stereochemical detail properly.

27) Draw the structure of the enantiomer of (2S,3R)-2,3-dichloropentane. Take particular care to indicate three-dimensional stereochemical detail properly.
28) Draw the structure of any diastereomer of (2S, 3R)-2,3-dichloropentane. Take particular care to indicate three-dimensional stereochemical detail properly.

29) Draw the structure of (S)-1-bromo-1-chloropropane. Take particular care to indicate three-dimensional stereochemical detail properly.

30) Draw the structure of the meso form of 1,3-dichlorocyclopentane. Take particular care to indicate three-dimensional stereochemical detail properly.

31) How many asymmetric carbons are present in the compound below?

![Chemical structure](image1)

32) How many asymmetric carbons are present in the compound below?

![Chemical structure](image2)

33) How many asymmetric carbons are present in the compound below?

![Chemical structure](image3)

34) How many asymmetric carbons are present in the compound below?

![Chemical structure](image4)

35) How many asymmetric carbons are present in the compound below?

![Chemical structure](image5)
36) How many asymmetric carbons are present in the compound below?

3-ethyl-2,2,4-trimethylpentane

37) Can the molecule shown below be properly described as a meso compound?

(CH)_2CHCH_2CH_3

38) Can the molecule shown below be properly described as a meso compound?

39) Can the molecule shown below be properly described as a meso compound?

40) Can the molecule shown below be properly described as a meso compound?

41) Can the molecule shown below be properly described as a meso compound?

42) Draw the structure of (S)-2-bromobutane. Take particular care to indicate stereochemistry properly.

43) Draw the structure of (1R, 2R)-1-bromo-2-chlorocyclobutane. Take particular care to indicate stereochemistry properly.

44) Draw the structure of (S)-3-chloro-3-methylhexane. Take particular care to indicate stereochemistry properly.

45) Draw the structure of (1R, 2S, 3S)-1,2-dibromo-3-ethylcyclohexane. Take particular care to indicate stereochemistry properly.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

46) ___________ are isomers which have the same bonding sequence but differ in the orientation of their atoms in space.
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

47) Which of the statements below correctly describes an achiral molecule?
   A) The molecule has a nonsuperimposable mirror image.
   B) The molecule exhibits optical activity when it interacts with plane-polarized light.
   C) The molecule has an enantiomer.
   D) The molecule might be a meso form.
   E) None of the above

48) Which of the following statements correctly pertains to a pair of enantiomers?
   A) They rotate the plane of polarized light by exactly the same amount and in opposite directions.
   B) They rotate the plane of polarized light by differing amounts and in opposite directions.
   C) They rotate the plane of polarized light by differing amounts and in the same direction.
   D) They have different melting points.
   E) They have the same melting point, but they have different boiling points.

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

49) Can one predict whether a compound with a single asymmetric carbon is dextro- or levorotatory based on the R/S assignment at this asymmetric carbon? Explain briefly.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

50) If (S)-glyceraldehyde has a specific rotation of -8.7°, what is the specific rotation of (R)-glyceraldehyde?
   A) 0.0°
   B) -8.7°
   C) +8.7°
   D) cannot be determined from the information given

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

51) A newly isolated natural product was shown to be optically active. If a solution of 2.0 g in 10 mL of ethanol in a 50 cm tube gives a rotation of +2.57°, what is the specific rotation of this natural product?

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

52) Stereoisomers which are not mirror image isomers are _________.

53) The process by which enantiomers are separated is called _________.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

54) A mixture of equal amounts of two enantiomers _________.
   A) is called a racemic mixture
   B) is optically inactive
   C) implies that the enantiomers are meso forms
   D) both A and B
   E) none of the above
This document is a page from a textbook or a study guide, containing various questions and exercises related to organic chemistry, particularly focusing on stereochemistry and chiral compounds. The questions are intended to test understanding of concepts such as specific rotation, enantiomer separation, and optical activity. The text includes short answer, multiple choice, and essay questions that require detailed responses, reflecting a comprehensive approach to teaching these topics through a variety of question types.
65) Which of the following statements is (are) true for the compound \((3R, 4R)-3,4\)-dimethylhexane?  
A) This compound is chiral.  
B) The enantiomer of this compound is \((3S, 4S)-3,4\)-dimethylhexane.  
C) This compound is a diastereomer of \((3R, 4S)-3,4\)-dimethylhexane.  
D) all of the above  
E) none of the above

66) Which of the following statements is (are) true for the compound \(\text{cis-}1,2\)-dichlorocyclopropane?  
A) This compound is chiral.  
B) The enantiomer of this compound is \(\text{trans-}1,2\)-dichlorocyclopropane.  
C) This compound contains no asymmetric carbons.  
D) all of the above  
E) none of the above

67) How many asymmetric carbon atoms are present in the following compound?  
A) 0  
B) 1  
C) 2  
D) 3  
E) 4

68) How many chiral carbon atoms are present in the following compound?  
A) 0  
B) 1  
C) 2  
D) 3  
E) 4

69) Which of the following terms correctly describe(s) the structural relationship between \(\text{cis-}1,3\)-dimethylcyclopentane and \(\text{trans-}1,3\)-dimethylcyclopentane?  
A) enantiomers  
B) diastereomers  
C) geometric isomers  
D) both A and C  
E) both B and C
ESSAY. Write your answer in the space provided or on a separate sheet of paper.

70) Does the molecule shown below contain asymmetric carbon atoms? Is this molecule chiral?

![Molecule Image]

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

71) Compounds that rotate the plane of polarized light clockwise are called __________.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

72) If a mixture contains 75% of one compound and 25% of its enantiomer, what is the e.e. of the mixture?
   A) 100  B) 75  C) 50  D) 25  E) 3

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

73) Draw the Fischer projection of (S)-2-hydroxybutanoic acid, CH₃CH₂CH(OH)COOH.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

74) How many diastereomers are there of the molecule shown below?
   A) 0  B) 1  C) 2  D) 3  E) 6
75) How many enantiomers are there of the molecule shown below?

A) 0  
B) 1  
C) 2  
D) 3  
E) 6

76) How many diastereomers are there of the molecule shown below?

A) 0  
B) 1  
C) 2  
D) 3  
E) 6

77) How many enantiomers are there of the molecule shown below?

A) 0  
B) 1  
C) 2  
D) 3  
E) 6

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

78) If possible, draw the structure of the enantiomer of the molecule shown below.

A) 0  
B) 1  
C) 2  
D) 3  
E) 6
79) If possible, draw the structure of any diastereomer of the molecule shown below.

80) If possible, draw the structure of the enantiomer of the molecule shown below.

81) If possible, draw the structure of any diastereomer of the molecule shown below.

82) Is the mirror image of the following molecule an enantiomer or is it superimposable with it?

83) Label each asymmetric carbon in the molecule below as having the R or S configuration.
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

84) What term describes the structural relationship between (E)- and (Z)-2-pentene?
   A) not isomers
   B) constitutional isomers
   C) enantiomers
   D) diastereomers
   E) conformers

85) What term describes the structural relationship between cis-1,2-dimethylcyclopentane and trans-1,2-dimethylcyclopentane?
   A) not isomers
   B) constitutional isomers
   C) enantiomers
   D) diastereomers
   E) conformers

86) What term describes the structural relationship between cis-1,2-dimethylcyclopentane and trans-1,3-dimethylcyclopentane?
   A) not isomers
   B) constitutional isomers
   C) enantiomers
   D) diastereomers
   E) conformers

87) What term describes the structural relationship between (2R,3R,4S)-2,3,4-trichloroheptane and (2S,3S,4R)-2,3,4-trichloroheptane?
   A) not isomers
   B) constitutional isomers
   C) enantiomers
   D) diastereomers
   E) conformers

88) What term describes the structural relationship between (2R,3R,4S)-2,3,4-trichloroheptane and (2R,3R,4R)-2,3,4-trichloroheptane?
   A) not isomers
   B) constitutional isomers
   C) enantiomers
   D) diastereomers
   E) conformers

89) What term describes the structural relationship between (2R,3R,4S)-2,3,4-trichloroheptane and (2S,3S,5R)-2,3,5-trichloroheptane?
   A) not isomers
   B) constitutional isomers
   C) enantiomers
   D) diastereomers
   E) conformers
90) Provide a Fischer projection of (2R,3R,4S)-2,3,4-trichloroheptane.

91) Provide a Fischer projection of (2S,3S,4S)-2,3,4-trichloroheptane.

92) Which of the following incorrectly describes cis-1,2-dimethylcyclopentane?
   A) It is a meso compound.
   B) It is achiral.
   C) It contains two asymmetric carbons.
   D) Its diastereomer is trans-1,2-dimethylcyclopentane.
   E) It has an enantiomer.

93) Can one separate a mixture of enantiomers by gas chromatography? Explain.

94) For the structure shown below, draw the stereoisomer having a configuration of (1R,3S,4S) in a perspective structure.

95) Circle all structures shown below that are chiral.

96) Which of the following configurations corresponds to the structure below?
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

97) Captopril is used to treat high blood pressure and congestive heart failure. Label the chiral centers as R or S.

\[ \text{HO} \quad \text{OH} \]
\[ \text{CH}_2 \text{OH} \quad \text{CH}_2 \text{OH} \]
\[ \text{CH}_2 \text{OH} \quad \text{CH}_2 \text{OH} \]

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Use the following three structures to answer the questions below.

98) The relationship between I and II is:
   A) same compound
   B) enantiomers
   C) diastereomers
   D) constitutional isomers

99) The relationship between I and III is:
   A) same compound
   B) enantiomers
   C) diastereomers
   D) constitutional isomers

100) Which of the structures above are meso structures?
   A) I
   B) II
   C) III
   D) II & III
   E) None of the previous

101) A student measured the optical activity of an unknown sugar at two different concentrations. The results of his measurements are shown below. Given that the sample cell had a path length of 10.0 cm, calculate the specific rotation for the unknown sugar. (Hint: consider each measurement of plane polarized light has a true reading and a "ghost" reading 180° from the true reading).

<table>
<thead>
<tr>
<th>concentration</th>
<th>observed rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.00 g sugar in 10.0 mL water</td>
<td>+159.1°</td>
</tr>
<tr>
<td>5.00 g sugar in 10.0 mL water</td>
<td>+127.8°</td>
</tr>
</tbody>
</table>

   A) -10.5°  B) +25.6°  C) +79.5°  D) -105°  E) +256°
1) achiral
   ID: oc6w 5-1
   Diff: 1
   Skill:

2) achiral
   ID: oc6w 5-2
   Diff: 2
   Skill:

3) achiral
   ID: oc6w 5-3
   Diff: 2
   Skill:

4) chiral
   ID: oc6w 5-4
   Diff: 2
   Skill:

5) achiral
   ID: oc6w 5-5
   Diff: 2
   Skill:

6) achiral
   ID: oc6w 5-6
   Diff: 3
   Skill:

7) achiral
   ID: oc6w 5-7
   Diff: 3
   Skill:

8) achiral
   ID: oc6w 5-8
   Diff: 2
   Skill:

9) chiral
   ID: oc6w 5-9
   Diff: 2
   Skill:

10) achiral
    ID: oc6w 5-10
    Diff: 3
    Skill:

11) the same compound
    ID: oc6w 5-11
    Diff: 1
    Skill:

12) the same compound
    ID: oc6w 5-12
    Diff: 1
    Skill:
Answer Key

Testname: UNTITLED8

13) enantiomers
   ID: oc6w 5-13
   Diff: 3
   Skill:

14) diastereomers
   ID: oc6w 5-14
   Diff: 2
   Skill:

15) diastereomers
   ID: oc6w 5-15
   Diff: 3
   Skill:

16) the same compound
   ID: oc6w 5-16
   Diff: 2
   Skill:

17) the same compound
   ID: oc6w 5-17
   Diff: 3
   Skill:

18) enantiomers
   ID: oc6w 5-18
   Diff: 3
   Skill:

19) enantiomers
   ID: oc6w 5-19
   Diff: 2
   Skill:

20) enantiomers
   ID: oc6w 5-20
   Diff: 1
   Skill:

21)  

   ID: oc6w 5-21
   Diff: 1
   Skill:

22)  

   ID: oc6w 5-22
   Diff: 2
   Skill:
Answer Key
Testname: UNTITLED8

23)

ID: oc6w 5-23
Diff: 3
Skill:

24)

ID: oc6w 5-24
Diff: 2
Skill:

25)

ID: oc6w 5-25
Diff: 3
Skill:

26)

ID: oc6w 5-26
Diff: 2
Skill:

27)

ID: oc6w 5-27
Diff: 2
Skill:
Answer Key
Testname: UNTITLED8

28)

ID: oc6w 5–28
Diff: 2
Skill:

29)

ID: oc6w 5–29
Diff: 1
Skill:

30)

ID: oc6w 5–30
Diff: 2
Skill:

31) 1
ID: oc6w 5–31
Diff: 1
Skill:

32) none
ID: oc6w 5–32
Diff: 1
Skill:

33) 5
ID: oc6w 5–33
Diff: 1
Skill:

34) 5
ID: oc6w 5–34
Diff: 3
Skill:

35) 2
ID: oc6w 5–35
Diff: 2
Skill:

36) 1
ID: oc6w 5–36
Diff: 2
Skill:
37) No
   ID: oc6w 5–37
   Diff: 2
   Skill:

38) No
   ID: oc6w 5–38
   Diff: 2
   Skill:

39) Yes
   ID: oc6w 5–39
   Diff: 1
   Skill:

40) Yes
   ID: oc6w 5–40
   Diff: 1
   Skill:

41) No
   ID: oc6w 5–41
   Diff: 2
   Skill:

42)
   \[ \text{CH}_3 \]
   \[ \text{H} \rightarrow \text{Br} \]
   \[ \text{CH}_2\text{CH}_3 \]
   ID: oc6w 5–42
   Diff: 1
   Skill:

43)
   \[ \text{Br} \]
   \[ \text{Cl} \]
   ID: oc6w 5–43
   Diff: 2
   Skill:

44)
   \[ \text{Cl} \]
   ID: oc6w 5–44
   Diff: 2
   Skill:

45)
   \[ \text{Br} \]
   ID: oc6w 5–45
   Diff: 2
   Skill:
46) Stereoisomers
   ID: oc6w 5–46
   Diff: 1
   Skill:

47) D
   ID: oc6w 5–47
   Diff: 2
   Skill:

48) A
   ID: oc6w 5–48
   Diff: 2
   Skill:

49) No, R/S assignment is purely a convention of nomenclature and is completely independent of the direction in which plane-polarized light is rotated by the compound.
   ID: oc6w 5–49
   Diff: 2
   Skill:

50) C
   ID: oc6w 5–50
   Diff: 2
   Skill:

51) +2.57°
   ID: oc6w 5–51
   Diff: 3
   Skill:

52) diastereomers
   ID: oc6w 5–52
   Diff: 1
   Skill:

53) resolution
   ID: oc6w 5–53
   Diff: 1
   Skill:

54) D
   ID: oc6w 5–54
   Diff: 2
   Skill:

55) 76%
   ID: oc6w 5–55
   Diff: 3
   Skill:

56) −1.9°
   ID: oc6w 5–56
   Diff: 3
   Skill:

57) 60%
   ID: oc6w 5–57
   Diff: 2
   Skill:
58) Yes. The presence of asymmetric carbons is not required for a molecule to be chiral. The only requirement is that the molecule be nonsuperimposable with its mirror image. Structural features other than asymmetric carbons can lead to chirality.
ID: oc6w 5-58
Diff: 2
Skill:

59) Yes. The molecules are related as diastereomers and hence have different boiling points.
ID: oc6w 5-59
Diff: 2
Skill:

60) inversion
ID: oc6w 5-60
Diff: 1
Skill:

61) retention
ID: oc6w 5-61
Diff: 1
Skill:

62) The two compounds can be converted to diastereomers, separated based on different physical properties of these diastereomers, and subsequently returned to their original forms after separation. Another method involves the chromatographic separation using a chiral stationary phase.
ID: oc6w 5-62
Diff: 2
Skill:

63) A
ID: oc6w 5-63
Diff: 2
Skill:

64) D
ID: oc6w 5-64
Diff: 2
Skill:

65) D
ID: oc6w 5-65
Diff: 2
Skill:

66) E
ID: oc6w 5-66
Diff: 2
Skill:

67) B
ID: oc6w 5-67
Diff: 1
Skill:

68) A
ID: oc6w 5-68
Diff: 1
Skill:
69) E
   ID: oc6w 5-69
   Diff: 2
   Skill:

70) Yes, the molecule contains 4 asymmetric carbon atoms. No, the molecule is not chiral since it is superimposable with its mirror image.
   ID: oc6w 5-70
   Diff: 3
   Skill:

71) dextrorotatory
   ID: oc6w 5-71
   Diff: 1
   Skill:

72) C
   ID: oc6w 5-72
   Diff: 2
   Skill:

73)

   CO₂ H
   HO
   H
   CH₃ CH₃

   ID: oc6w 5-73
   Diff: 1
   Skill:

74) E
   ID: oc6w 5-74
   Diff: 3
   Skill:

75) B
   ID: oc6w 5-75
   Diff: 1
   Skill:

76) C
   ID: oc6w 5-76
   Diff: 1
   Skill:

77) A
   ID: oc6w 5-77
   Diff: 2
   Skill:
The compound is an achiral, meso compound; it has no enantiomer.

Superimposable. The molecule is achiral.
Answer Key

Testname: UNTITLED8

83) [Chemical structure diagram]
   ID: oc6w 5–83
   Diff: 2
   Skill:

84) D
   ID: oc6w 5–84
   Diff: 2
   Skill:

85) D
   ID: oc6w 5–85
   Diff: 2
   Skill:

86) B
   ID: oc6w 5–86
   Diff: 2
   Skill:

87) C
   ID: oc6w 5–87
   Diff: 2
   Skill:

88) D
   ID: oc6w 5–88
   Diff: 2
   Skill:

89) B
   ID: oc6w 5–89
   Diff: 2
   Skill:

90) [Chemical structure diagram]
   ID: oc6w 5–90
   Diff: 3
   Skill:
91) 

![Diagram](image)

ID: oc6w 5-91
Diff: 3
Skill:

92) E

ID: oc6w 5-92
Diff: 1
Skill:

93) Provided the compounds can be volatilized, a mixture of enantiomers can be separated by GC if an appropriate chiral column can be found. Enantiomers will be retained differently by the chiral stationary phase of the column.

ID: oc6w 5-93
Diff: 3
Skill:

94) 

![Diagram](image)

ID: oc6w 5-94
Diff: 3
Skill:

95) 

![Diagram](image)

ID: oc6w 5-95
Diff: 3
Skill:

96) A

ID: oc6w 5-96
Diff: 3
Skill:
Answer Key
Testname: UNTITLED8

97) 

\[
\begin{array}{c}
\text{HS} \\
\text{S} \\
\text{C} \\
\text{H}_3
\end{array}
\]

ID: oc6w 5-97
Diff: 3
Skill:

98) C
ID: oc6w 5-98
Diff: 3
Skill:

99) C
ID: oc6w 5-99
Diff: 3
Skill:

100) A
ID: oc6w 5-100
Diff: 3
Skill:

101) D
ID: oc6w 5-101
Diff: 3
Skill:
QOI 0809   STEREOCHEMISTRY

Name___________________________________

1) ______
2) ______
3) ______
4) ______
5) ______
6) ______
7) ______
8) ______
9) ______
10) ______
11) ______
12) ______
13) ______
14) ______
15) ______
16) ______
17) ______
18) ______
19) ______
20) ______
21) ______

22) ______

23) ______

24) ______

25) ______