

Chapter 5: Stereochemistry

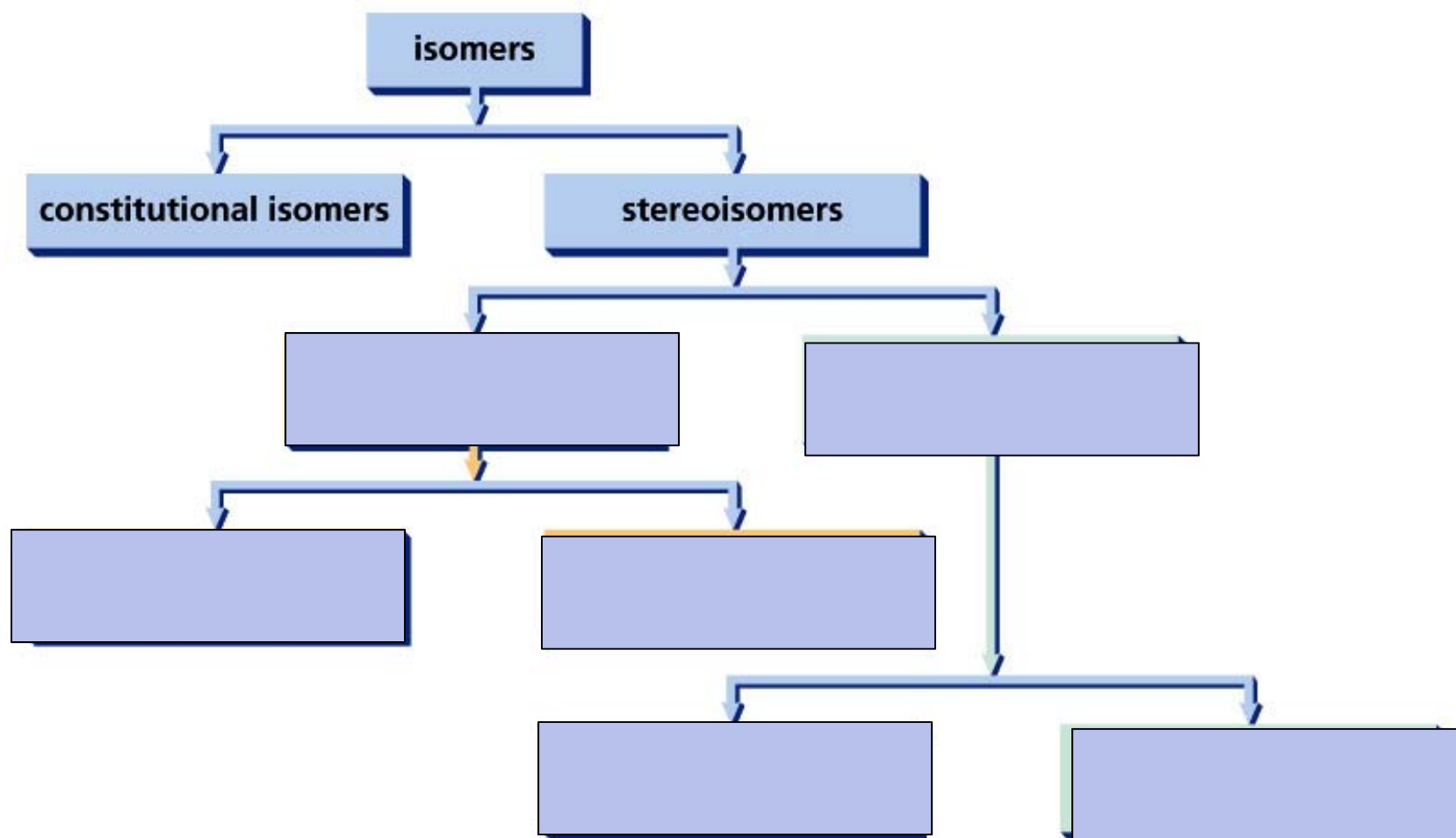
Today – Chapter 5 (5.1-5.3)
Stereochemistry

Monday Chapter 5 (5.3, 5.5, 5.6, 5.8)
Diastereomers

Wednesday Chapter 5 (5.4, 5.9)
Resolving Enantiomers

Isomers

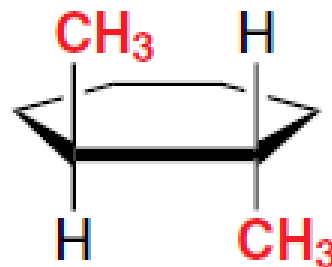
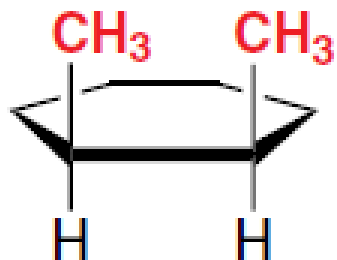
Nonidentical compounds having the same molecular formula



Stereoisomers:

Isomers

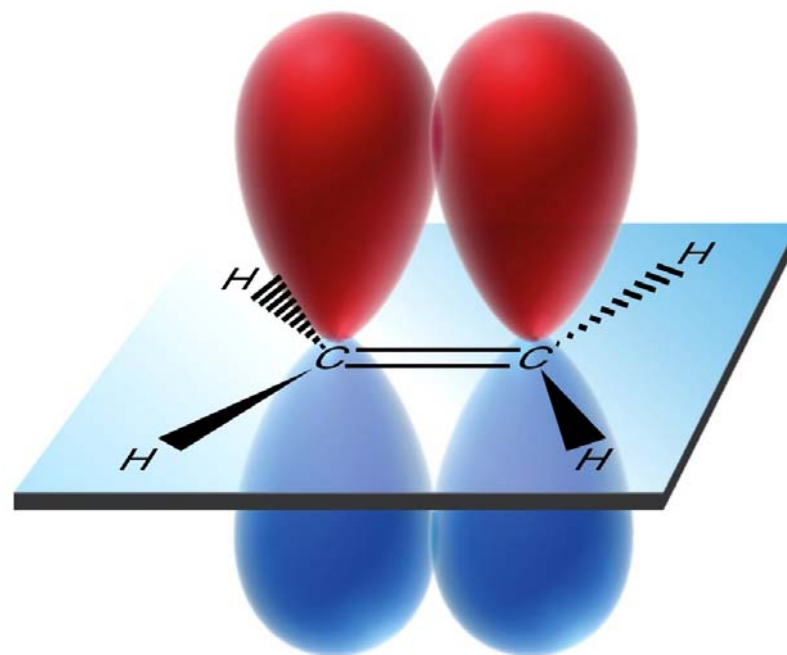
- ◆ C—C bonds that are constrained in a cyclic structure cannot freely rotate.
- ◆ Although the two molecules below have the same connectivity, they are NOT identical. WHY?



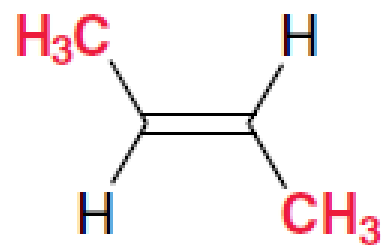
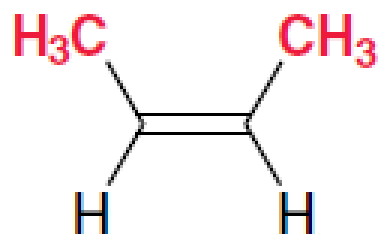
Isomers



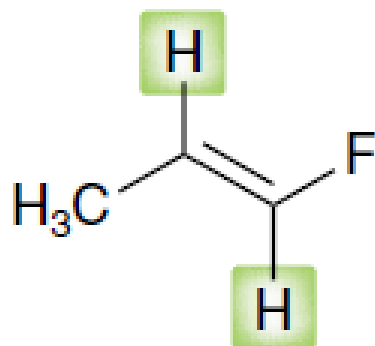
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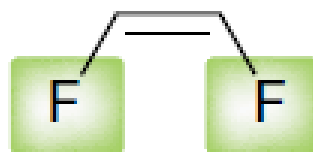
π Bond



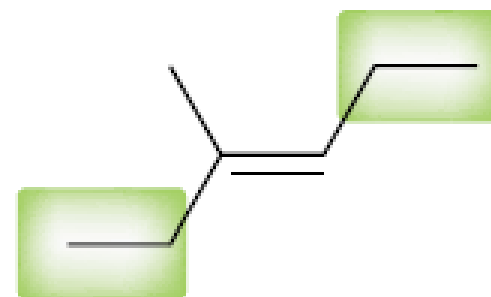
Isomers



trans because of the H's:

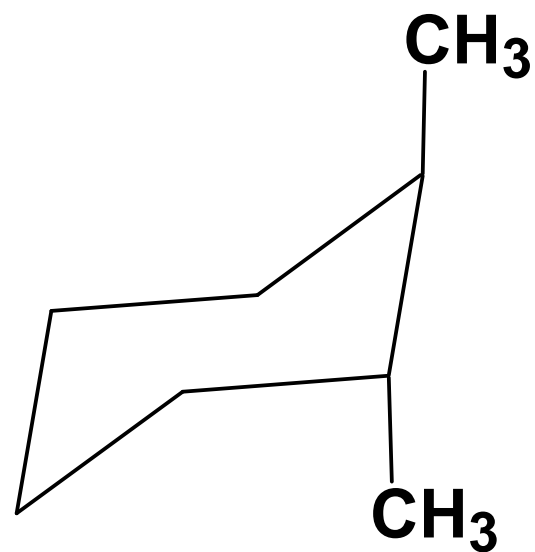
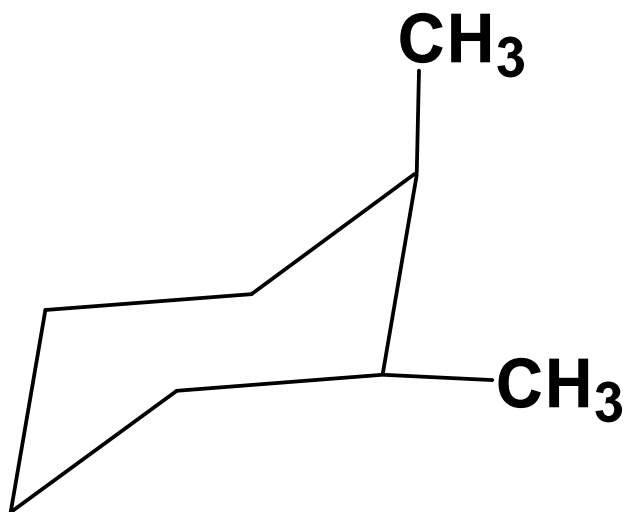
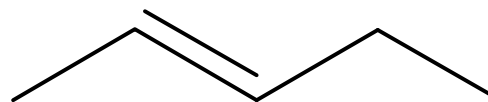
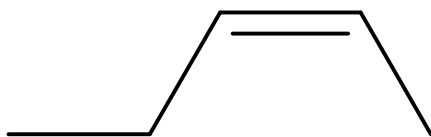


Two fluorine atoms
are *cis*

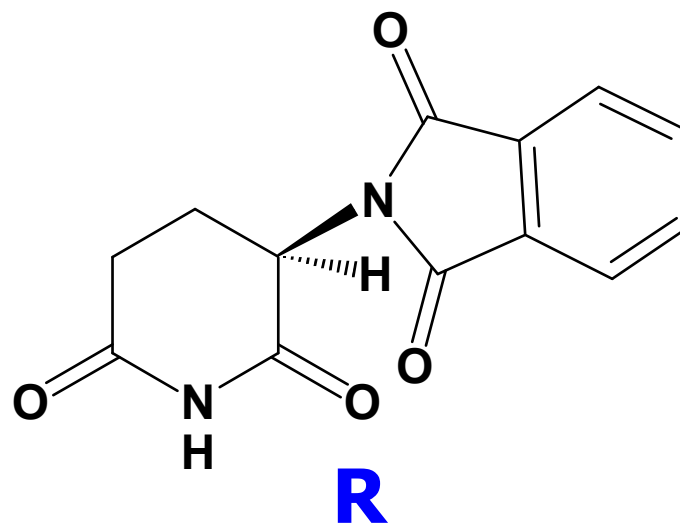
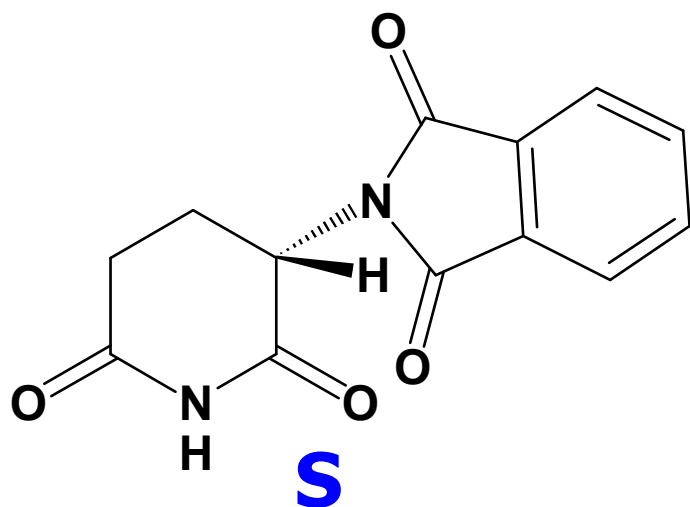


Two ethyl groups
are *trans*

Cis-Trans Isomers



Thalidomide: why chirality matters

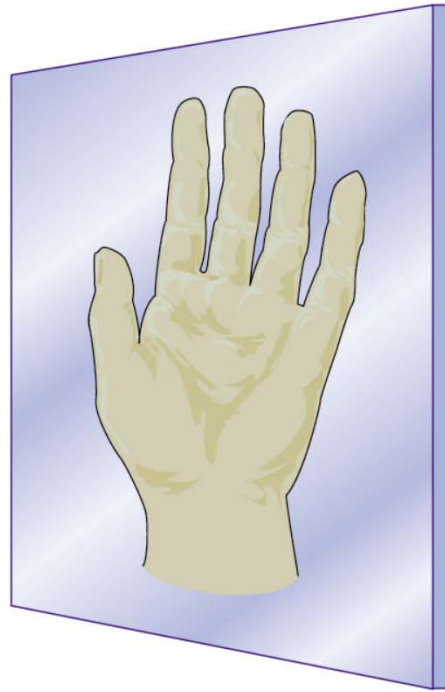


- Thalidomide - sedative resulted in severe birth defects only because the S and R isomers or enantiomers given as a mixture. Pure R form would probably have not created a problem.
- Thalidomide S enantiomer is now being used to treat MS.
- Must be avoided by women of child-bearing age!

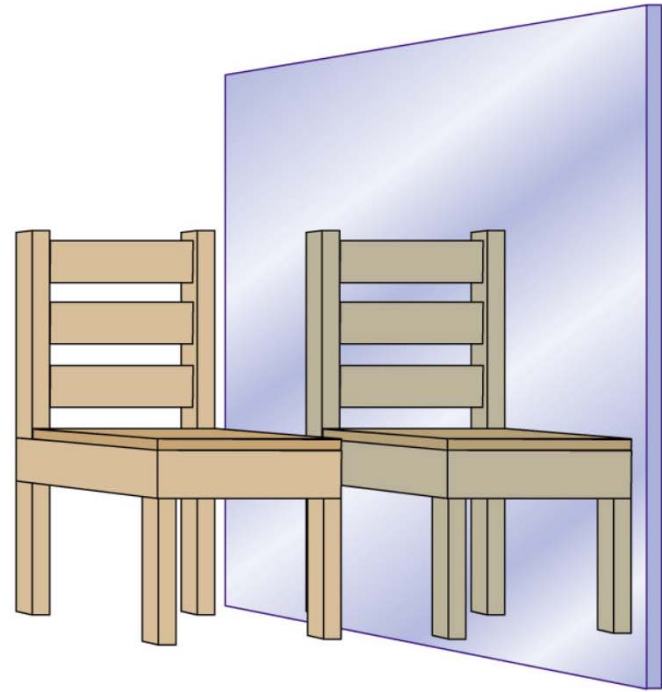
"Handedness"



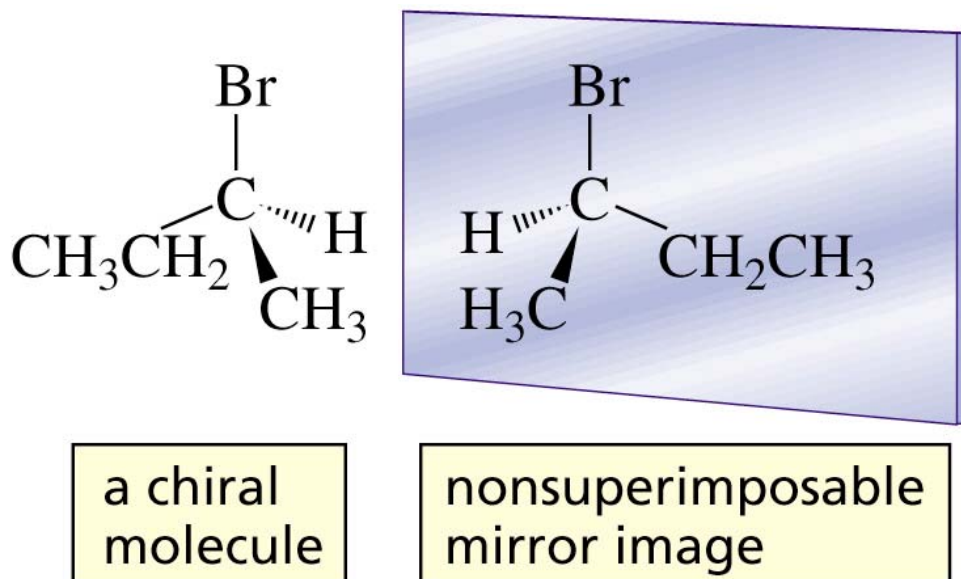
right hand



left hand

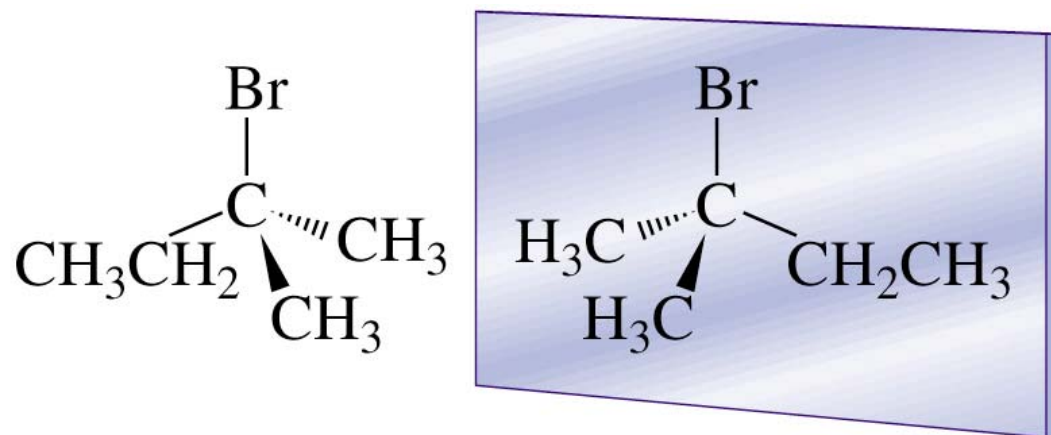


Chirality



2-bromobutane

Example of an Achiral Molecule

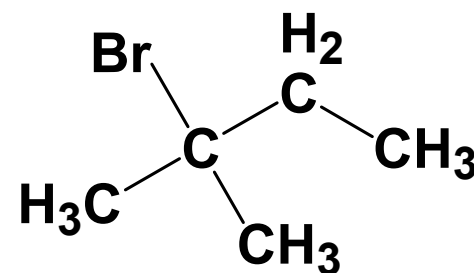


an achiral molecule

superimposable mirror image

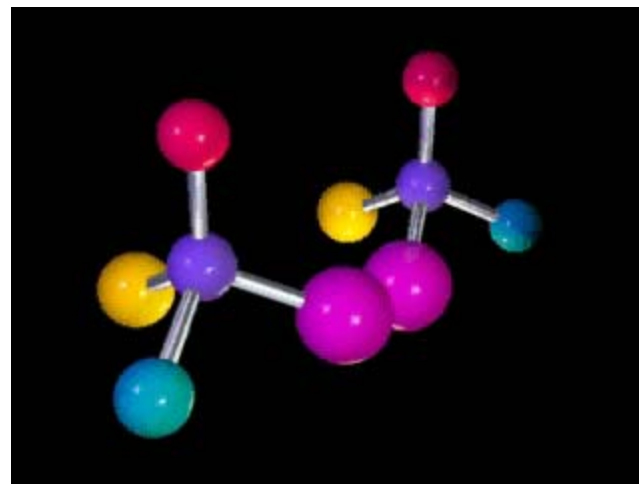
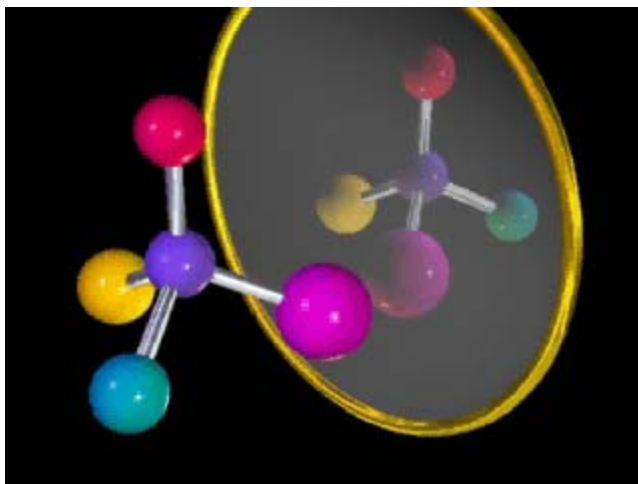
identical molecules

2-bromo-2-methylbutane

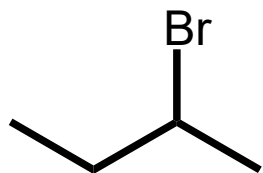


Enantiomers

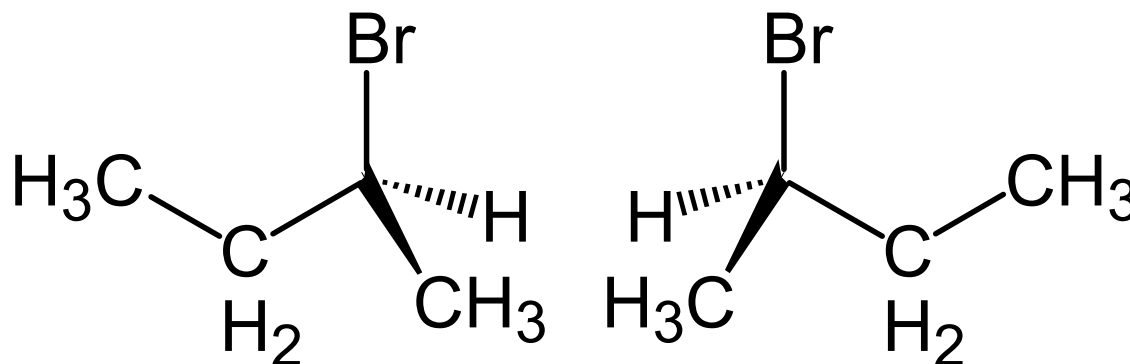
nonsuperimposable mirror-image molecules



Some Insights into Chirality



2-bromobutane

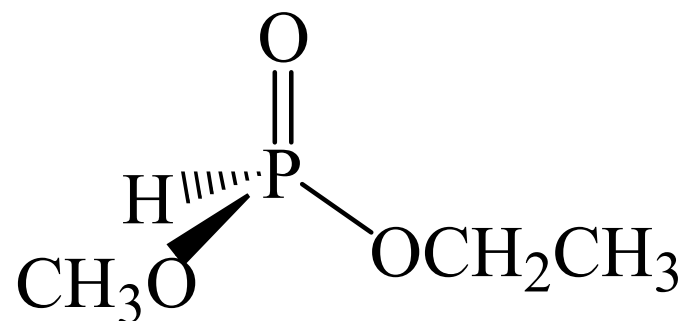
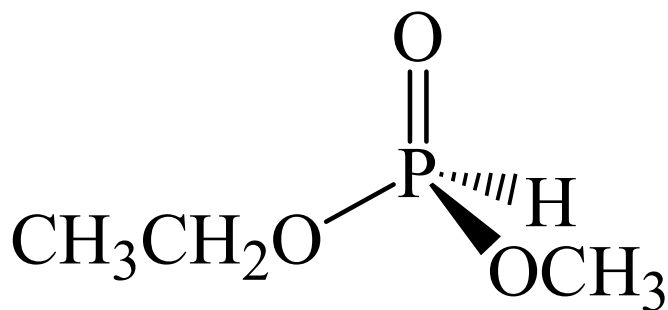
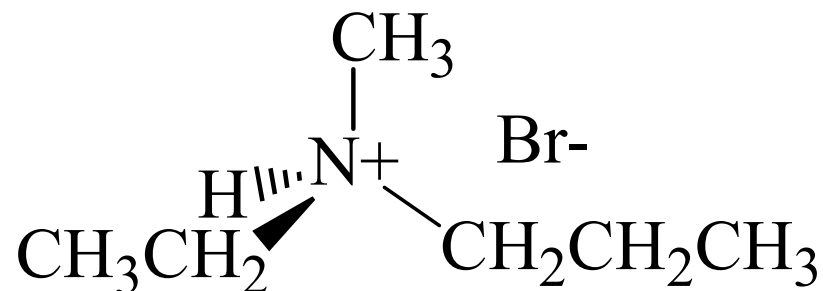
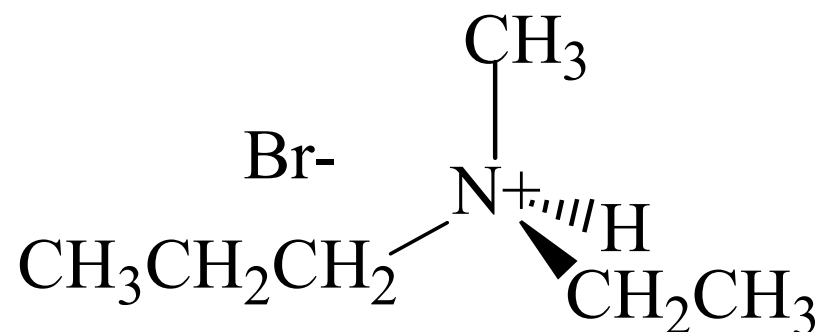


- 2-Bromobutane is chiral because
-

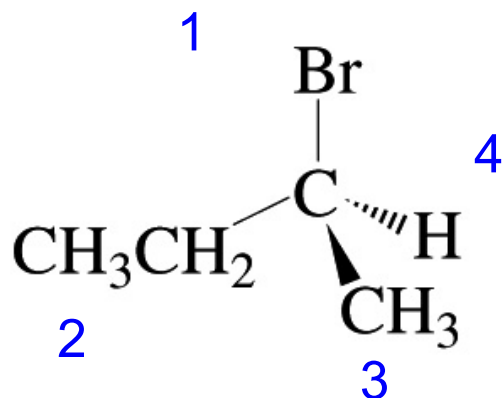
We will see later that if 2 stereogenic centers are present chirality

Some Simplifying Tricks for Chirality

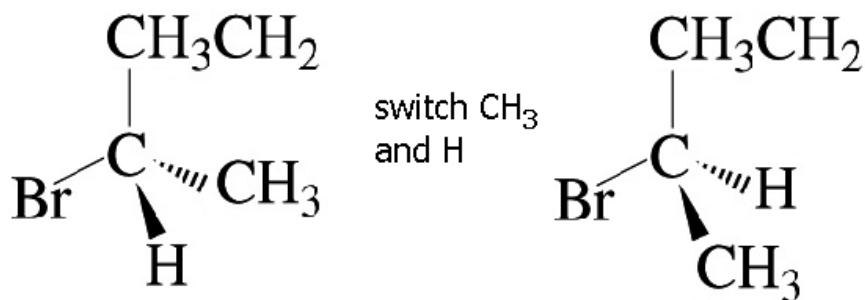
Atoms other than carbon can be asymmetric

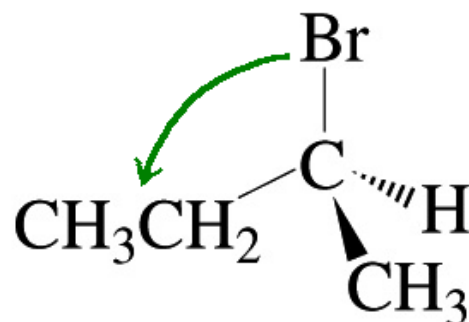


Naming Enantiomers ~ *R* and *S*

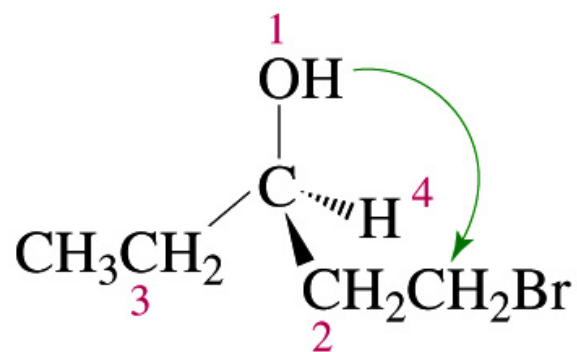


2.

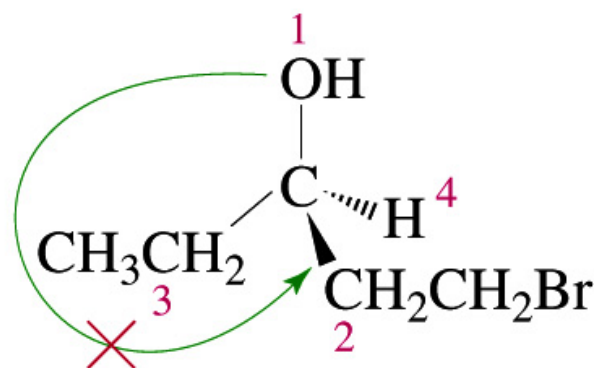




4.



(R)-1-bromo-3-pentanol



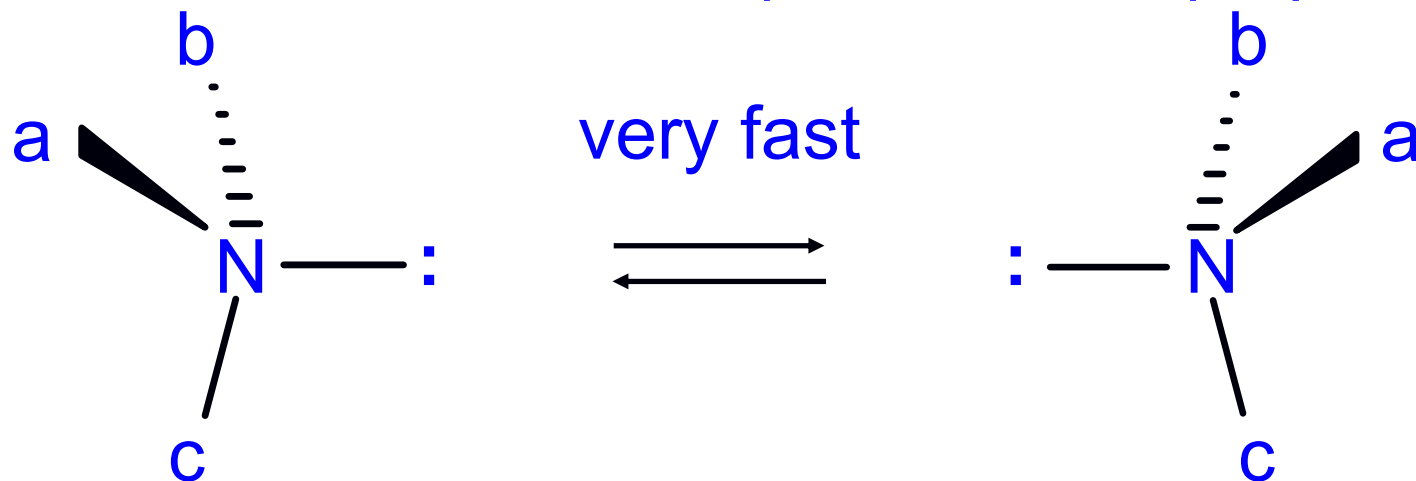
The *R,S* system of nomenclature

Clockwise =

Counterclockwise =

Non Carbon Chiral Centers

Nitrogen in amines - pyramidal geometry at nitrogen can produce a chiral structure, but enantiomers equilibrate too rapidly to be resolved



Silicon - silicon, like carbon, forms four bonds in its stable compounds and many chiral silicon compounds have been resolved



For Next Time....

Today – Chapter 5 (5.1-5.3)

Stereochemistry

Wednesday – EXAM #1

Friday - Chapter 5 (5.3, 5.5, 5.6, 5.8)

Diastereomers (We will not cover 5.7.)

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