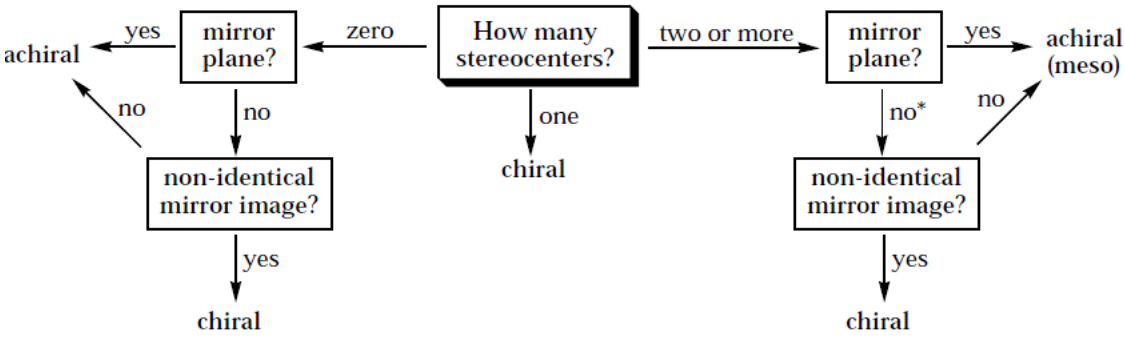
Stereochemistry



stereochemistry: study of the spatial characteristics of a molecule
stereocenter: atom bonded to four different groups (has R or S configuration)
internal mirror plane: plane that divides molecule in such a way that two halves are identical

chiral (optically active): possessing a non-identical mirror image (an enantiomer)
achiral: superimposable on its mirror image

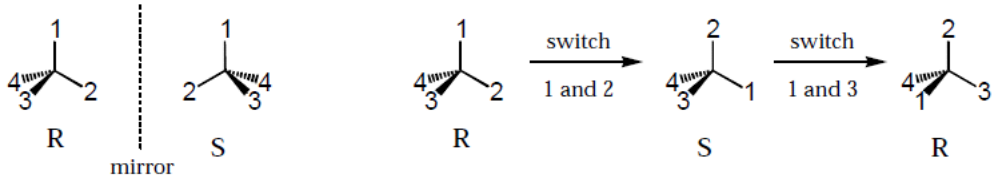
enantiomers: non-identical mirror images (same physical properties)
diastereomers: stereoisomers that are not enantiomers (different physical properties)
meso compound: achiral molecule that has stereocenters

Assigning R/S Stereochemistry (Cahn–Ingold–Prelog)

- Every stereocenter can be assigned as R or S.
- A stereocenter is an atom attached to four different groups.

1. Assign each group a priority (1 = highest).
   a) Highest atomic number has priority.
   b) Heavier isotopes have priority (D > H).
   c) In a tie, move along the chain to the first point of difference.
   d) With multiple bonds, break each pi-bond and duplicate the atoms at each end.
2. Put the lowest priority group (4) in back and view along the bond from carbon to group 4.
3. Draw an arrow from 1 to 2 to 3.
   a) Clockwise = R (Your car turns right!)
   b) Counterclockwise = S (sinister means left in Latin)

Tricks:
1. Taking the mirror image of a stereocenter switches R and S. This means that, if a molecule is chiral, switching the R/S configuration of every stereocenter will give you the enantiomer.
2. Exchanging any two groups on a stereocenter switches R and S.

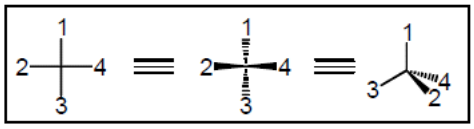


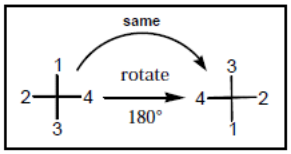
Fischer Projections

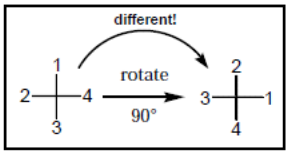
- Useful for comparing stereoisomers with more than one stereocenter.

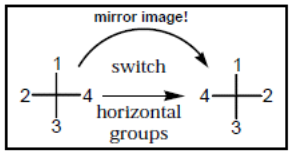
The Rules:

1. At every intersection, the vertical lines are pointed back (away from you) and the horizontal lines are pointed up (toward you).
2. Draw the carbon backbone of a molecule as the vertical line with the most highly oxidized carbon on top.
   a) You can think of oxidation as how many bonds carbon has to oxygen. So the ranking goes as follows: CO_2H > (CHO or CRO) > CH_2OH > CH_3
3. It is legal to rotate Fischer projections by 180° in the plane of the paper.
4. It is not legal to rotate Fischer projections by 90° or out of the plane of the paper.









Tricks:

1. Exchanging the horizontal substituents on a stereocenter switches R and S.
2. To take the mirror image, just exchange the horizontal substituents at each intersection. If the molecule is chiral, this will give you the enantiomer.
3. If you can draw a mirror plane through the Fischer projection, then the molecule is achiral.