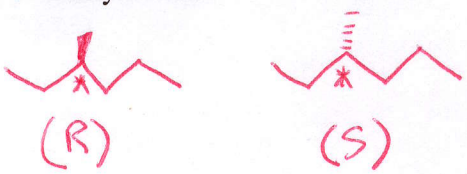
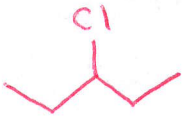
1. Draw the following compounds and indicate any stereocenters with a (*). For those that have chiral centers, draw each enantiomer and label the configuration at each stereocenter (R or S).

2-chloropentane

3-methylhexane

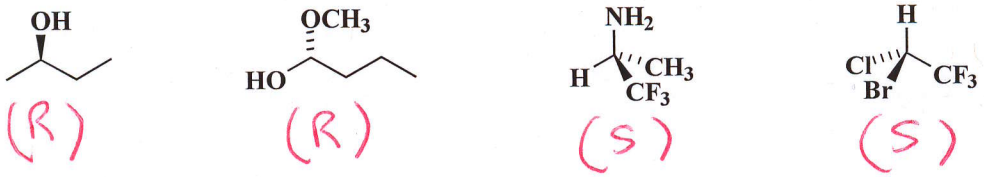


3-chloropentane

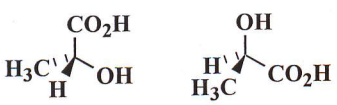


2-methylhexane

2. Determine (R) or (S) configurations at all chiral centers in the following molecules.



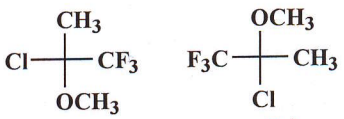
3. For each pair of molecules below indicate whether they are identical to each other or if they are enantiomers of each other. For those that are identical, draw the enantiomer.



(R) (R)

Identical

enant = 

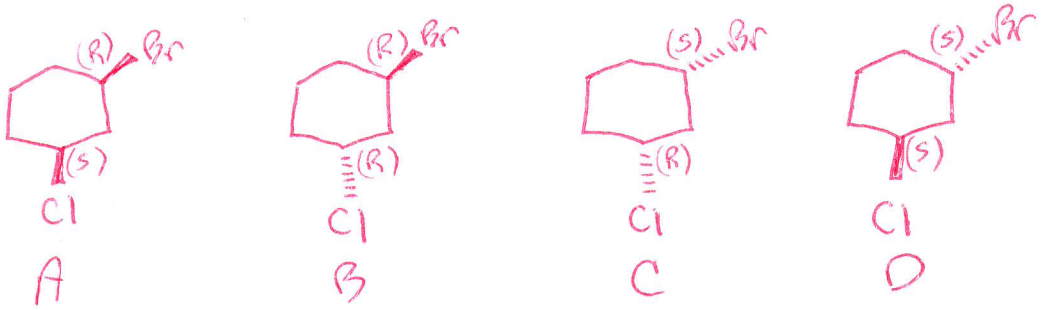


(S) (R)

Enantiomers

4. Consider the molecule 1-bromo-3-chlorocyclohexane and answer the following questions: (a) how many chiral centers are present? (b) what is the maximum number of stereoisomers possible? (c) draw all the possible stereoisomers and label them A, B, C etc. (draw them as a hexagon using wedge and dash to indicate stereochemistry). (d) define the configuration at all chiral centers and describe the relationship between all stereoisomers.

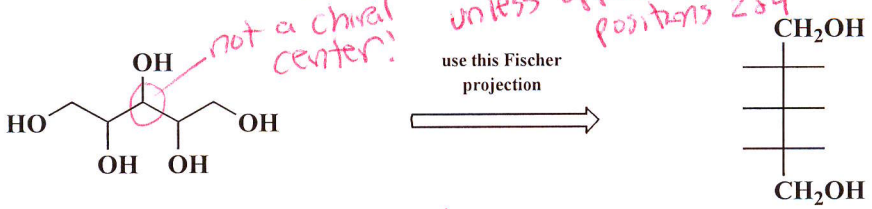
2 chiral centers, $2^2 = 4$ max stereoisomers

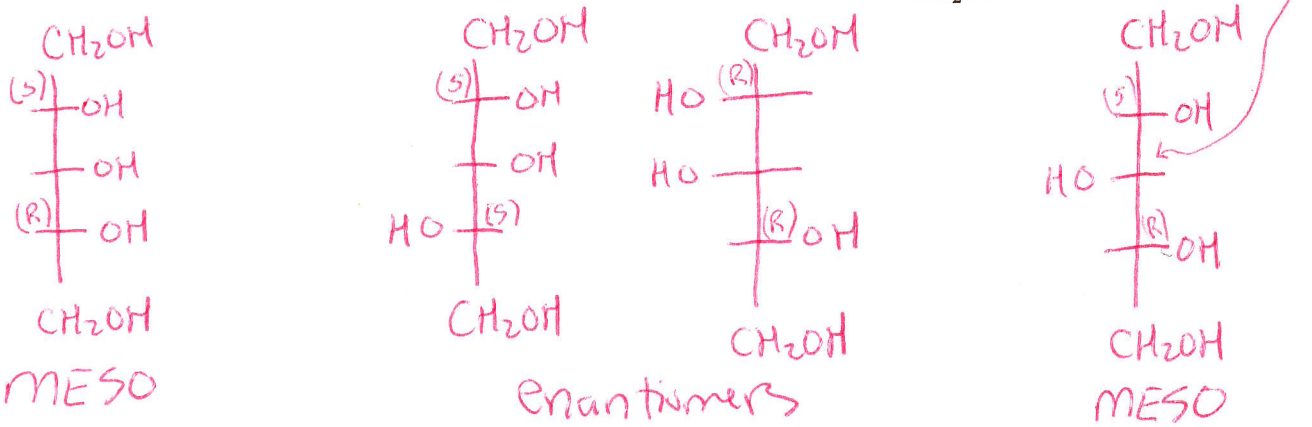


Enant
A + C
B + D

Diastereomers
A + B
A + D
B + C
C + D

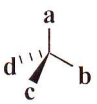
5. Draw all possible stereoisomers of the following compound. To make it easier, use Fischer projections with the CH_2OH on top and bottom in each drawing. Label the configuration at each chiral center. Which of these compounds are chiral?

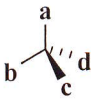




6. Given the following information about a hypothetical molecule, calculate the % optical purity of a sample containing a mixture of the two enantiomers with an optical rotation [α] of (**a**) +33.9° and (**b**) –14.1°. For each of these mixtures also provide the relative % of each enantiomer (%R and %S).

(-)-(R)-hypothetical
[α] = -37.6





(+)-(S)-hypothetical
[α] = +37.6

a) $\frac{33.9}{37.6} * 100 = 90.2\%$ ee, 9.8% racemic

$\%S = 95.1$

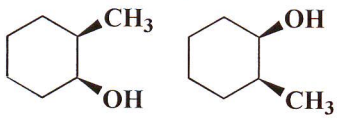
$\%R = 4.9$

b) $\%R = 68.75\%$

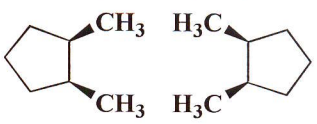
$\%S = 31.25\%$

7. For each pair of molecules below indicate if they are identical, enantiomers or diastereomers.

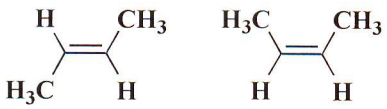
(2R,3R,4R,5R)-2,3,4,5-tetrachlorohexane and (2R,3R,4R,5S)-2,3,4,5-tetrachlorohexane — diastereomers



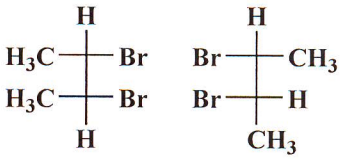
enantiomers



identical (meso)

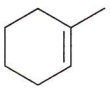
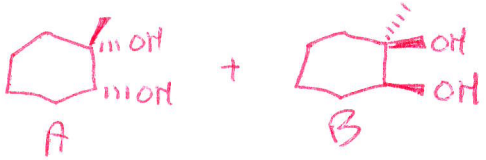


diastereomers

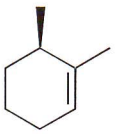
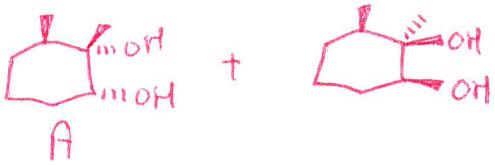


diastereomers

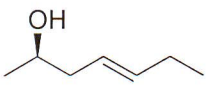
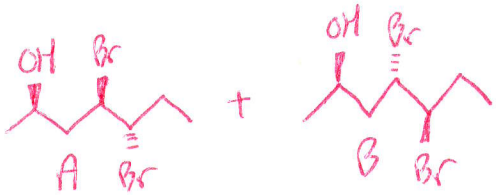
8. Draw all possible (stereoisomeric) products from each of the following reactions. Label the products A, B, C, etc and describe the relationship between the possible products. Indicate which molecules are chiral. Indicate if all products form in equal amounts or unequal amounts. If the product mixture is expected to be optically active check the box in front of the reaction.

☐  1. OsO_4 2. $NaHSO_3$ →  A + B

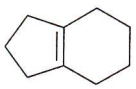
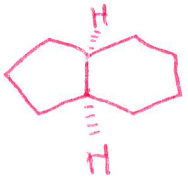
enantiomers both chiral equal amounts

☑  1. OsO_4 2. $NaHSO_3$ →  A + B

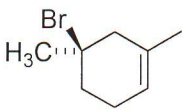
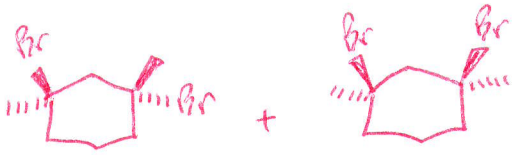
diastereomers both chiral unequal amounts

☑  Br_2 →  A + B

diastereomers both chiral unequal amounts

☐  H_2, Pd/C → 

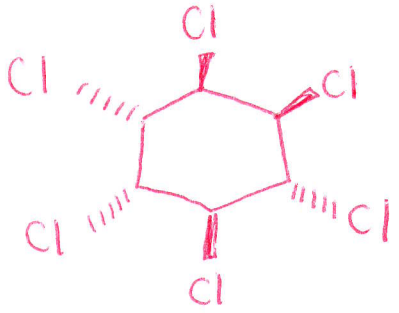
meso, not chiral

☐  HBr →  A + meso

A chiral

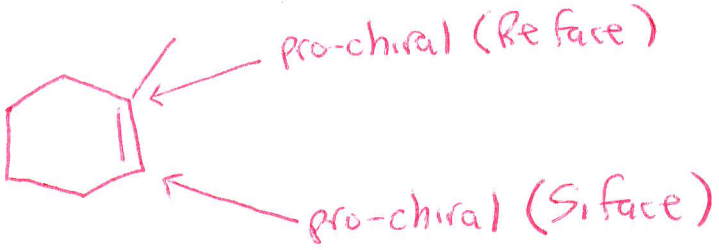
diastereomers unequal amounts

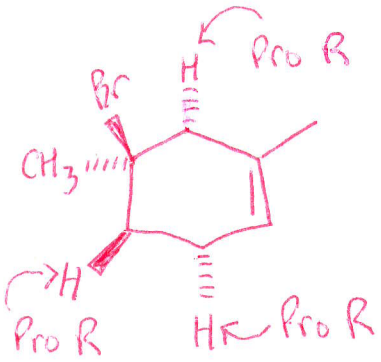
9. While considering the cyclohexane ring as a planar hexagon, draw an optically active version of 1,2,3,4,5,6-hexachlorocyclohexane.



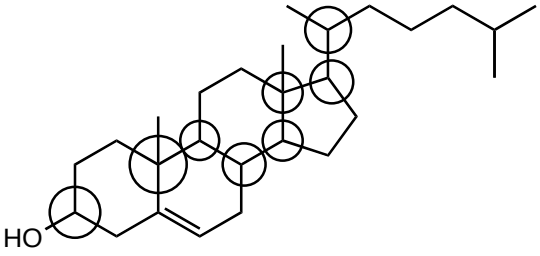
All others have a plane of symmetry

10. For the first compound in question 8, identify all pro-chiral sp^2 carbons. Are you looking at the Re face or Si face? For the last compound in question 8, identify all pro-R positions.

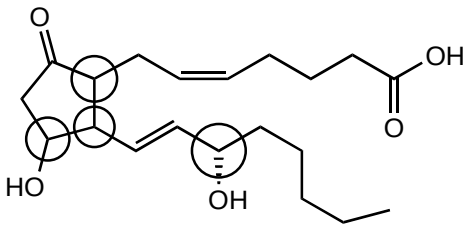




11. Circle the chiral centers in the following compounds.

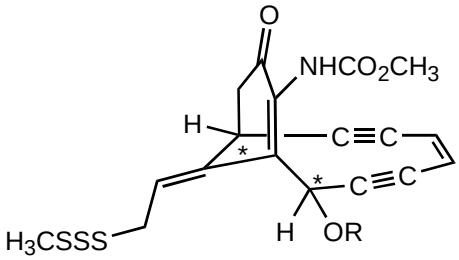


Cholesterol

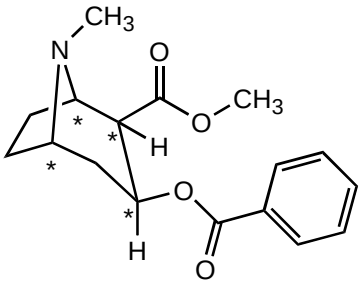


Prostaglandin E_2

12. Label with a "*" all the chiral centers in the following molecules.

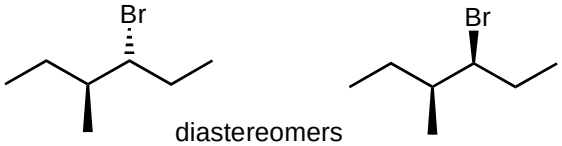


calecheamicin

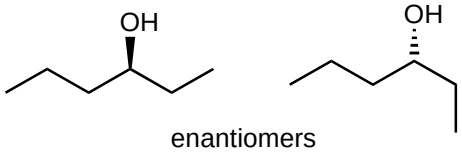


cocaine

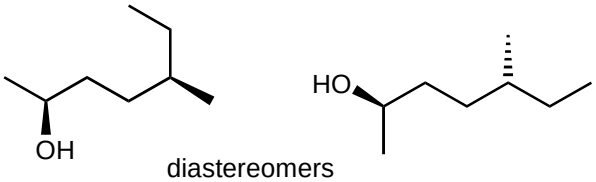
13. Identify the following pairs of compounds as enantiomers, diastereomers, or the same.



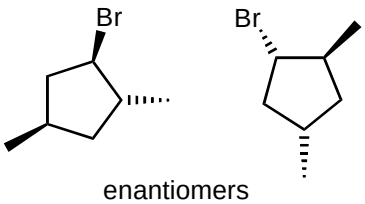
diastereomers



enantiomers



diastereomers

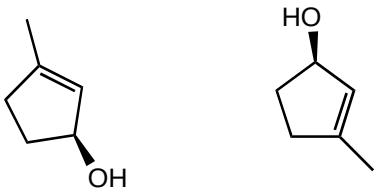


enantiomers

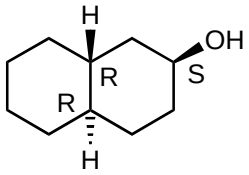
14. Identify the following pairs of compounds as enantiomers, diastereomers, constitutional isomers, or the same.

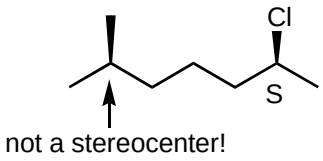
a. diastereomers

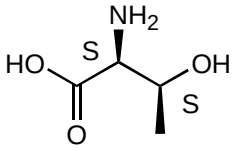
b. enantiomers



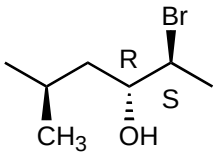
15. Identify the stereocenters in the following molecules and indicate whether they are R or S.



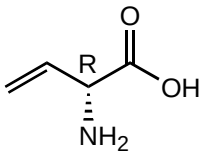




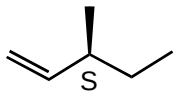
16. Using the tests for chirality we have learned, determine whether the following molecules are chiral. Determine the configuration (R or S) of any chiral centers in the molecules.



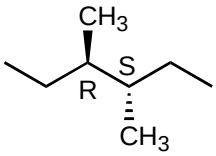
chiral



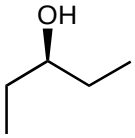
chiral



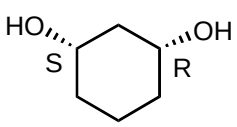
chiral



achiral
meso

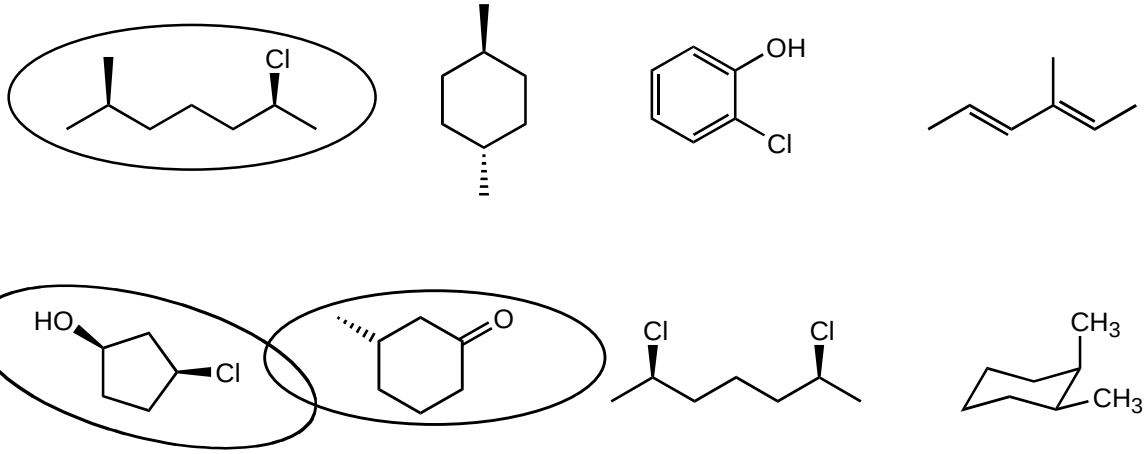


achiral
no stereocenter

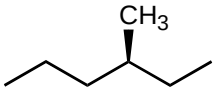


achiral
meso

17. Circle those molecules below that are chiral.



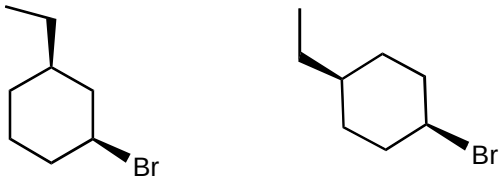
18. Name the compound below. Be sure to include R,S designations.



S-3-methylhexane

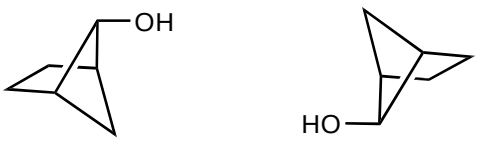
19. Determine the relationship between the following pairs of molecules: enantiomers, diastereomers, identical, or structural (constitutional) isomers.

a. structural isomers

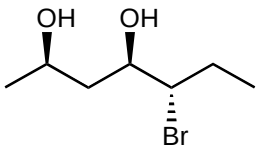


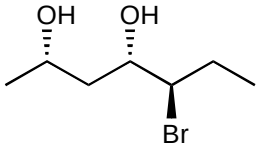
b. diastereomers

c. identical -- no chiral center

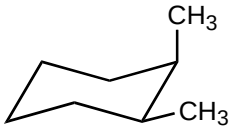


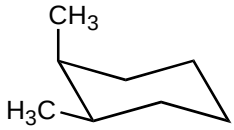
d. enantiomers





e. identical -- draw flat and see -- compound is meso





f. identical -- meso