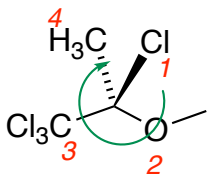
Problem Set Chapter 5

Organic Chemistry for Life Sciences: CHM 223 Section A

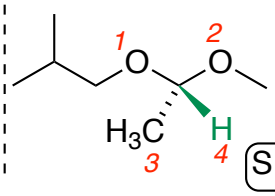
Name_____

DUE: Friday October 6th @ 8 am

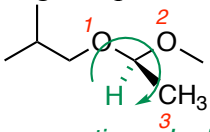
1. Assign the R or S configuration to the stereogenic carbon in each of the following compounds:



R configuration

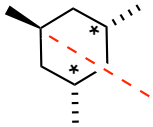


S configuration



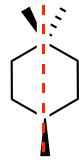
enantiomer! = R

2. Label **all** stereogenic carbons in the molecules below with a *, **AND** determine which compounds are chiral.



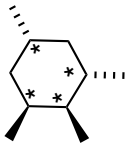
A
- 2 stereogenic centers
- plane of symmetry

achiral



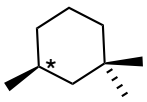
B
- no stereogenic centers
- plane of symmetry

achiral



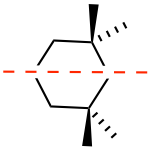
C
- 4 stereogenic centers
- no plane of symmetry

chiral



D
- 1 stereogenic center
- no plane of symmetry

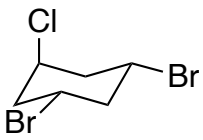
chiral

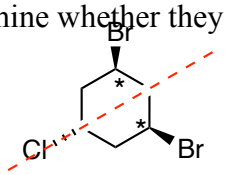


E
- no stereogenic centers
- plane of symmetry

achiral

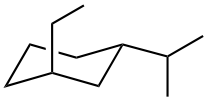
3. When a cyclohexane is drawn in a chair conformation, it might at first appear to be chiral since there is no obvious plane of symmetry. When redrawn in the planar form (as in question 2, above), however, it is much easier to determine whether a plane of symmetry exists. For the two cyclohexanes below, redraw them in their planar form and determine whether they are chiral or not:



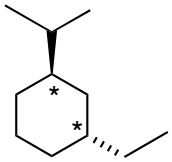


- 2 stereogenic centers
- a plane of symmetry

achiral



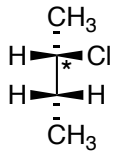
chiral



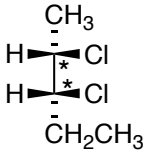
- 2 stereogenic centers
- no plane of symmetry

4. Which of the following compounds are meso (may be more than one)?

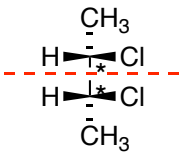
to be meso:
1. must have 2 or more stereogenic centers
2. must retain a plane of symmetry



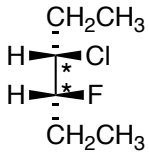
A
- only 1 stereogenic center
- no plane of symmetry



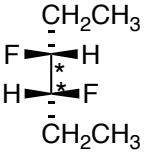
B
- 2 stereogenic centers
- no plane of symmetry



C
- 2 stereogenic centers
- **plane of symmetry**

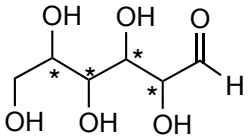


D
- 2 stereogenic centers
- no plane of symmetry



E
- 2 stereogenic centers
- no plane of symmetry

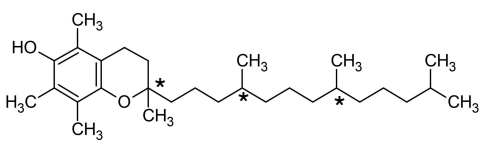
5. Label the stereogenic centers with a * and calculate the total POSSIBLE number of stereoisomers that could be drawn for the molecules below:



glucose

- 4 stereogenic centers

2^4= 16 possible stereoisomers

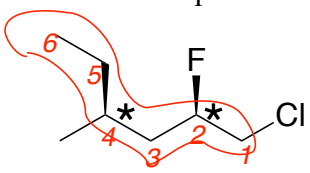


vitamin E

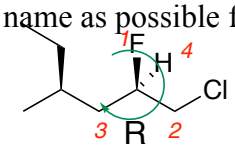
- 3 stereogenic centers

2^3= 8 possible stereoisomers

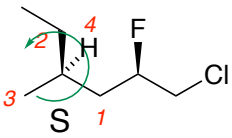
6. Provide as complete an IUPAC name as possible for the following compound (include R/S as necessary).



basic name: 1-chloro-2-fluoro-4-methylhexane



determine the stereochemical configuration at carbon 2

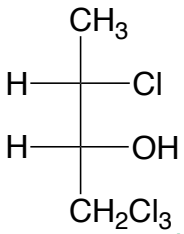


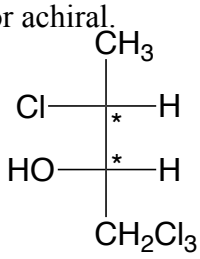
determine the stereochemical configuration at carbon 4

complete IUPAC name:

(2R,4S)-1-chloro-2-fluoro-4-methylhexane

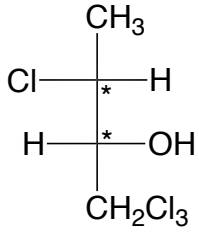
7. Draw the Fisher projection of the **enantiomer** and **a diastereomer** for the compound below (label each). Label each as chiral or achiral.



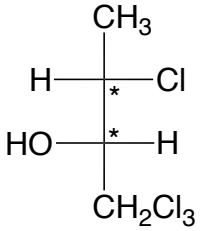


enantiomer

NOTE: both stereogenic centers are inverted so they are mirror image stereoisomers



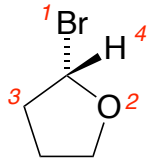
OR



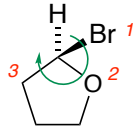
diastereomers

NOTE: not all stereogenic centers are inverted (only one of the two possible), so these are non-mirror image stereoisomers

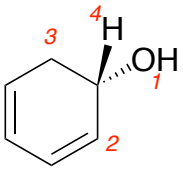
8. Assign the R or S configuration for the compounds below.



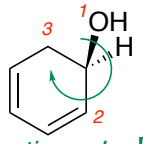
S configuration



enantiomer! = R



S configuration



enantiomer! = R

9. (S)-2-bromodecane has the following properties: boiling point, 124 °C; density, 1.051 g/ml. Which of the following statements MUST be true given this information (may be more than one)?

A. (R)-2-bromodecane rotates a plane of polarized light in the levorotatory direction. not enough information is provided to determine

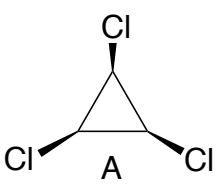
B. (R)-2-bromodecane has a density of 1.051 g/ml enantiomers have identical physical properties

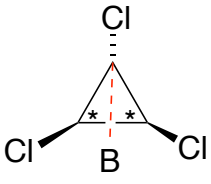
C. (R)-2-bromodecane cannot be a meso compound only a single stereogenic carbon is present, a meso compound requires 2 or more

D. A 50/50 mixture of (S)- and (R)-2-bromodecane is optically inactive racemic mixtures are optically inactive (they do not rotate a plane of polarized light in a polarimeter)

10. Jimmy insists there are 8 different stereoisomers that can be drawn for 1,2,3-trichlorocyclopropane and that 4 are chiral. Draw all of the different stereoisomers below (*be careful to not duplicate!*) and indicate which ones are chiral. Based on your finding, do you agree or disagree with Jimmy?

Jimmy





Sorry Jimmy! there are only **2 different stereoisomers** possible (all others are duplicates). Plus, neither one is chiral. Stereoisomer A has no stereogenic carbons, and, while B has 2 stereogenic carbons, there is a plane of symmetry present (i.e. a meso compound)