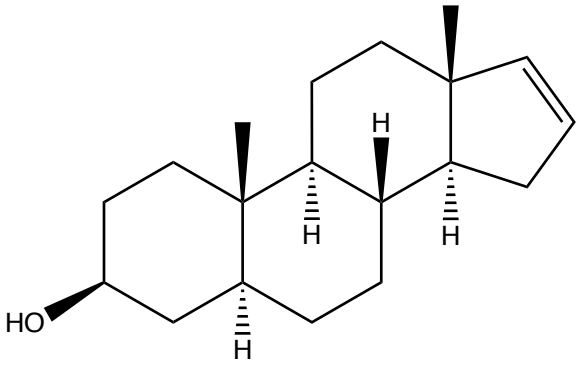
Pheromone: from Greek "pherein horman" meaning to carry excitement

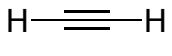


Only about 50 % of the population can smell this compound

Nomenclature of Alkynes

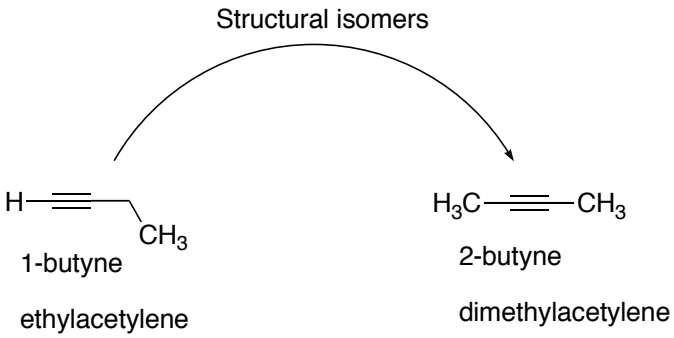
Rules:

- Find longest chain with max number of multiple bonds
- Number from end to give 1st multiply bonded position the lowest number
- Drop "ane" and add "yne"
- For multiple triple bonds, drop "ne" and add "diyne"," triyne", etc.



ethyne
acetylene

Structural isomers



1-butyne
ethylacetylene

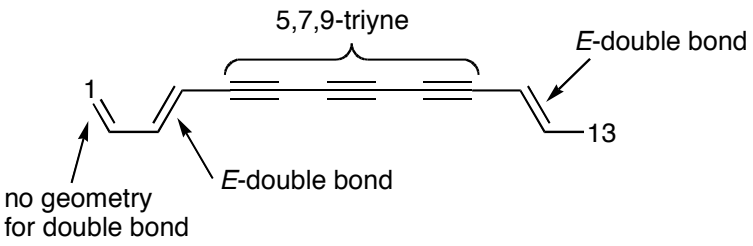
2-butyne
dimethylacetylene

Multiple alkynes end with:

2	C≡C	diyne
3	C≡C	triyne
4	C≡C	tetrayne

Mixed double and triple bond containing compounds are "eneynes"

The below example is a compound found in the canola plant. It is a defense substance against worms, or anti-nematode.



trideca-1,3*E*,11*E*-triene-5,7,9-triyne
OR (3*E*,11*E*)-trideca-1,3,11-triene-5,7,9-triyne

Stereochemistry and Chirality

Chiral object or molecule: has a non-superimposable mirror image
Achiral object: not chiral, has a superimposable mirror image

1848 - Louis Pasteur separated the "right-handed" and "left-handed" forms of tartaric acid crystals (from wine)

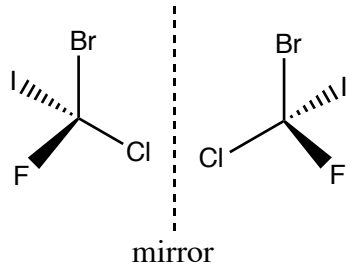
Resolution - Separation of right and left-handed forms (enantiomers)

1874 - J. van't Hoff and Le Bel proposed that differences are due to tetrahedral geometry of carbon
1877 - Kolbe did not receive van't Hoff's idea very well
1901 - J. van't Hoff was the first recipient of the Nobel Prize in Chemistry

Enantiomers: molecules that are stereoisomers and are non-superimposable mirror images of each other

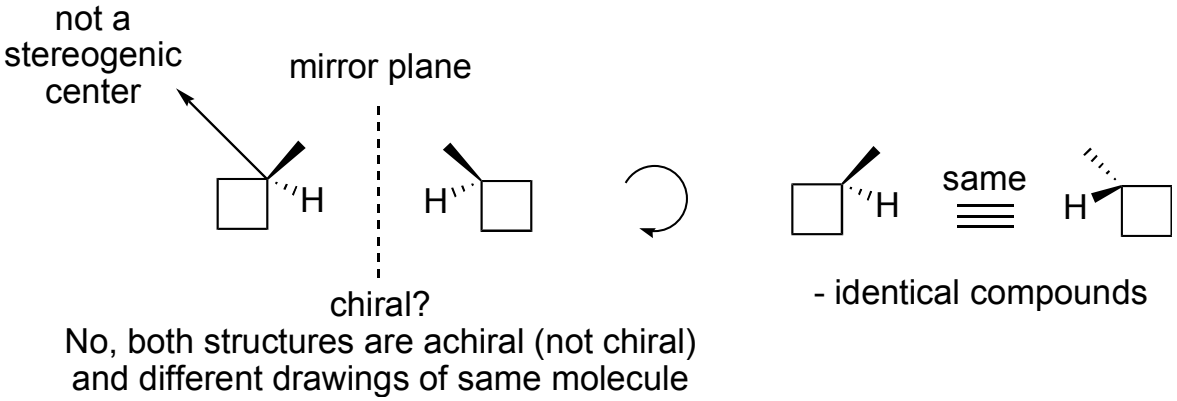
Diastereomers: stereoisomers that are not enantiomers

Enantiomers
Stereoisomers, non-superimposable mirror images
Example:



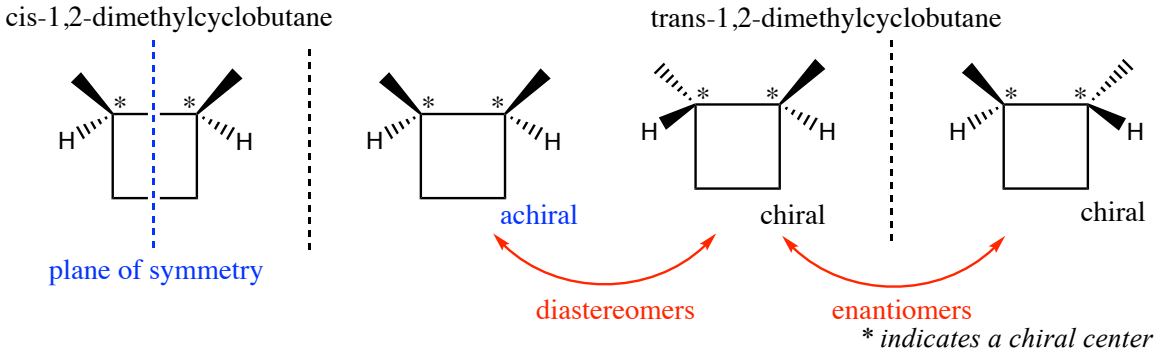
NON-SUPERIMPOSABLE → Enantiomers

Example: Achiral (not chiral) molecule; the mirror image is superimposable

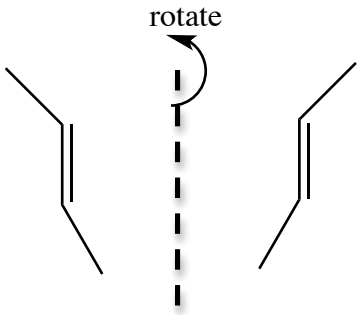


If there is plane of symmetry within a molecule, then the molecule is **achiral** (not chiral)

However, can chiral centers exist within an achiral molecule?
Yes! These are called *meso* compounds!



Note: a chiral center exists if *4 different groups* are attached to the carbon in question

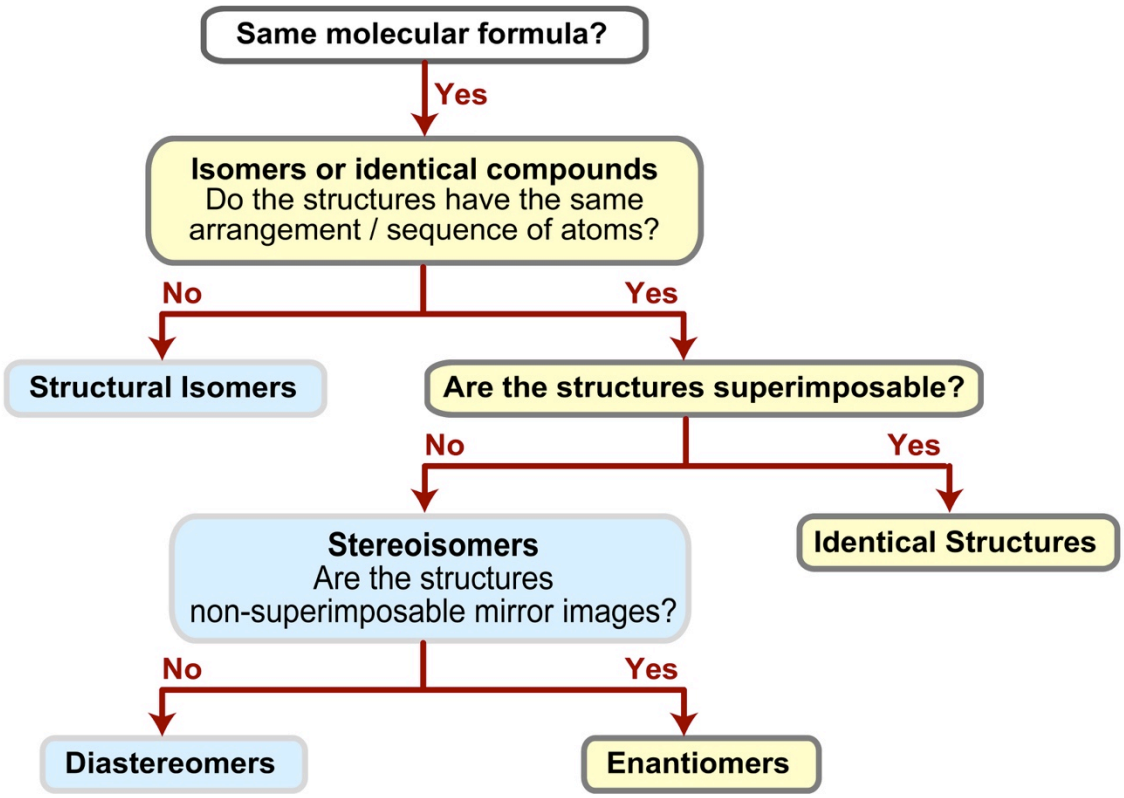


these two are identical

trans-2-butene is achiral

All stereoisomers that are not enantiomers are diastereoisomers!

How to Determine Relationships Among Structures



R/S Nomenclature:

R and S designation of stereoisomers

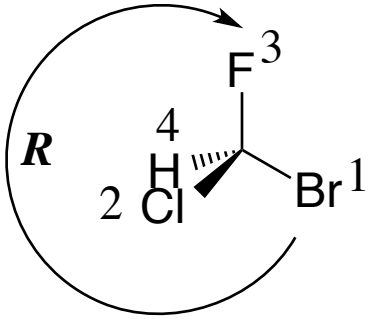
- R = Rectus (right, clockwise)
- S = Sinister (left, counterclockwise)

Labeling a stereogenic center as R or S:

- Identify all stereogenic centers (i.e. 4 different substituents)
- Assign priority based on atomic number (similar to *E* and *Z*). If you cannot decide, go to the next set of atoms.
- With the lowest priority group pointing back, count 1, 2, 3:
  - Clockwise → R configuration
  - Counterclockwise → S configuration

Each stereogenic center in a molecule is analyzed separately

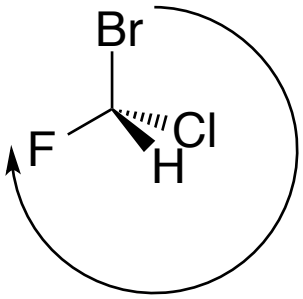
Example:



Place lowest priority to the back

1,2,3 --> clockwise = "R"
1,2,3 --> counterclockwise = "S"

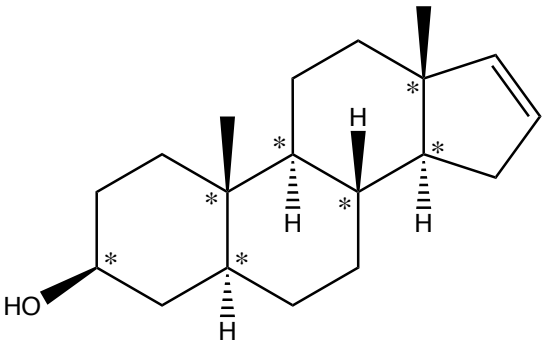
What if the lowest priority group is pointing forward?



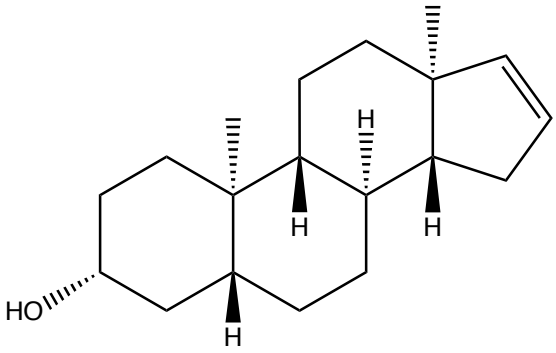
Counting 1, 2, 3 gives clockwise, BUT the smallest group is pointing forward, so the configuration is opposite of what you get if the smallest group is back

In this case, the configuration of the stereogenic center is "***S***"

Recall our male pheromone example:



biologically active compound



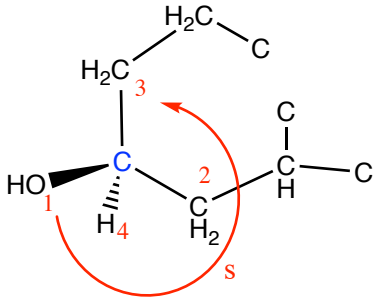
enantiomer

stereogenic centers = 7

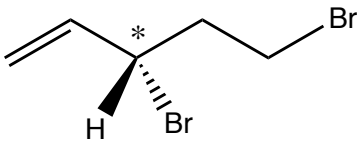
stereoisomers possible = $2^7 = 128$

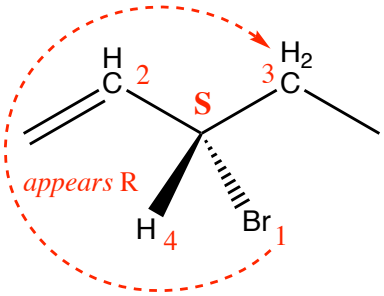
- 1 stereoisomer, on the left, is the only one known to be biologically active
- 1 is an enantiomer (to draw enantiomers, invert every stereogenic center)
- 126 diastereomers

Assigning nomenclature, starting of the left most chiral carbon of the phermone:



Simpler example:





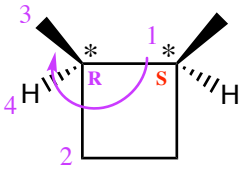
As the lowest priority group (hydrogen) is at the front, the chirality is reversed and deemed S rather than R as it appears.

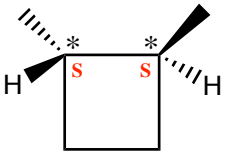
(3*S*)-3,5-dibromo-1-pentene

Note: chirality is indicated at the beginning of compound names, with R and S italicized in brackets, following the carbon location of the chiral center.

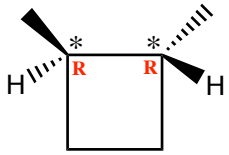
Back to our cyclobutane example: cis and trans

(1*R*,2*S*)-1,2-dimethylcyclobutane





(1*R*,2R)-1,2-dimethylcyclobutane



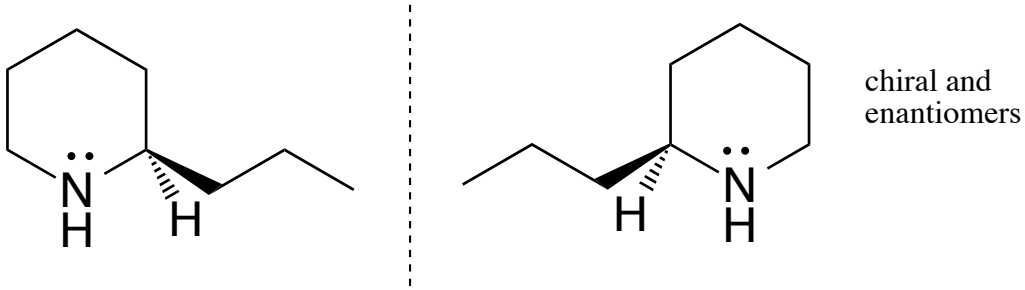
(1*S*,2S)-1,2-dimethylcyclobutane

diastereomers

enantiomers

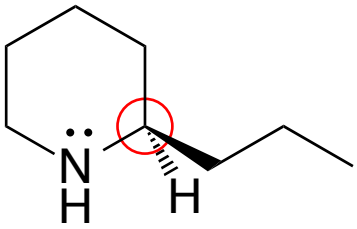
(Aside: cis and trans naming will be acceptable for the midterm)

Coniine: Poison hemlock, potent neurotoxin



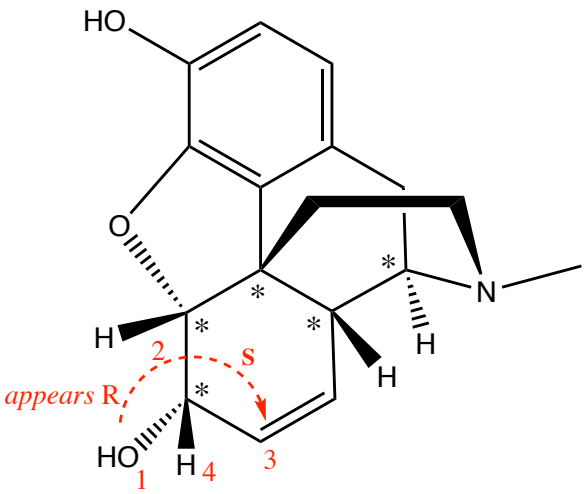
chiral and enantiomers

Stereogenic center (chiral centers or asymmetric centers) is circled in red



At room temperature the lone pair on nitrogen sits above or below and inverts freely like an umbrella → not chiral

Popular example: morphine



Stereocentre is S