

Chapter 5: Stereochemistry – Part 2 Diastereomers

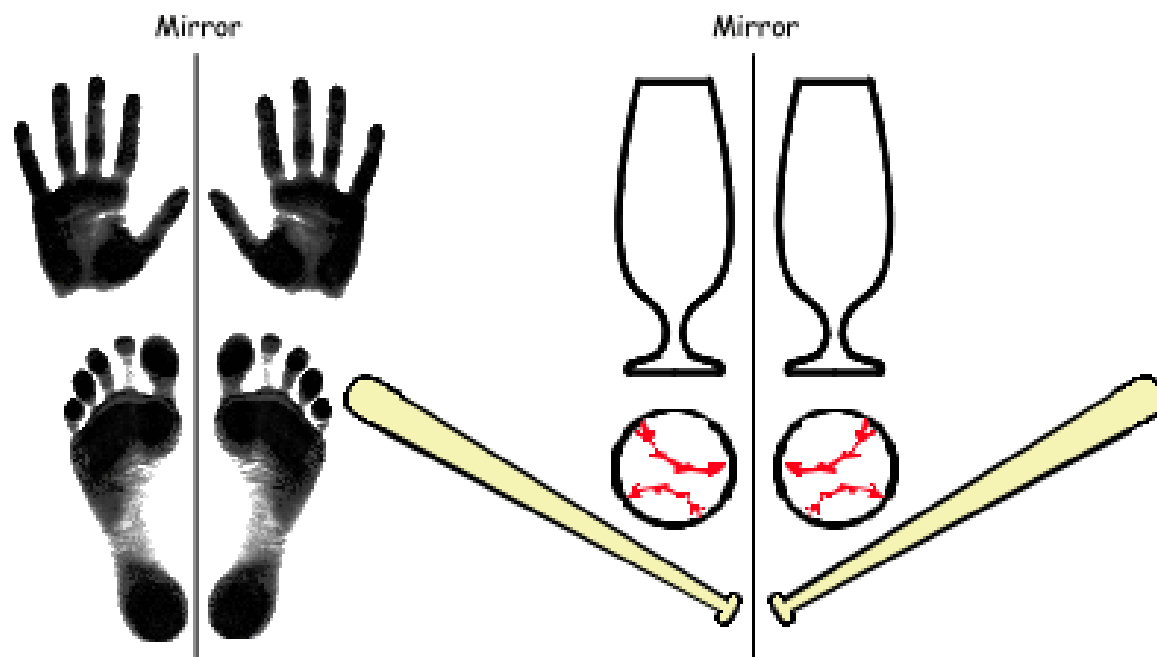
Today –Chapter 5 (5.3, 5.5, 5.6, 5.8)
Diastereomers

Monday Chapter 5 (5.4, 5.9-5.11)
Resolving Enantiomers

Wednesday Chapter 6

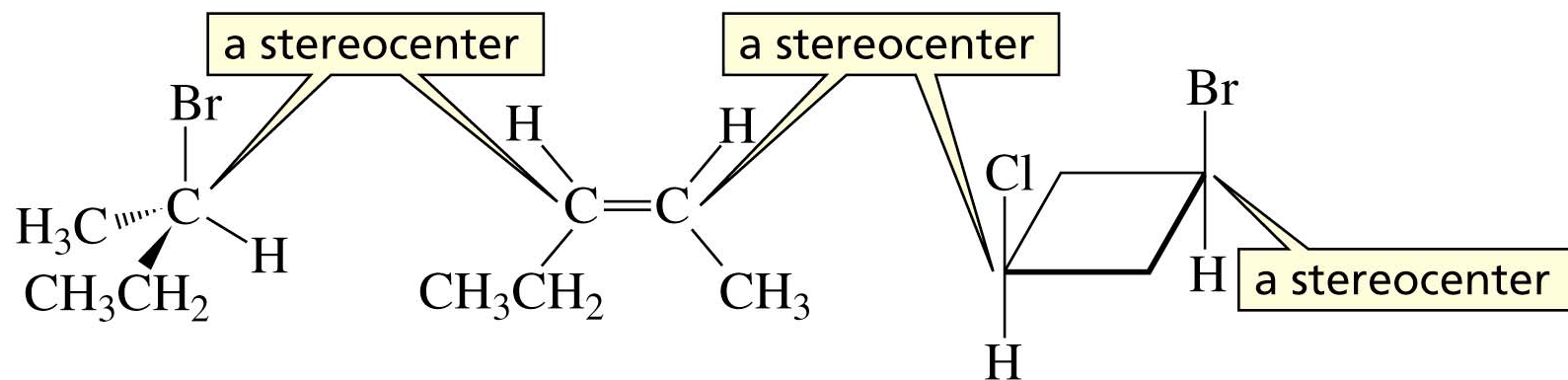
CHIRALITY

An object that cannot be superimposed on its mirror image is called chiral



Chiral objects
Nonsuperimposable
mirror images

Nonchiral objects
Superimposable
mirror images



Designating Configurations

Designating Configurations

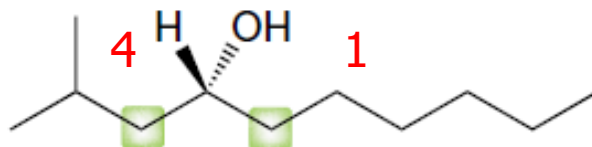
◆ Cahn-Ingold-Prelog rules:

1. Using atomic numbers, prioritize the four groups attached to the chiral center
2. Arrange the molecule in space so the lowest priority group faces away from you
3. Count the group priorities 1...2...3 to determine whether the order progresses in a clockwise or counterclockwise direction

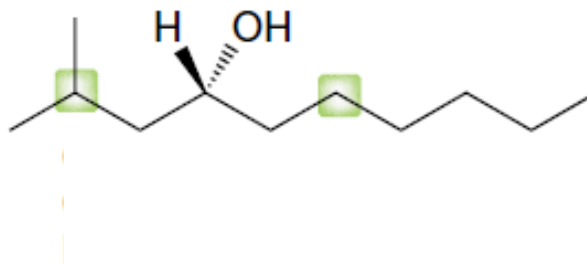
Designating Configurations

- Is this molecule *R* or *S*?

First layer:

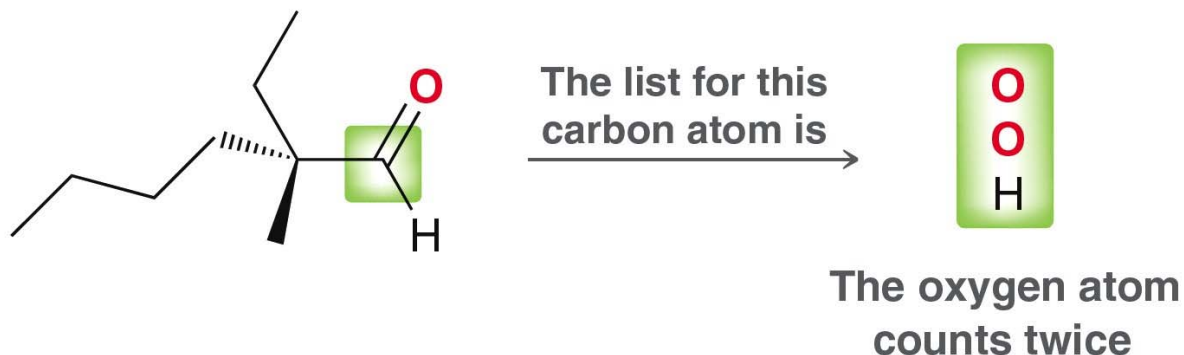


Second layer:

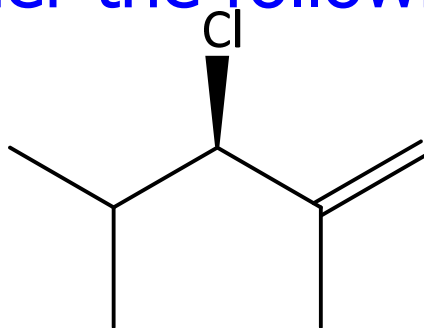


Designating Configurations

- When prioritizing for the Cahn-Ingold-Prelog rules, double bonds count as two single bonds.

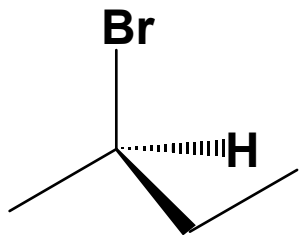


- Determine whether the following molecule is *R* or *S*.



Stereoisomeric Relationships

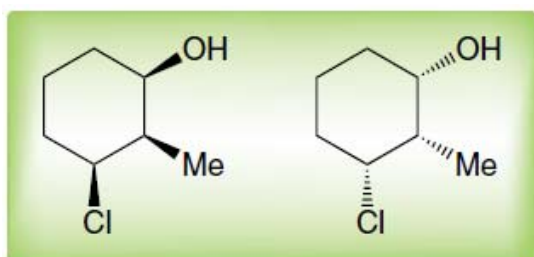
Draw (R) – 2- bromo – butane



Let's look at 2,3 – dibromopentane

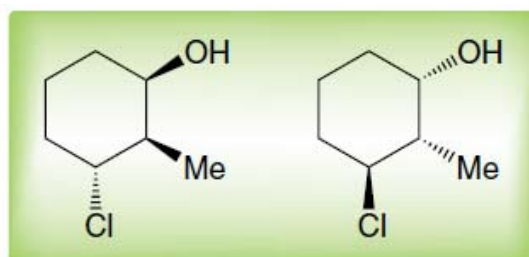
Stereoisomeric Relationships

- ◆ Consider a cyclohexane with three substituents:



1R, 2R, 3S

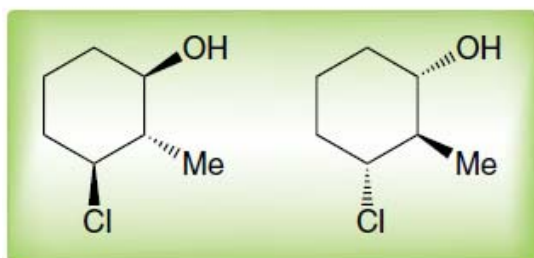
1S, 2S, 3R



1R, 2R, 3R

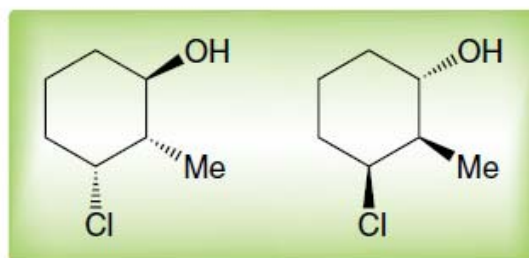
1S, 2S, 3S

- What patterns do you notice?



1R, 2S, 3S

1S, 2R, 3R



1R, 2S, 3R

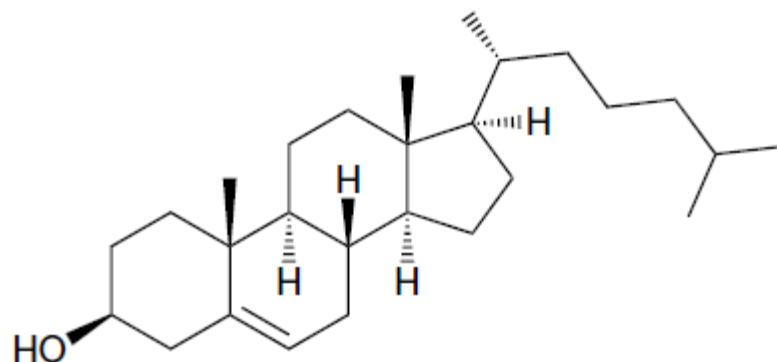
1S, 2R, 3S

Stereoisomeric Relationships

- ◆ The number of possible stereoisomers for a compound depends on the number of chiral centers (n) in the compound.

$$\text{Maximum number of stereoisomers} = 2^n$$

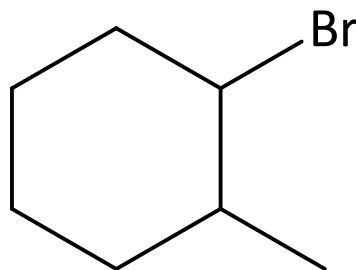
- ◆ What is the maximum number of possible cholesterol isomers?



Cholesterol

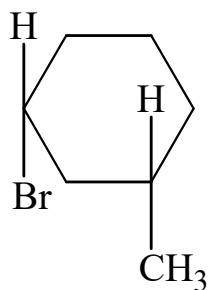
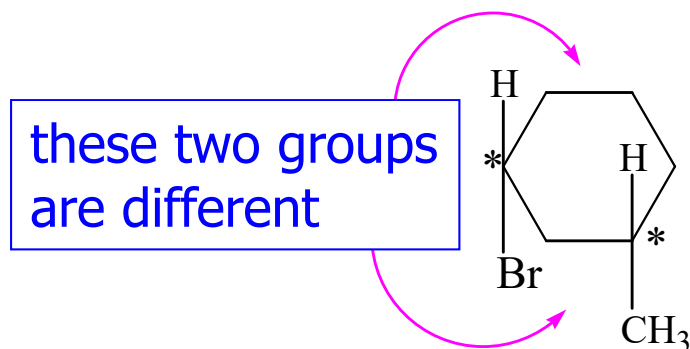
Stereoisomeric Relationships

- ◆ Draw each of the four possible stereoisomers for the following compound. It might be helpful to also make a handheld model for each isomer.

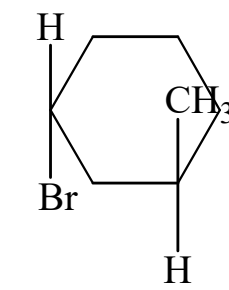
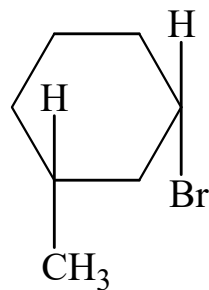


- ◆ Pair up the isomers in every possible combination and label the pairs as either enantiomers or diastereomers.

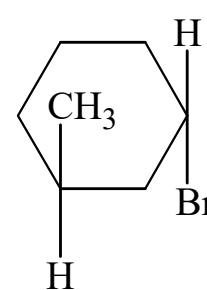
Identification of Asymmetric Carbons in Cyclic Compounds



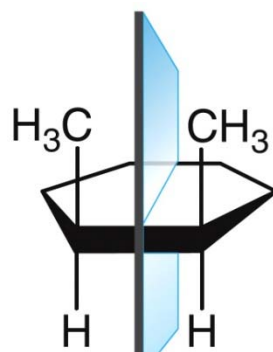
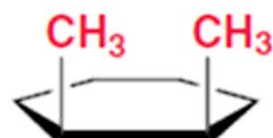
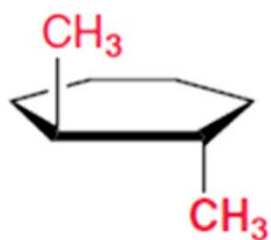
cis-1-bromo-3-methylcyclohexane



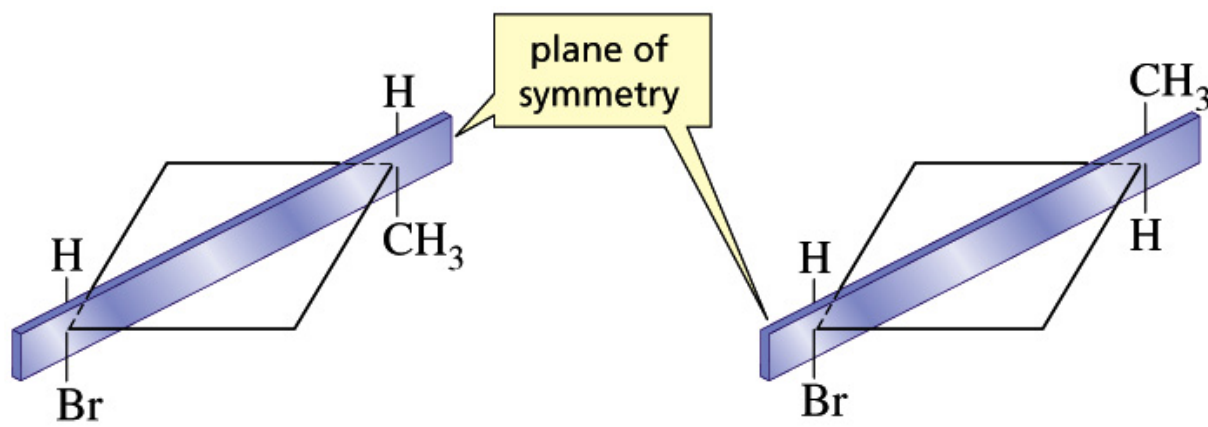
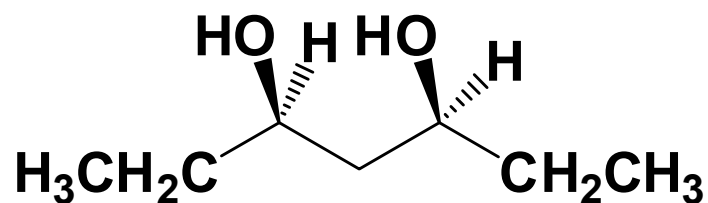
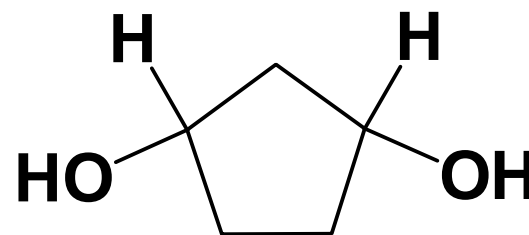
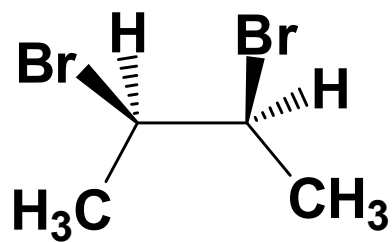
trans-1-bromo-3-methylcyclohexane



Symmetry and Chirality

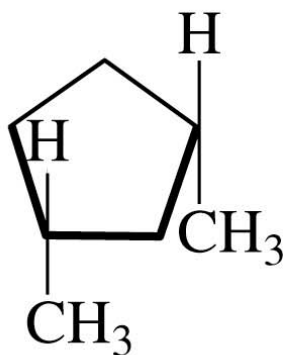


Meso Compounds

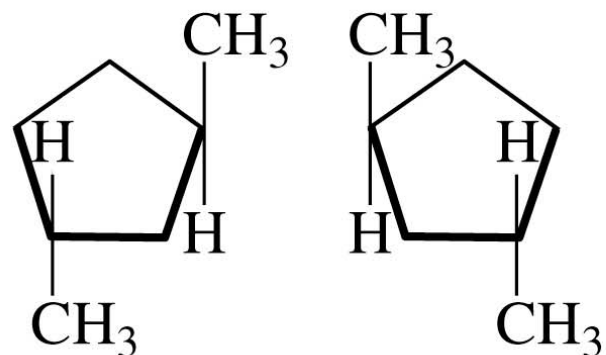


cis-1-bromo-3-methylcyclobutane

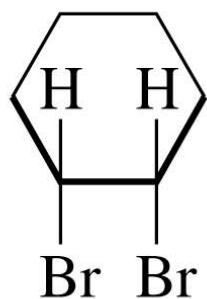
trans-1-bromo-3-methylcyclobutane



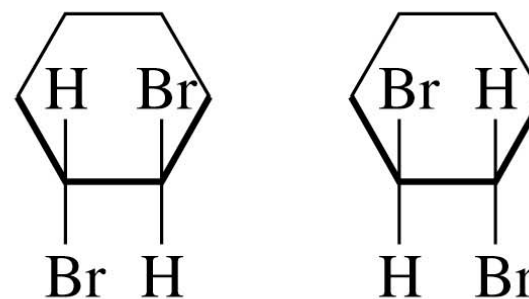
cis-1,3-dimethylcyclopentane
a meso compound



trans-1,3-dimethylcyclopentane
a pair of enantiomers



cis-1,2-dibromocyclohexane
a meso compound



trans-1,2-dibromocyclohexane
a pair of enantiomers

For Next Time....

Monday Chapter 5 (5.4, 5.9 – 5.11)

Resolving Enantiomers

Suggested Homework Problems Chapter 5

#4, 9, 19, 23, 31, 36, 38 (a-c), 39 (a-e), 45, 55