

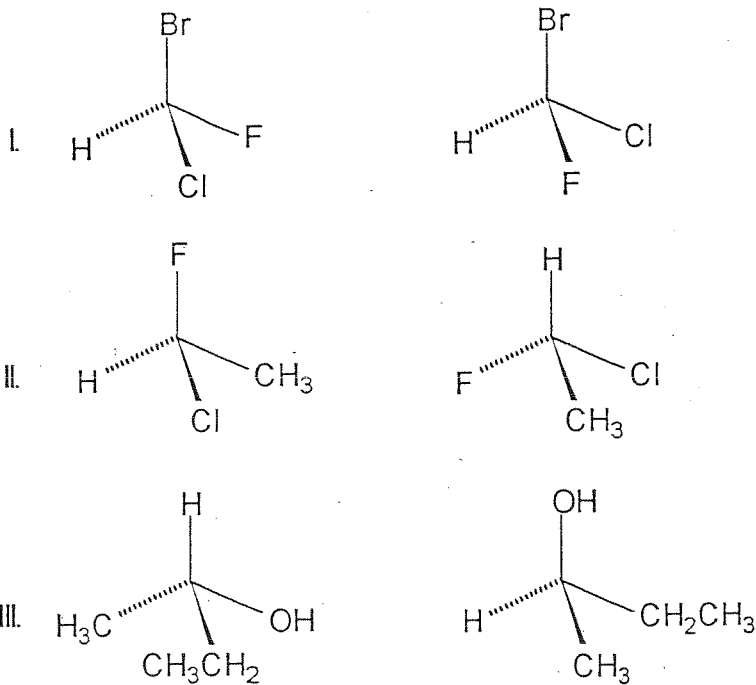
Multiple Choice. Select the best answer (4 pts each).

1. Which of the following molecules are achiral?

- I. trans-1,2-cyclohexanediol II. cis-1,2-cyclohexanediol
 III. trans-1,4-cyclohexanediol IV. trans-1,3-cyclohexanediol

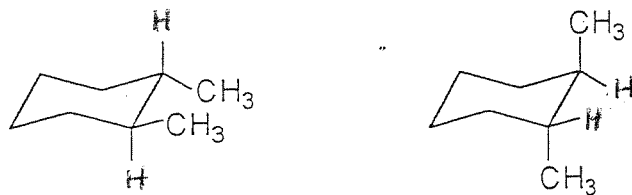
- a) I, IV b) II, III c) I, II d) III, IV

2. For the following sets of structures, which pairs are enantiomers?



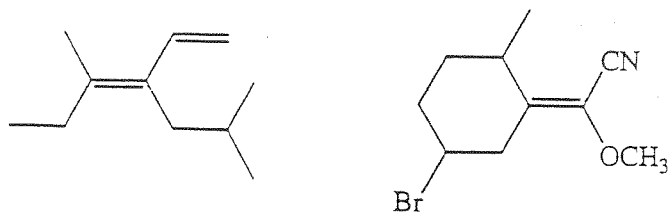
- a) I, II b) I, III c) II, III d) none

3. What relationship do the following structures have?



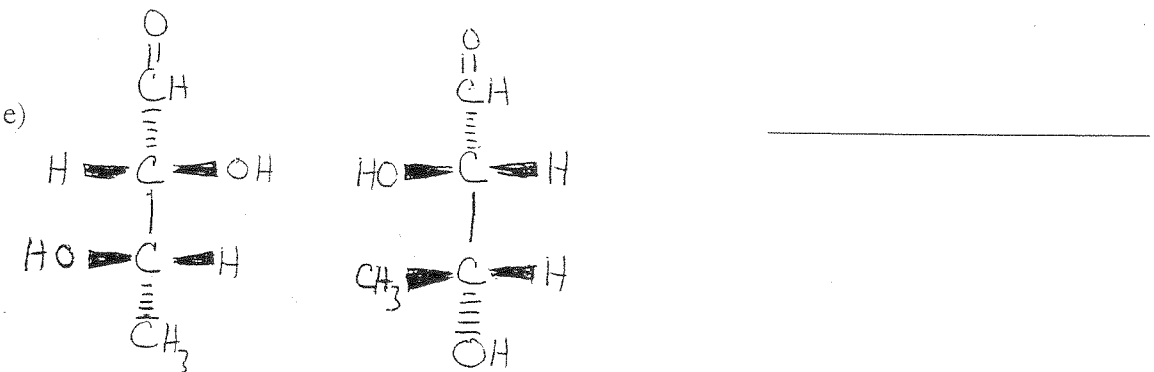
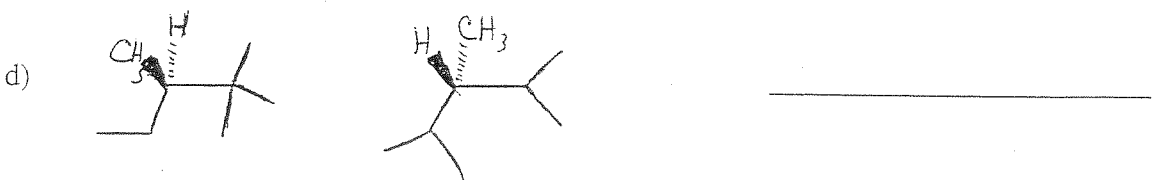
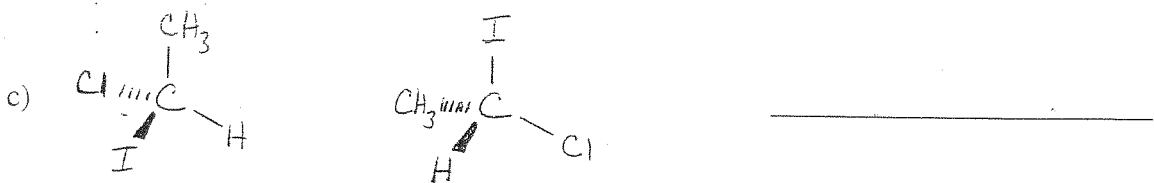
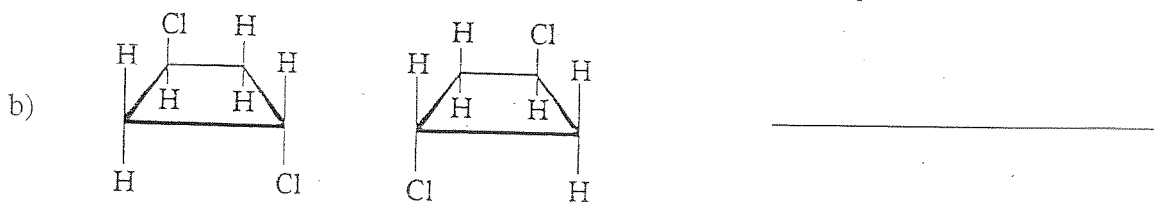
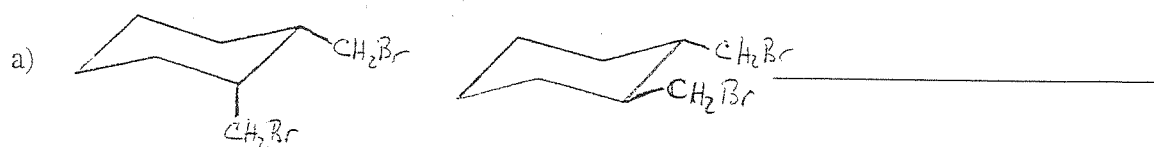
- a) enantiomers b) diastereomers
 c) structural isomers d) conformational isomers

4. (3 pts) Assign the compounds (from left to right) as Z or E.



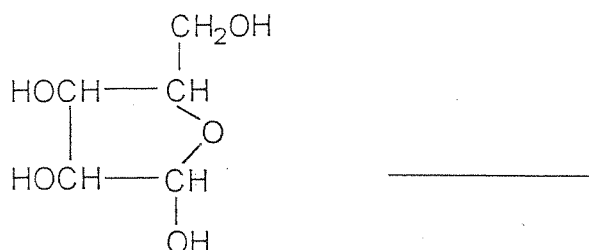
- a) Z,Z b) Z,E c) E,Z d) E,E e) neither is E nor Z

5. (15 pts, 3 each) For the following pairs of compounds, indicate whether they are enantiomers, diastereomers, the same compound, or constitutional (structural) isomers.



6. (3 pts) a) The specific rotation, $[\alpha]$, of pure quinine, an antimalarial drug, is -165° . Calculate the %ee (optical purity) of a solution with a measured $[\alpha]$ of -50° . b) Calculate the percent of each enantiomer present in this solution.

7. (3 pts) What is the maximum number of stereoisomers possible for the following compound?



8. (1 pt) Which of the conformations of cyclohexane is most stable?

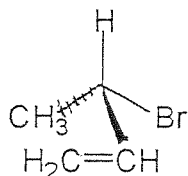
- a) boat b) twist boat c) planar d) chair

9. (9 pts) a) Draw the structure (showing the stereochemistry at the chiral center) for the optically active compound (2R)-2,3-dimethyl-1-butanol

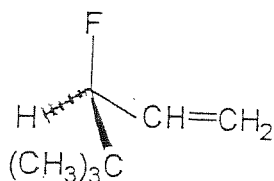
b) Draw the **Newman projection** of the **most stable** conformer of this compound where the C1-C2 bond is the bond represented by the circle.

10. (16 pts) A) Place an asterisk (*) by each chiral carbon atom in the following structures.
 B) For each chiral center, determine whether it has the R or S configuration.
SHOW YOUR WORK (i.e. label the priorities of each substituent of the chiral center).

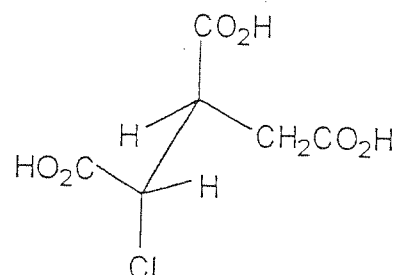
a)



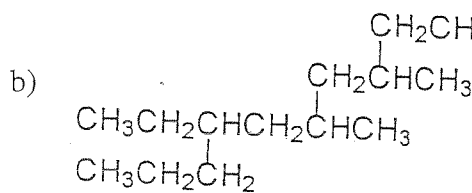
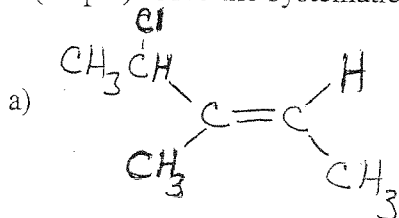
b)



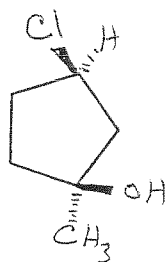
c)



11. (15 pts) Give the systematic (IUPAC) names for the following compounds. (Be sure to use R, S, E, Z when necessary).

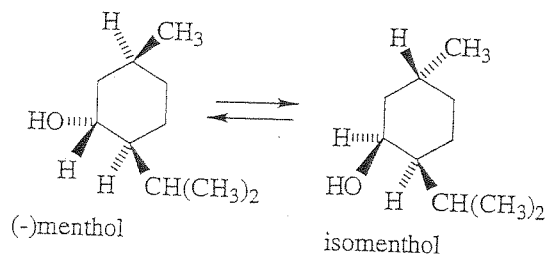


c)



12. (3 pts)

(-)-Menthol has a specific rotation of $[\alpha_D] = -58^\circ$. It can be isomerized to isomenthol under the proper reaction conditions. What is the likely specific rotation of isomenthol?



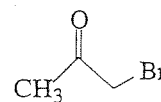
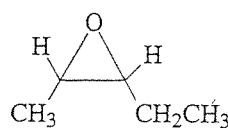
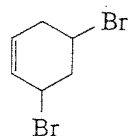
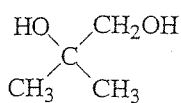
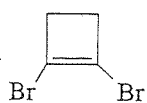
- a) $+58^\circ$ b) -58° c) can't tell d) 0° e) -35°

13. (4 pts) Which of the following are more stable?

cis- or trans- 1,2-dimethylcyclohexane cis- or trans-1,3-dimethylcyclohexane

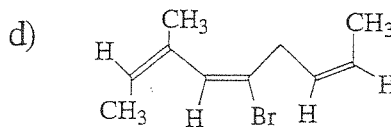
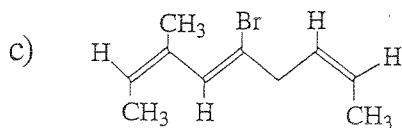
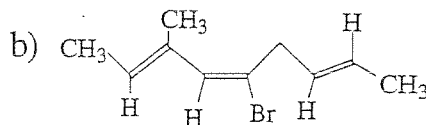
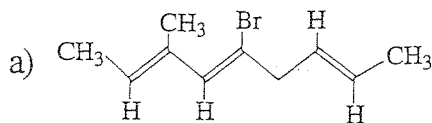
a) cis, cis b) cis, trans c) trans, cis d) trans, trans

14. (3 pts) How many of the substances have chiral stereoisomers?



a) 0 b) 1 c) 2 d) 3 e) 4

15. (4 pts) In which of these substances do all of the alkenes have the "Z" configuration?



16. (10 pts) a) Draw the **two possible chair conformations** of the **trans** isomer of 3-*tert*-butyl-1-cyclohexanol. Carefully label the non-hydrogen substituents as being in the axial (*a*) or equatorial (*eq*) positions. (*Be sure to show the correct angles for all the bonds and show all atoms- including hydrogen- in your structures*).

b) Circle the structure which would be the major conformer. **Explain why you chose your answer.**