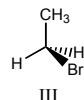
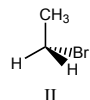
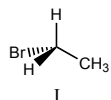
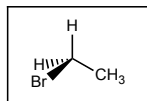


## MULTIPLE CHOICE QUESTIONS Part 5: Stereochemistry

Answers on page 24-26

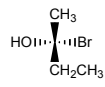
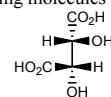
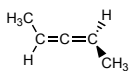
### Topic: Identifications and Comparisons

1. Which of the following is the enantiomer of the following substance?



- A) I  
 B) II  
 C) III  
 D) It does not have a non-superposable enantiomer.  
 E) Both II and III

2. Which of the following molecules is achiral?

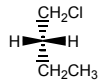
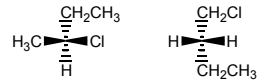


- I  
 A) I  
 B) II  
 C) III  
 D) IV  
 E) V

3. Hexane and 3-methylpentane are examples of:

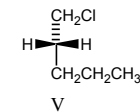
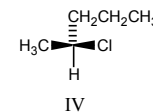
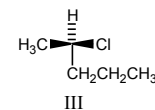
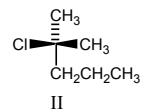
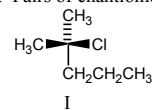
- A) enantiomers.  
 B) stereoisomers.  
 C) diastereomers.  
 D) constitutional isomers.  
 E) None of these

4. I and II are:



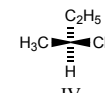
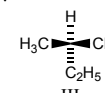
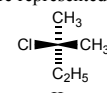
- I                      II  
 A) constitutional isomers.  
 B) enantiomers.  
 C) non-superposable mirror images.  
 D) diastereomers.  
 E) not isomeric.

5. Pairs of enantiomers are:



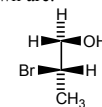
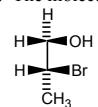
- A) I, II and III, IV  
 B) I, II  
 C) III, IV  
 D) IV, V  
 E) None of the structures

6. Chiral molecules are represented by:



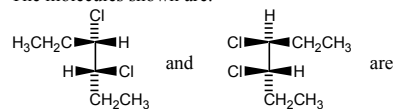
- A) I, II, III, IV and V  
 B) I, II, III and IV  
 C) I and II  
 D) III and IV  
 E) IV alone

7. The molecules shown are:



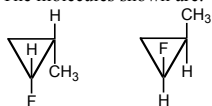
- A) constitutional isomers.  
 B) enantiomers.  
 C) diastereomers.  
 D) identical.  
 E) None of these

8. The molecules shown are:



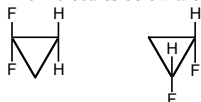
- A) enantiomers.  
 B) diastereomers.  
 C) constitutional isomers.  
 D) two conformations of the same molecule.  
 E) not isomeric.

9. The molecules shown are:



- A) constitutional isomers.  
 B) enantiomers.  
 C) diastereomers.  
 D) identical.  
 E) None of these

10. The molecules below are:



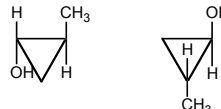
- A) constitutional isomers.  
 B) enantiomers.  
 C) diastereomers.  
 D) identical.  
 E) stereoisomers.

11. The molecules shown are:



- A) enantiomers.  
 B) diastereomers.  
 C) constitutional isomers.  
 D) two different conformations of the same molecule.  
 E) not isomeric.

12. The molecules shown are:



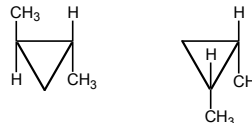
- A) constitutional isomers.  
 B) enantiomers.  
 C) diastereomers.  
 D) identical.  
 E) None of these

13. The molecules shown are:



- A) constitutional isomers.  
 B) enantiomers.  
 C) diastereomers.  
 D) identical.  
 E) None of these

14. The molecules below are:

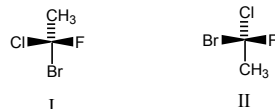


- A) structural isomers.  
 B) enantiomers.  
 C) diastereomers.  
 D) identical.  
 E) None of these

15. Cis-trans isomers are:

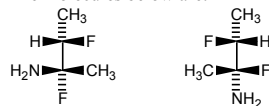
- A) diastereomers.  
 B) enantiomers.  
 C) stereoisomers.  
 D) constitutional isomers.  
 E) More than one of these  
 Ans: E

16. The molecules below are:



- A) constitutional isomers.  
 B) enantiomers.  
 C) diastereomers.  
 D) identical.  
 E) None of these

17. The molecules below are:



- A) constitutional isomers.  
 B) enantiomers.  
 C) diastereomers.  
 D) identical.  
 E) None of these

18. The molecules shown are:



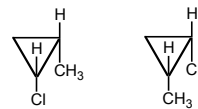
- A) constitutional isomers.  
 B) enantiomers.  
 C) diastereomers.  
 D) identical.  
 E) None of these

19. The molecules below are:



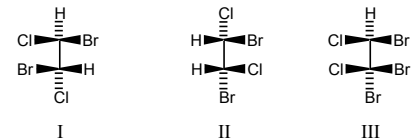
- A) constitutional isomers.  
 B) enantiomers.  
 C) diastereomers.  
 D) identical.  
 E) None of these

20. The molecules below are:



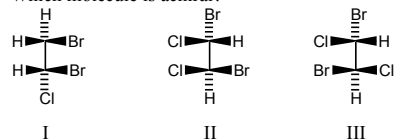
- A) constitutional isomers.  
 B) enantiomers.  
 C) diastereomers.  
 D) identical.  
 E) None of these

21. Which molecule is achiral?



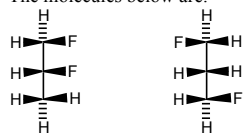
- A) I  
 B) II  
 C) III  
 D) More than one of these  
 E) None of these

22. Which molecule is achiral?



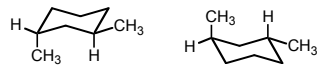
- A) I  
 B) II  
 C) III  
 D) More than one of the above  
 E) None of the above

23. The molecules below are:



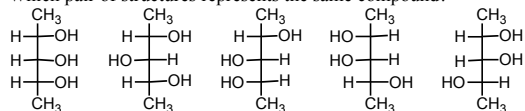
- I                      II
- A) constitutional isomers.  
 B) enantiomers.  
 C) diastereomers.  
 D) identical.  
 E) None of these

24. The structures



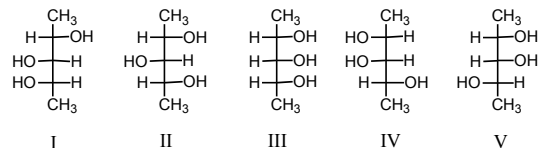
- represent:
- A) a single compound.  
 B) enantiomers.  
 C) meso forms.  
 D) diastereomers.  
 E) conformational isomers.

25. Which pair of structures represents the same compound?



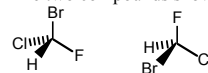
- I            II            III            IV            V
- A) I and II  
 B) II and III  
 C) III and IV  
 D) III and V  
 E) IV and V

26. Which structure(s) represent(s) diastereomer(s) of I?



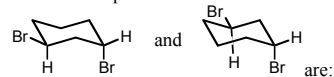
- I            II            III            IV            V
- A) II  
 B) II and III  
 C) II and IV  
 D) III and V  
 E) IV and V

27. The two compounds shown below are:



- A) enantiomers.  
 B) diastereomers.  
 C) constitutional isomers.  
 D) identical.  
 E) different but not isomeric.

28. The two compounds shown below are:

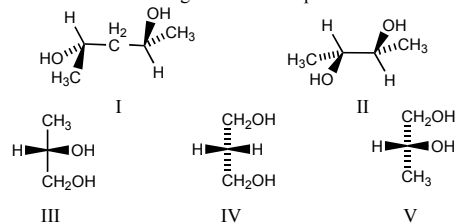


- A) identical.  
 B) enantiomers.  
 C) diastereomers.  
 D) conformational isomers.  
 E) meso forms.

29. (2R,4S)-2,4-Dichloropentane and (2S,4R)-2,4-dichloropentane are:

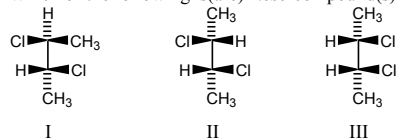
- A) enantiomers  
 B) diastereomers  
 C) identical  
 D) conformational isomers  
 E) constitutional isomers

30. Which of the following is a *meso* compound?



- A) I  
B) II  
C) III  
D) IV  
E) V

31. Which of the following is(are) *meso* compound(s)?

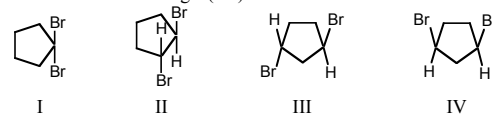


- A) I  
B) II  
C) III  
D) Both II and III  
E) Both I and III

32. Which of the following molecules is achiral?

- A) (2R,3R)-2,3-Dichloropentane  
B) (2R,3S)-2,3-Dichloropentane  
C) (2S,4S)-2,4-Dichloropentane  
D) (2S,4R)-2,4-Dichloropentane  
E) Two of these

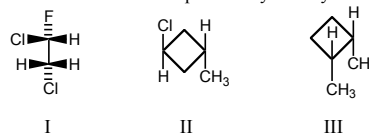
33. Which of the following is(are) *meso*?



- A) I  
B) II  
C) III  
D) IV  
E) Two of the above

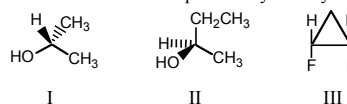
**Topic: Meso compounds**

34. Which molecule has a plane of symmetry?



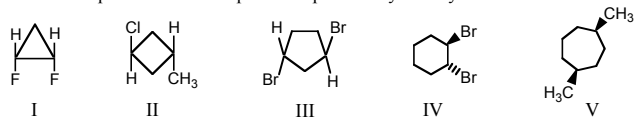
- A) I  
B) II  
C) III  
D) More than one of these  
E) None of these

35. Which molecule has a plane of symmetry?



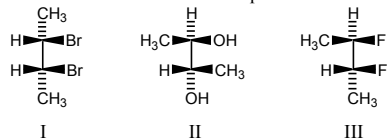
- A) I  
B) II  
C) III  
D) More than one of these  
E) None of these

36. Which compound does NOT possess a plane of symmetry?



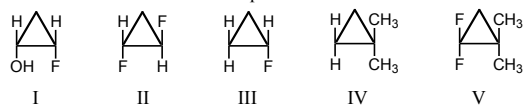
- A) I, II and V  
 B) I, III and IV  
 C) II, III and IV  
 D) III and IV  
 E) V

37. Which molecule is a *meso* compound?



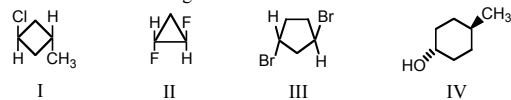
- A) I  
 B) II  
 C) III  
 D) More than one of the above  
 E) None of the above

38. Which molecule is a *meso* compound?



- A) I and II  
 B) IV and V  
 C) II and III  
 D) I, II and III  
 E) None of the above

39. Which of the following substances is achiral ?



- A) I  
 B) II  
 C) III  
 D) IV  
 E) More than one of these

40. Which statement is not true for a *meso* compound?

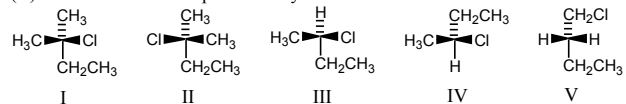
- A) The specific rotation is 0°.  
 B) There are one or more planes of symmetry.  
 C) A single molecule is identical to its mirror image.  
 D) More than one stereogenic center must be present.  
 E) The stereochemical labels, (R) and (S), must be identical for each stereogenic center.

41. Which is a *meso* compound?

- A) (2R,3R)-2,3-Dibromobutane  
 B) (2R,3S)-2,3-Dibromopentane  
 C) (2R,4R)-2,4-Dibromopentane  
 D) (2R,4S)-2,4-Dibromopentane  
 E) (2R,4S)-2,4-Dibromohexane

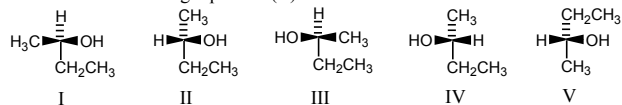
#### Topic: Specific names

42. (R)-2-Chlorobutane is represented by:



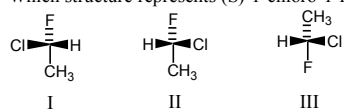
- A) I  
 B) II  
 C) III  
 D) IV  
 E) V

43. Which of the following represent (R)-2-butanol?



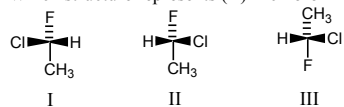
- A) III and V  
 B) I, III, IV and V  
 C) I, IV and V  
 D) I and III  
 E) I, II, IV and V

44. Which structure represents (S)-1-chloro-1-fluoroethane?



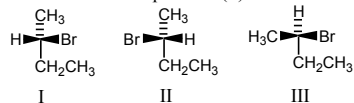
- A) I  
 B) II  
 C) III  
 D) More than one of the above  
 E) None of the above

45. Which structure represents (R)-1-chloro-1-fluoroethane?

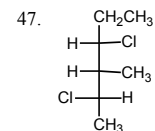


- A) I  
 B) II  
 C) III  
 D) More than one of the above  
 E) None of the above

46. Which structure represents (S)-2-bromobutane?



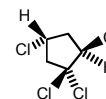
- A) I  
 B) II  
 C) III  
 D) More than one of the above  
 E) None of the above



is properly named:

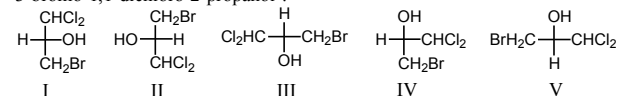
- A) (3R,4S,5R)-3,5-Dichloro-4-methylhexane  
 B) (2S,3S,4S)-2,4-Dichloro-3-methylhexane  
 C) (2S,3R,4R)-2,4-Dichloro-3-methylhexane  
 D) (2S,3R,4S)-2,4-Dichloro-3-methylhexane  
 E) (2S,3S,4R)-2,4-Dichloro-3-methylhexane

48. The Cahn-Ingold-Prelog stereochemical designations used for the following substance are:



- A) 2R,4S  
 B) 2S,4R  
 C) 2R,4R  
 D) 2S,4S  
 E) The "R,S" terminology doesn't apply in this case.

49. Which of these is not a correct Fischer projection formula of the (S) form of 3-bromo-1,1-dichloro-2-propanol?



- A) I  
 B) II  
 C) III  
 D) IV  
 E) V

## Topic: Optical activity

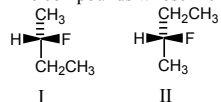
50. What is the percent composition of a mixture of (S)-(+)-2-butanol,  $[\alpha]_D^{25} = +13.52^\circ$ , and (R)-(-)-2-butanol,  $[\alpha]_D^{25} = -13.52^\circ$ , with a specific rotation  $[\alpha]_D^{25} = +6.76^\circ$ ?

- A) 75%(R) 25%(S)  
 B) 25%(R) 75%(S)  
 C) 50%(R) 50%(S)  
 D) 67%(R) 33%(S)  
 E) 33%(R) 67%(S)

51. Which one of the following can exist in optically active forms?

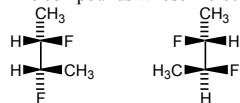
- A) cis-1,3-Dichlorocyclohexane  
 B) trans-1,3-Dichlorocyclohexane  
 C) cis-1,4-Dichlorocyclohexane  
 D) trans-1,4-Dichlorocyclohexane  
 E) cis-1,2-Dichlorocyclohexane

52. The compounds whose molecules are shown below would have:



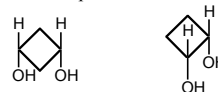
- A) the same melting point.  
 B) different melting points.  
 C) equal but opposite optical rotations.  
 D) More than one of the above  
 E) None of the above

53. The compounds whose molecules are shown below would have:



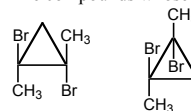
- A) the same melting point.  
 B) different melting points.  
 C) equal but opposite optical rotations.  
 D) More than one of the above  
 E) None of the above

54. The compounds whose molecules are shown below would have:



- A) the same melting point.  
 B) different melting points.  
 C) equal but opposite optical rotations.  
 D) More than one of these  
 E) None of these

55. The compounds whose structures are shown below would have:



- A) the same melting point.  
 B) different melting points.  
 C) equal but opposite optical rotations.  
 D) More than one of these  
 E) None of these

(Ej .56-57)

58. Which of these is a comparatively insignificant factor affecting the magnitude of specific optical rotation?

- A) Concentration of the substance of interest  
 B) Purity of the sample  
 C) Temperature of the measurement  
 D) Length of the sample tube  
 E) All of the above are equally significant.

59. What can be said with certainty if a compound has  $[\alpha]_D^{25} = -9.25^\circ$ ?

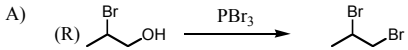
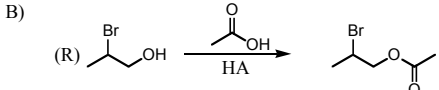
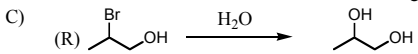
- A) The compound has the (S) configuration.  
 B) The compound has the (R) configuration.  
 C) The compound is not a meso form.  
 D) The compound possesses only one stereogenic center.  
 E) The compound has an optical purity of less than 100%.



60. An alkane which can exhibit optical activity is:  
 A) Neopentane  
 B) Isopentane  
 C) 3-Methylpentane  
 D) 3-Methylhexane  
 E) 2,3-Dimethylbutane
61. In the absence of specific data, it can only be said that (R)-2-bromopentane is:  
 A) dextrorotatory (+).  
 B) levorotatory (-).  
 C) optically inactive.  
 D) achiral.  
 E) analogous in absolute configuration to (R)-2-chloropentane.
62. If a solution of a compound (30.0 g/100 mL of solution) has a measured rotation of +15° in a 2 dm tube, the specific rotation is:  
 A) +50°  
 B) +25°  
 C) +15°  
 D) +7.5°  
 E) +4.0°
63. Which compound would show optical activity?  
 A) *cis* 1,4- Dimethylcyclohexane  
 B) *trans* 1,4- Dimethylcyclohexane  
 C) *cis* 1,4- Dimethylcycloheptane  
 D) *trans* 1,4- Dimethylcycloheptane  
 E) More than one of these
64. Of the compounds which correspond to the general name "dichlorocyclobutane", how many are optically active?  
 A) 0  
 B) 1  
 C) 2  
 D) 3  
 E) 4

**Topic: General definitions**  
 (Ej .65)

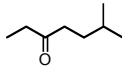
66. Which of the following is true of any (S)-enantiomer?  
 A) It rotates plane-polarized light to the right.  
 B) It rotates plane-polarized light to the left.  
 C) It is a racemic form.  
 D) It is the mirror image of the corresponding (R)-enantiomer.  
 E) It has the highest priority group on the left.

67. Enantiomers are:  
 A) molecules that have a mirror image.  
 B) molecules that have at least one stereogenic center.  
 C) non-superposable molecules.  
 D) non-superposable constitutional isomers.  
 E) non-superposable molecules that are mirror images of each other.
68. Which of the following is NOT true of enantiomers? They have the same:  
 A) boiling point.  
 B) melting point.  
 C) specific rotation.  
 D) density.  
 E) chemical reactivity toward achiral reagents.
69. Which statement is true of 1,3-dimethylcyclobutane?  
 A) Only one form of the compound is possible.  
 B) Two diastereomeric forms are possible.  
 C) Two sets of enantiomers are possible.  
 D) Two enantiomeric forms and one meso compound are possible.  
 E) None of the previous statements is true.
70. In which of the following reactions is the absolute configuration of the product likely to be the same as that of the reactant?  
 A)   
 B)   
 C)   
 D) All of the above  
 E) Answers A) and B) only

**Topic: Reaction stereochemistry**

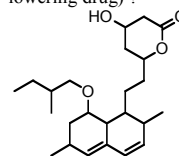
(Ej 71, 72)

73.

- The reaction of  with H<sub>2</sub>/Ni forms:  
 A) 2-methylheptane.  
 B) (R)-2-methyl-5-heptanol  
 C) (S)-6-methyl-3-heptanol  
 D) (R,S)-6-methyl-3-heptanol  
 E) Achiral 6,6-dimethyl-3-hexanol

74.  $\text{CH}_3\text{CHBrCH}_2\text{CHClCH}_3$  is the generalized representation of what number of stereoisomers?  
 A) 3  
 B) 4  
 C) 5  
 D) 6  
 E) 7
75. For the generalized structure  $\text{BrCH}_2\text{CHClCH}_2\text{CHClCH}_2\text{Br}$  there exists what number of stereoisomers?  
 A) 2  
 B) 3  
 C) 4  
 D) 6  
 E) 8
76. How many discrete dimethylcyclopropanes are there?  
 A) 2  
 B) 3  
 C) 4  
 D) 5  
 E) 6
77. What is the molecular formula for the alkane of smallest molecular weight which possesses a stereogenic center?  
 A)  $\text{C}_4\text{H}_{10}$   
 B)  $\text{C}_5\text{H}_{12}$   
 C)  $\text{C}_6\text{H}_{14}$   
 D)  $\text{C}_7\text{H}_{16}$   
 E)  $\text{C}_8\text{H}_{18}$
78. How many chiral stereoisomers can be drawn for  $\text{CH}_3\text{CHFCH}_2\text{FCH}(\text{CH}_3)_2$ ?  
 A) 1  
 B) 2  
 C) 3  
 D) 4  
 E) 8
79. How many different compounds are there which correspond to the general name "3-(1-methylbutyl)cyclobutanol"?  
 A) 2  
 B) 4  
 C) 6  
 D) 8  
 E) None of the above

80. How many stereogenic centers are there in Lovastatin (Mevacor® : a cholesterol-lowering drug) ?

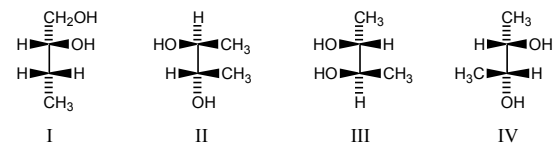


(Lovastatin)

- A) 4  
 B) 5  
 C) 6  
 D) 7  
 E) 8
81. What is the total number of compounds, stereoisomers included, designated by the general name "dichlorocyclopentane"?  
 A) 4  
 B) 5  
 C) 7  
 D) 8  
 E) 9

Use the following to answer questions 82-85:

Consider the following compounds:

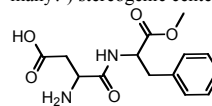


82. Which of the compounds above (I-IV) represent enantiomers?  
 A) I and II  
 B) II and III  
 C) III and IV  
 D) II and IV  
 E) III and IV

83. Which compound above (I-IV) is a meso compound?  
 A) I  
 B) II  
 C) III  
 D) IV  
 E) None of these
84. Which compound above (I-IV) is (2R,3R)-2,3-butanediol?  
 A) I  
 B) II  
 C) III  
 D) IV  
 E) None of these
85. Which compounds above (I-IV) form a set of stereoisomers?  
 A) I, II and III  
 B) II, III and IV  
 C) II and III  
 D) I, III and IV  
 E) I, II, III and IV

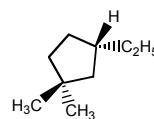
## SHORT ANSWER QUESTIONS Answers on p. 25-26

86. The molecule of aspartame (Nutrasweet®), depicted below, has \_\_\_\_\_ (how many?) stereogenic centers.

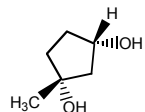


Aspartame

87. True or false: A sample consisting of the pure R enantiomer of a compound will always rotate plane-polarized light in a clockwise direction.  
 A) True  
 B) False
88. Draw a dash-wedge structure for (3R)-3-methyl-5-hexen-3-ol
89. Draw a dash-wedge structure for (1R)-1-bromo-1,3,3-trimethylcyclohexane
90. Draw a dash-wedge structure for (1R,3R)-1,3-dibromo-1,3-dimethylcyclohexane
91. Draw a dash-wedge structure for (1S,3R)-1-ethyl-1,3-dimethylcyclopentane
92. What is the complete IUPAC name of the following substance? (Remember to give stereochemical details, as relevant.)



93. What is the complete IUPAC name of the following substance? (Remember to give stereochemical details, as relevant.)



94. Draw Fischer projection formulas for all stereoisomers of 2,4-dibromohexane, giving stereochemical details for each structure.
95. Draw dash-wedge structures for all stereoisomers of 1-bromo-3-isopropylcyclohexane, giving stereochemical details for each structure.

Topic: Fischer projections

96. Draw Fischer projection formulas for all stereoisomers of 2,4-dimethyl-3-hexanol, giving stereochemical details for each structure.
97. Draw a Fischer projection formula of (*3R*)-6-Bromo-1-hexen-3-ol.

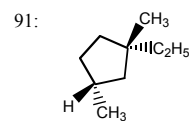
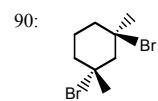
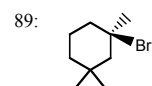
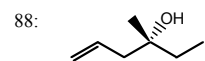
### Svar Part 5: Stereochemistry

Fråga	Svar	Rätt/Fel	Fråga	Svar	Rätt/Fel
1	D		44	D	
2	B		45	B	
3	D		46	A	
4	A		47	D	
5	C		48	C	
6	D		49	D	
7	B		50	B	
8	B		51	B	
9	B		52	D	
10	A		53	B	
11	A		54	B	
12	B		55	D	
13	E		56	C	
14	C		57	C	
15	E		58	C	
16	D		59	C	
17	C		60	D	
18	A		61	E	
19	D		62	B	
20	B		63	D	
21	A		64	C	
22	C		65	D	
23	A		66	D	
24	A		67	E	
25	D		68	C	
26	B		69	B	
27	A		70	E	
28	B		71	D	
29	C		72	D	
30	A		73	D	
31	E		74	B	
32	D		75	B	
33	E		76	C	
34	D		77	D	
35	D		78	D	
36	D		79	B	
37	D		80	E	
38	E		81	C	
39	E		82	B	
40	E		83	D	
41	D		84	C	
42	C		85	B	
43	C				

## Answer 86 – 97

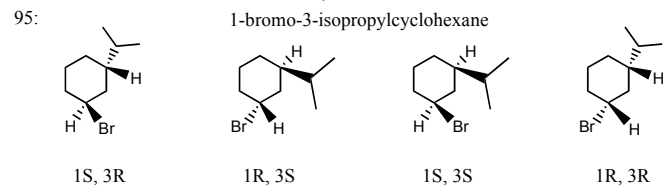
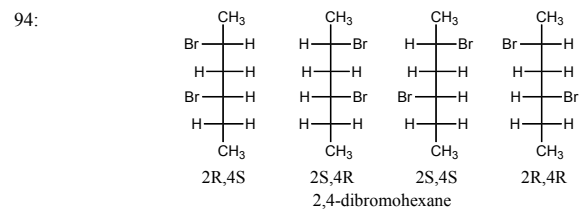
86: two

87: B

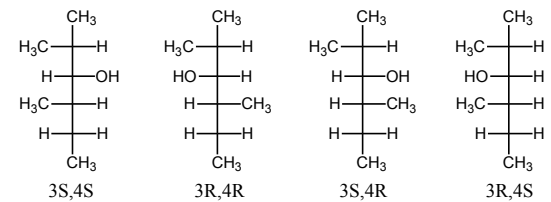


92: (1S)-1-ethyl-1,3,3-trimethylcyclopentane

93: (1R,3S)-1-methylcyclopentane-1,3-diol



96:



97:

