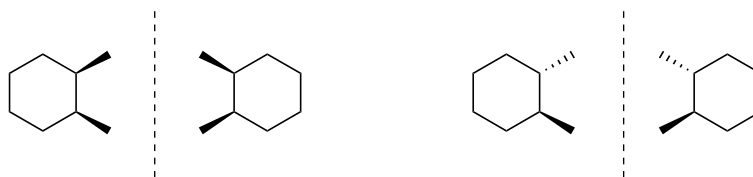
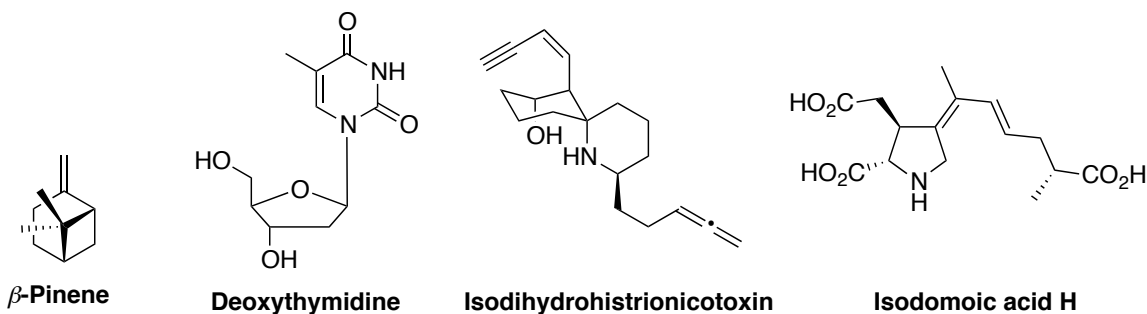


CHIRALITYStereoisomers

- **Stereoisomers** = compounds having the same molecular formula and connectivity, but *different 3D arrangements of atoms*.
- A pair of stereoisomers are **non-superimposable** on each other.
- A compound is said to be chiral (asymmetric) if its mirror image is not superimposable on the original image.
- Consider the following compounds and their mirror images. Are they superimposable?

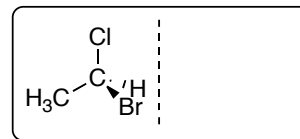
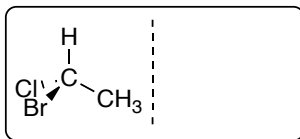
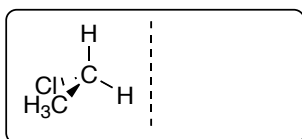
Chiral Centers

- A carbon atom is *chiral* if it has four different groups / substituents.
- How many chiral centers are in each biomolecule below?
 - Indicate each chiral center with a star (*).



A carbon atom is *chiral* if its mirror images are *non-superimposable*.

IS IT CHIRAL? Draw mirror images of the following tetrahedral carbon atoms.



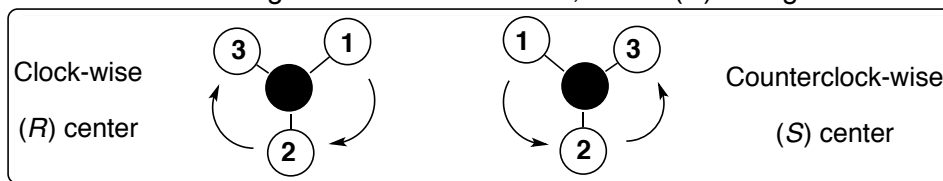
Is a compound chiral? This is a different question than “does the compound have chiral centers?”

- Recall that a chiral compound is asymmetric, in other words, it does not contain a plane of symmetry. You can check this by drawing a mirror-image of the compound in question.
 - If the mirror-image is superimposable with the original compound, the compound is symmetric and is **achiral**.
 - It is possible for a compound with chiral centers to be achiral. These are called meso compounds. **Meso compounds** contain chiral centers but have a plane of symmetry and so they are achiral.
 - If the mirror-image is non-superimposable with the original compound, the compound is asymmetric and so is chiral.

EXAMPLES:

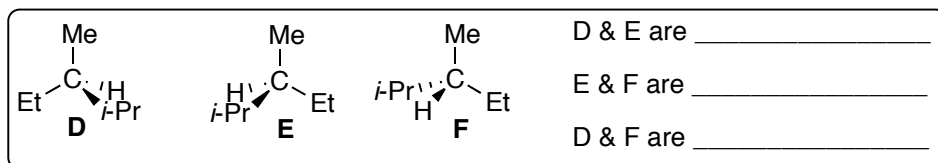
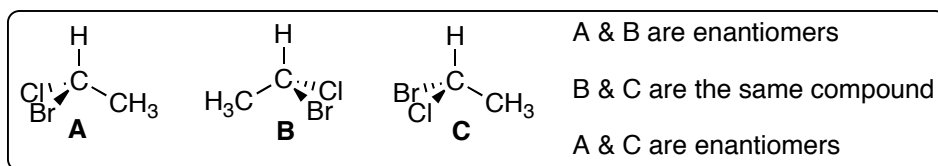
Absolute Stereochemistry is assigned by an R/S Configuration.

- The four different substituents are prioritized (1-4). If there are not four separate atoms attached, then the atom in question is not chiral anyway!
 - The atom with the highest atomic number gets highest priority (1).
 - If the same atoms are attached, continue one atom at a time away from the center until there is a difference.
 - Double bonds count as two bonds to that atom (C=O equals 2 x C-O).
- Orient the carbon atom so that two bonds are in the plane, one is above the plane (bold wedge), and the *fourth priority group* is behind the plane (dash).
- The remaining three substituents are counted in a circle: 1 then 2 then 3.
 - If the 1-2-3 circle goes clockwise, the chiral center is of (*R*) configuration.
 - If the 1-2-3 circle goes counter-clockwise, it is of (*S*) configuration.



Enantiomers are a pair of compounds that are non-superimposable mirror images of each other.

- For a given pair of enantiomers, any (*R*) stereocenters on one compound will be (*S*) stereocenters on the enantiomer, and *vice versa*.



Diastereomers are a pair of stereoisomers that are not mirror images (examples on next page).

- Two or more chiral centers must be present in order for a pair of compounds to be considered diastereomers. Some of the chiral centers change in configuration, but at least one must be the same.