



Pre-Health Post-Baccalaureate Program  
CHM2210 Study Guide & Practice Problems

Topics Covered:

Nomenclature of Cycloalkanes  
Conformations of Alkanes and Cycloalkanes  
Cis/Trans Isomerism  
Stereoisomerism and Chirality

Created by Isaac Loy

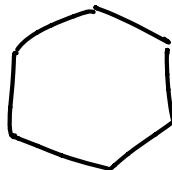
# Nomenclature of Cycloalkanes

- Cycloalkanes are cyclic, saturated hydrocarbons
- IUPAC naming is exactly the same, just add "cyclo-" before the prefix
- Common cycloalkanes

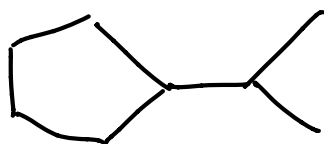
→ Cyclopropane 

→ cyclobutane 

→ cyclopentane 

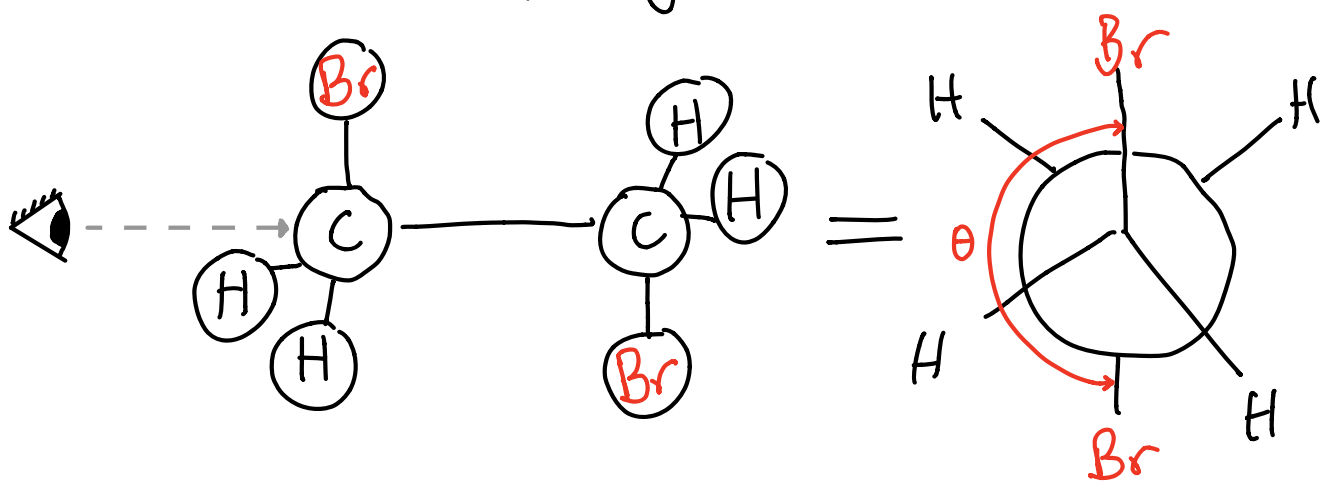
→ cyclohexane 

① Name the following molecule:



# Conformations of Alkanes and Cycloalkanes

- To analyze strain, we need to examine the conformation, or 3-D arrangement, of molecules
- Newman projections



→  $\theta$  is the dihedral angle

"staggered"

→ Anti-conformation:  
 $\theta = 180^\circ$

→ Gauche conformation:  
 $\theta = 60^\circ$

→ Eclipsed conformation:

$$\theta = 0^\circ$$

→ Strain is the energy due to structural instability of a molecule

→ Torsional strain:

caused by going from staggered → eclipsed

→ Angle strain:

caused by a bond angle that is greater than or less than its optimal angle

→ Steric strain:

caused by close proximity of atoms

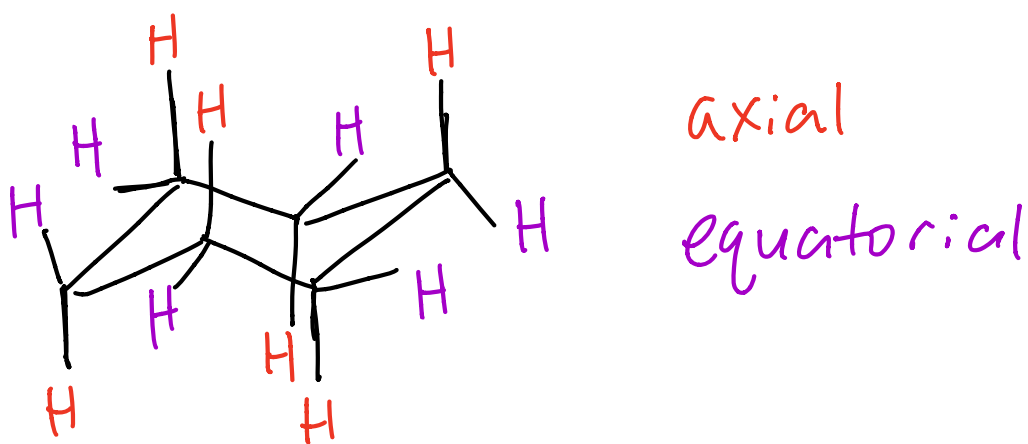
→ Ring strain:

caused by non-optimal angles in cyclic structures

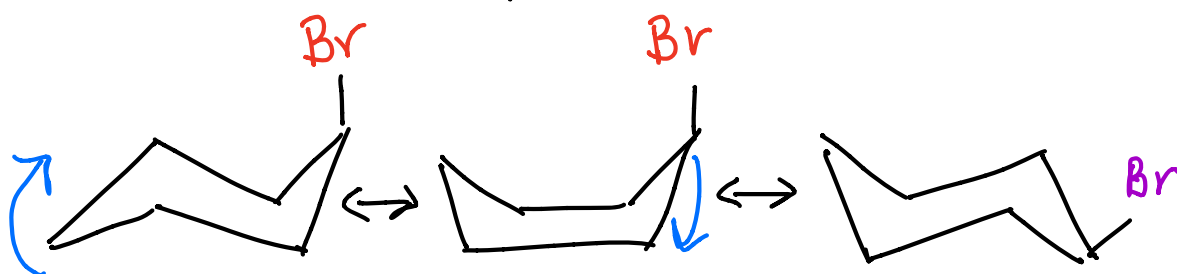
→ Minimizing strain (lowering energy) leads to stability!

→ Chair conformations

→ Most stable conformation of cyclohexane (all C-C bonds are  $110.9^\circ$  - reduces strain)



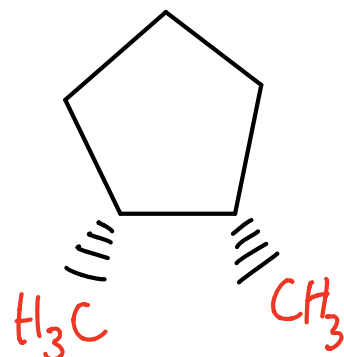
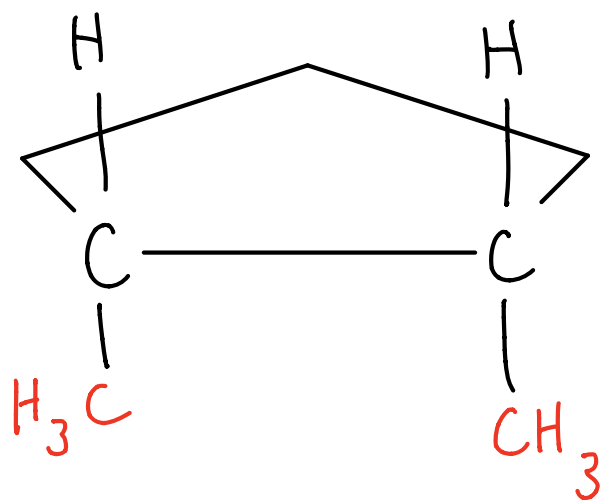
→ Chair flip



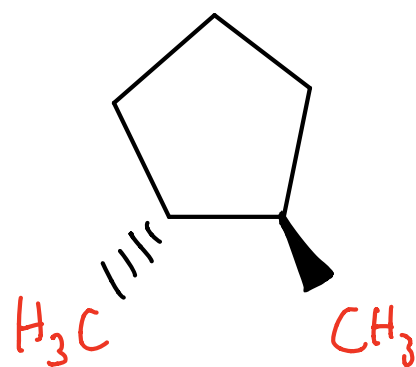
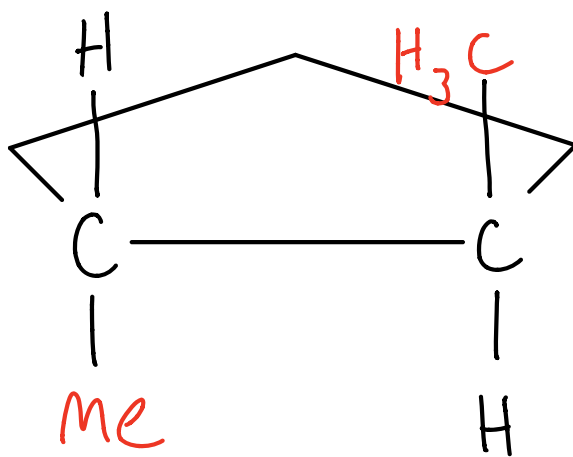
Sometimes necessary to reduce strain

# Cis/Trans Isomerism

→ cis-1,2-Dimethylcyclopentane



→ trans-1,2-Dimethylcyclopentane

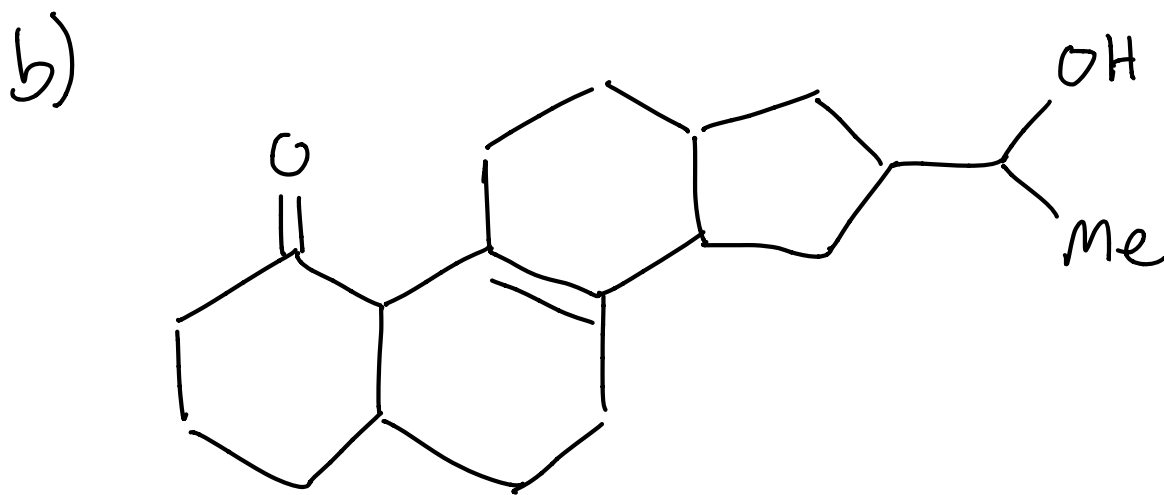
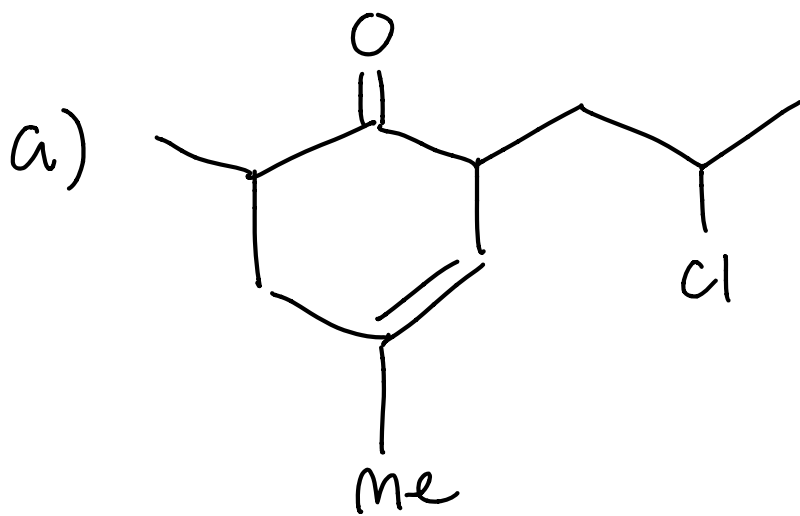


# Stereoisomerism and Chirality

- Stereochemistry is the 3-D arrangement of atoms within a molecule
- Something is chiral if it is not superposable on its mirror image
- Enantiomers are pairs of molecules that are non-superposable mirror images of one another
- Diastereomers are stereoisomers that are not mirror images
- Chiral center is a tetrahedral atom bonded to four different groups

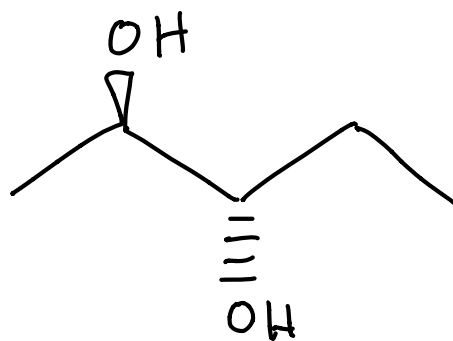
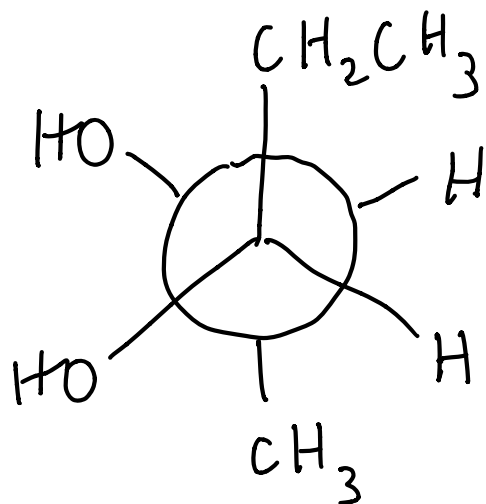
② Review: What are the four "Rules" of Organic Chemistry?

③ Locate all chiral centers.





④ Are the following molecules constitutional isomers, diastereomers, enantiomers, identical, or different molecules?



# Solutions

① Isopropyl cyclopentane

or

(1-methylethyl)cyclopentane

② 1) Neutrality rules the day

Exceptions: strong acids  
in water

2) Proton transfer is #1

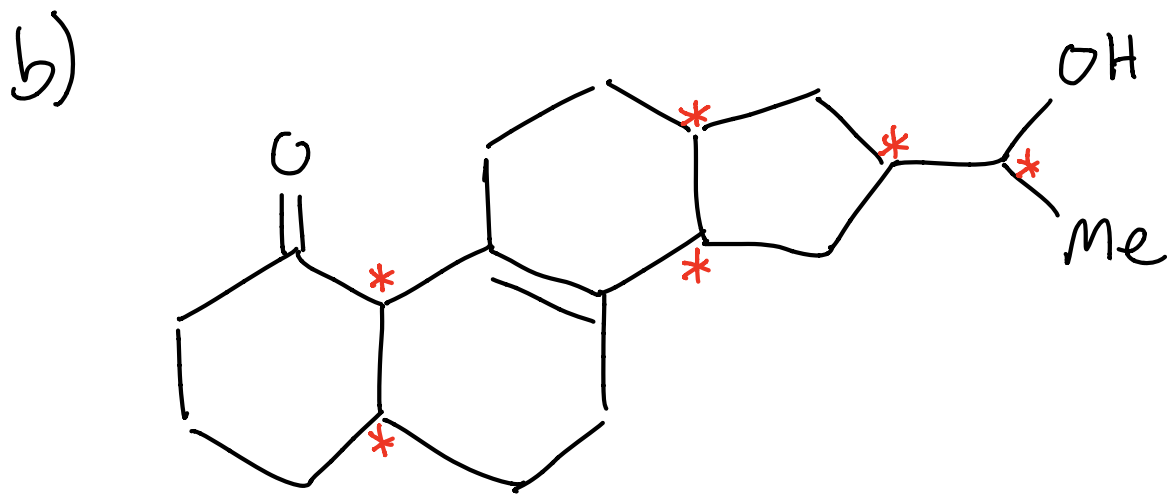
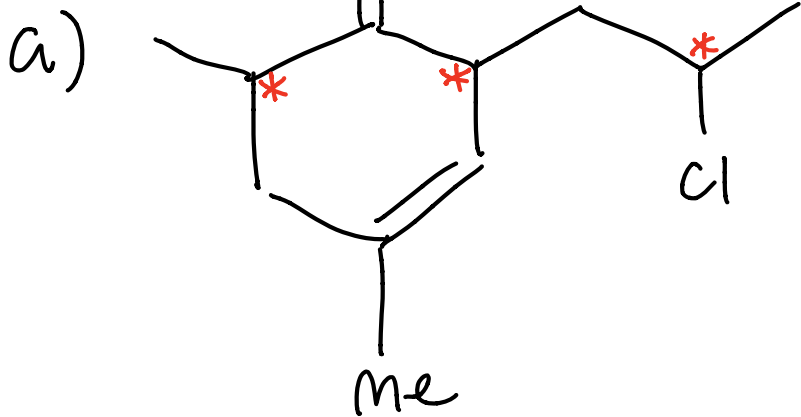
3) LP atoms bonded to atoms  
with pi bonds are  $sp^2$   
hybridized

Exception: halogens

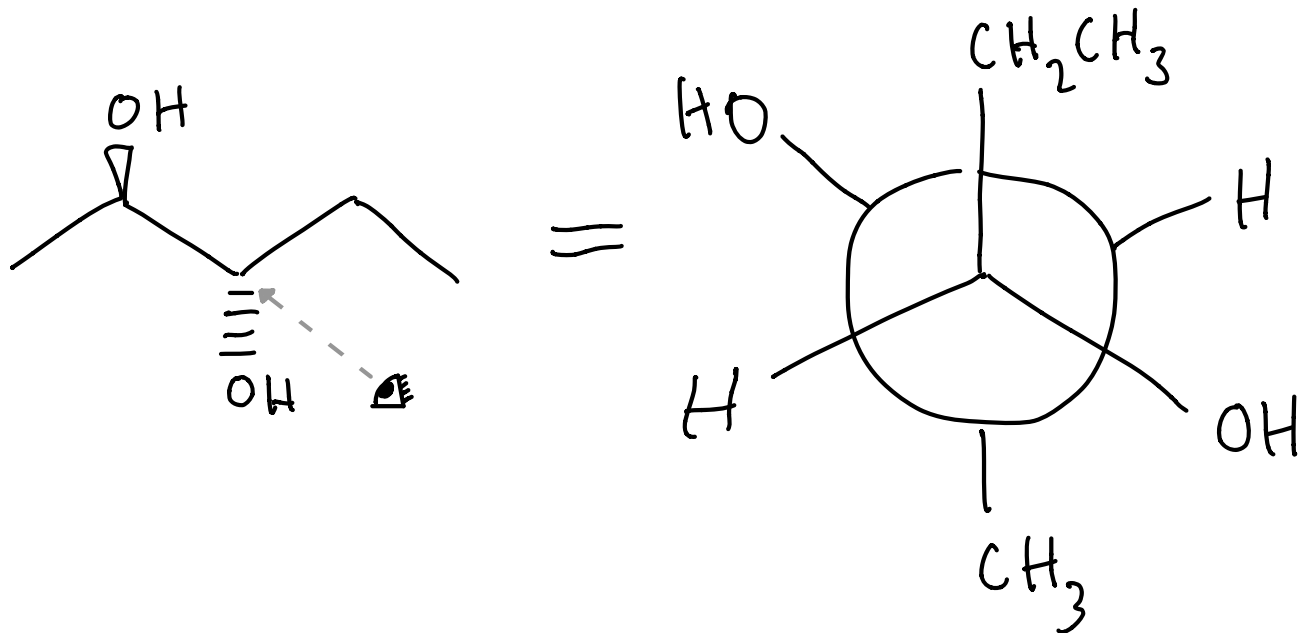
4) pi bonds prefer to become  
sigma bonds

Exceptions: benzene,  
carboxylic acids, and  
carboxylic acid derivatives

3



4



Diastereomers, because these two molecules are non-superposable stereoisomers