Today

Sections 4.1 and 4.2
Isomers and the stereoisomers of alkenes

Sections 4.3 - 4.8
Chirality

Next Class

Sections 4.9-4.14
Optical activity and compounds with more than one center of chirality

Answer any questions that did not receive full credit and hand in by Oct 27. I do not need the test returned to me, please just answer the questions on a separate piece of paper.

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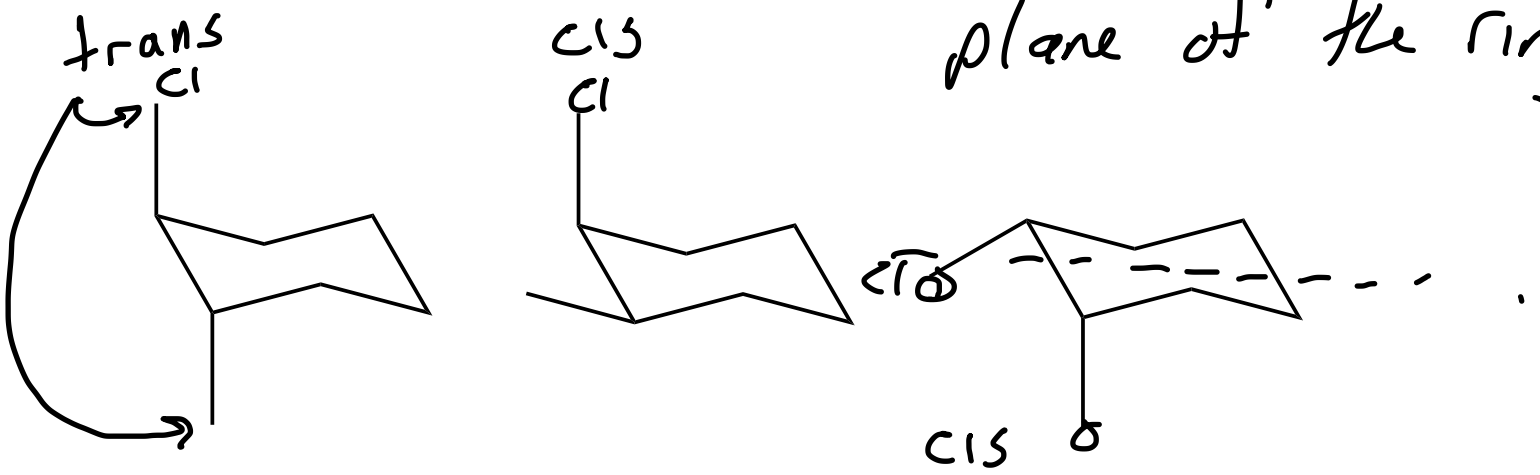
s sound same side

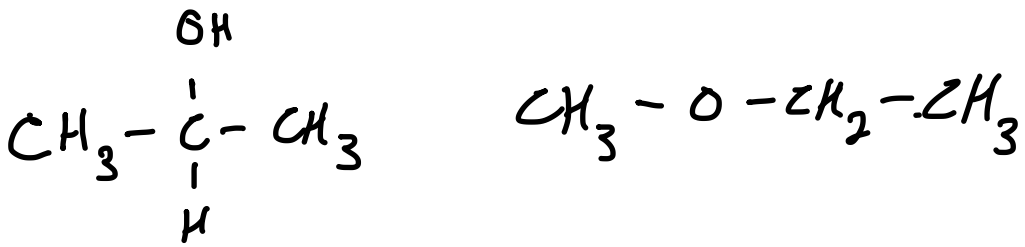
cis is same side relative to the plane of the ring



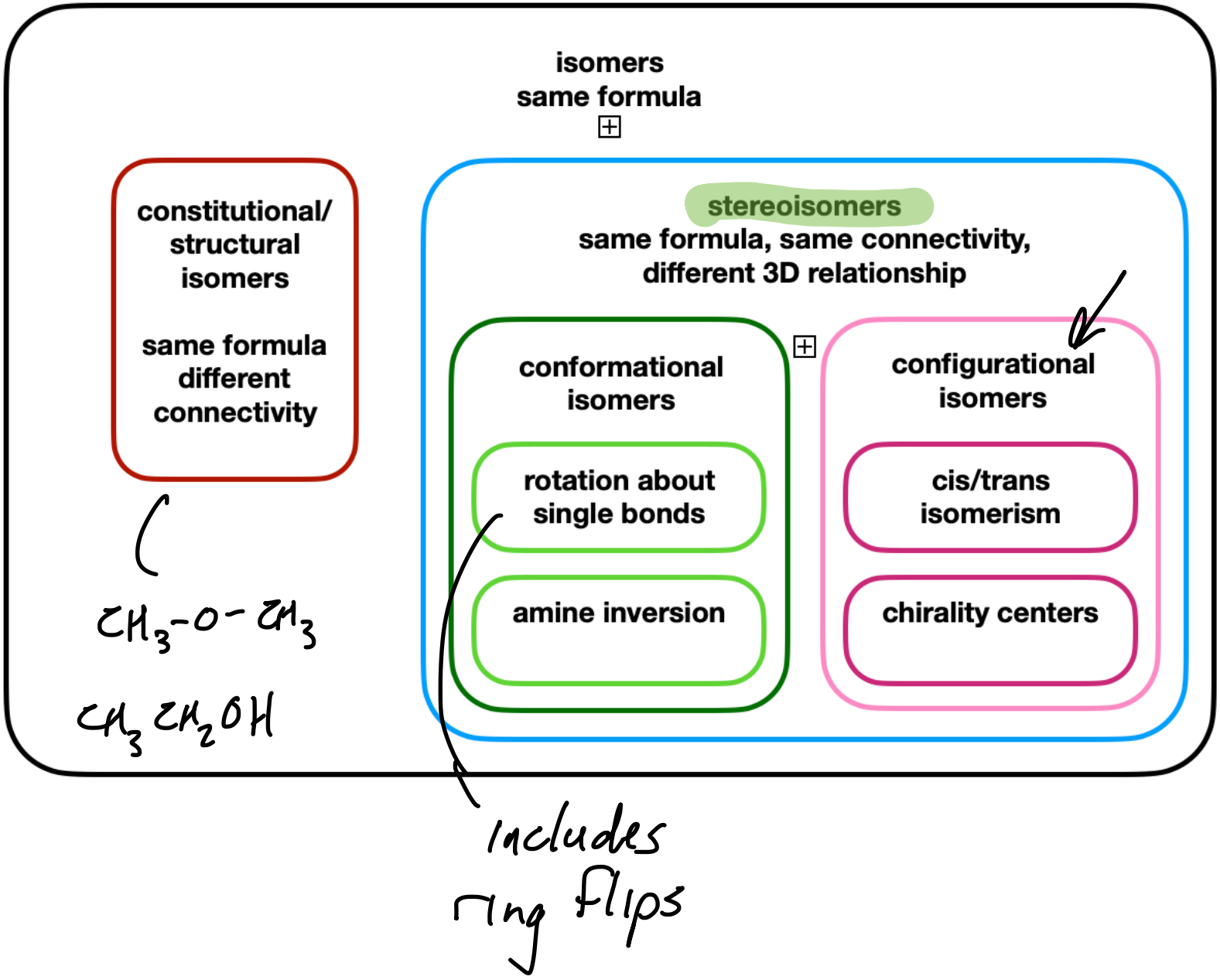
trans is opposite side

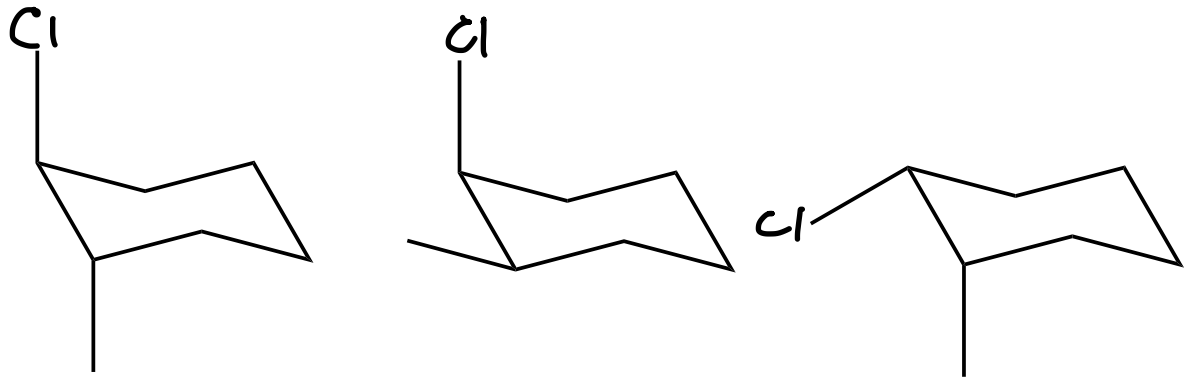
configurational isomers

structural / constitutional isomers



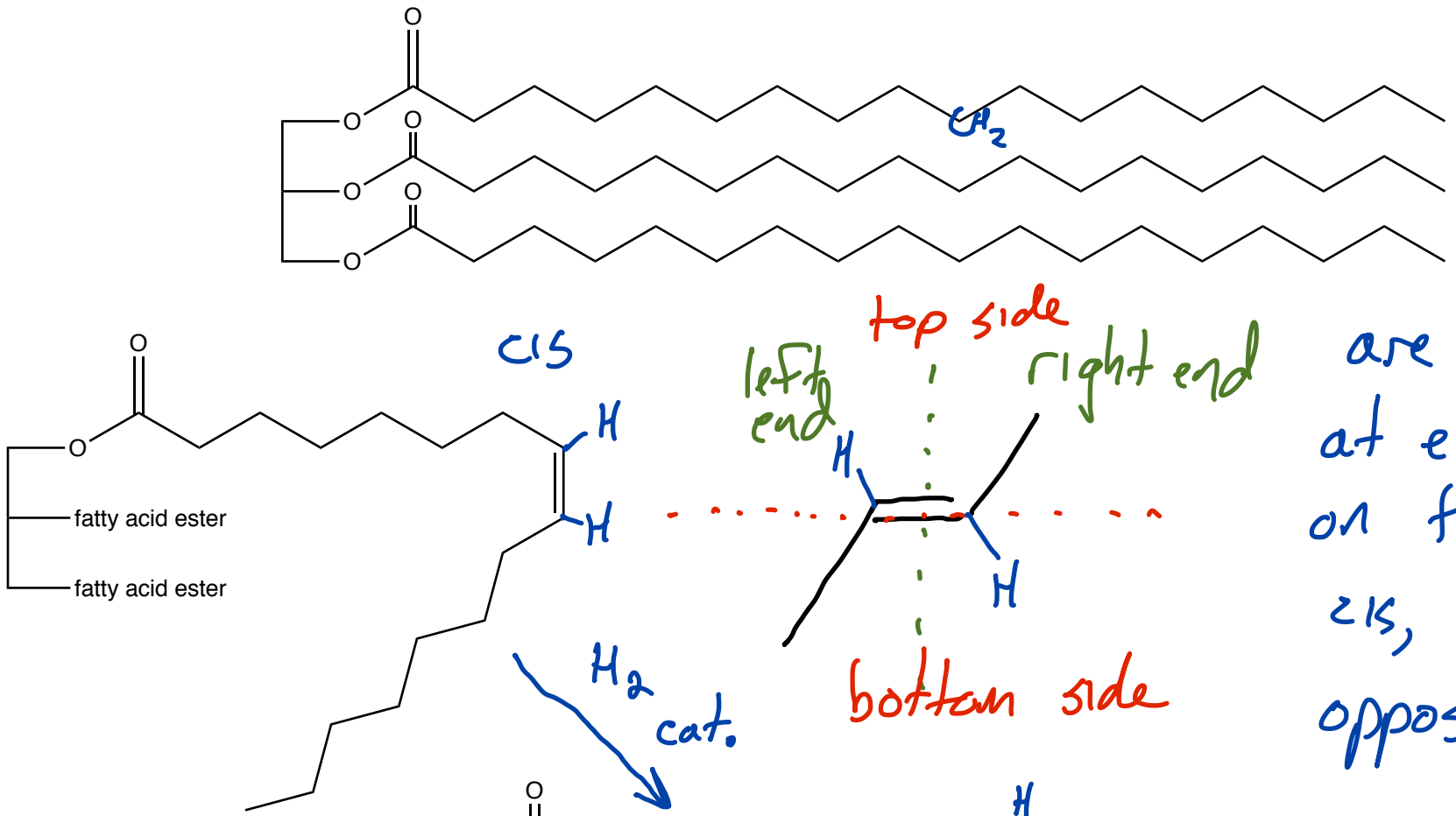
Isomers


isomers
same formula
⊞
constitutional/
structural
isomers
same formula
different
connectivity
stereoisomers
same formula, same connectivity,
different 3D relationship
conformational
isomers
⊞
configurational
isomers
rotation about
single bonds
amine inversion
cis/trans
isomerism
chirality centers
CH_3-O-CH_3
CH_3CH_2OH
includes
ring flips



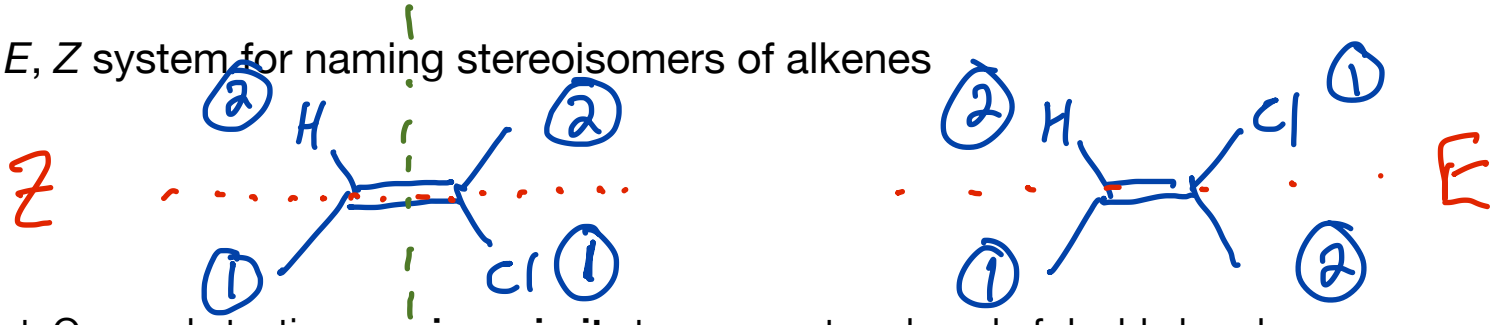
cis & trans relationship are relative to the plane of the ring

these molecules are all configurational isomers of each other. Ring flips will not interconvert them



are H atoms at either end on the same, cis, or opposite, trans, sides

partial hydrogenated oils



First: One end at a time, **assign priority** to groups at each end of double bond

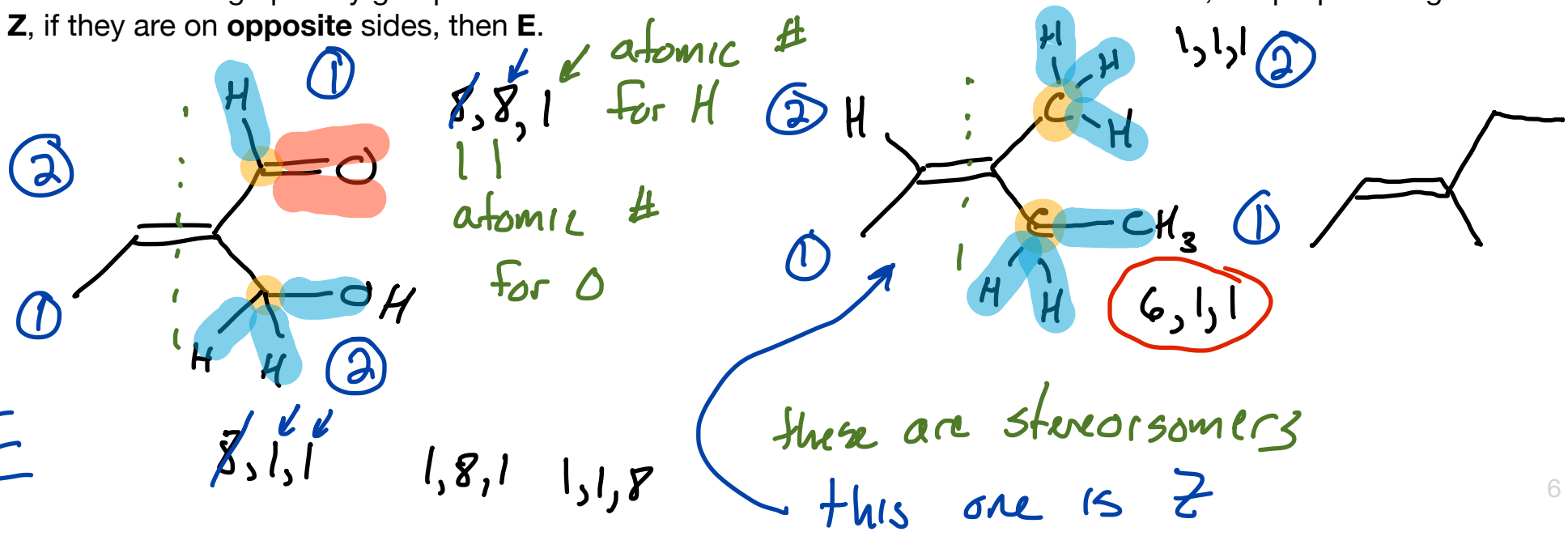
higher priority is given to the group with the higher atomic number for the atom directly bonded to the sp^2 carbon

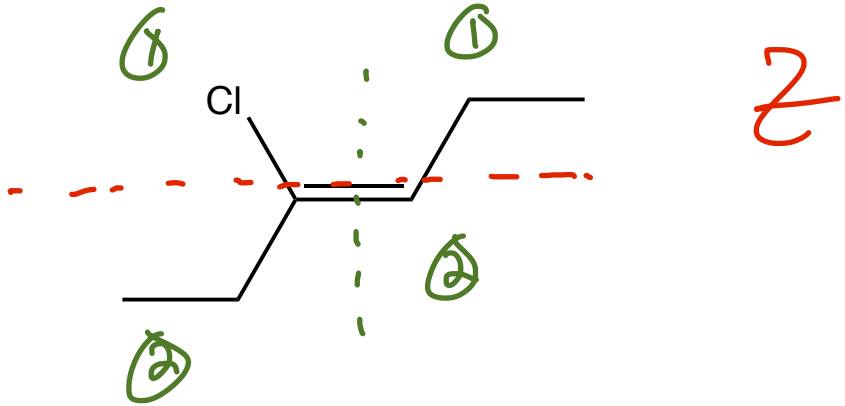
in a tie, consider the atomic numbers of the elements attached to the element that is attached to the sp^2 carbon (move one bond further out from the sp^2 hybridized C atom)

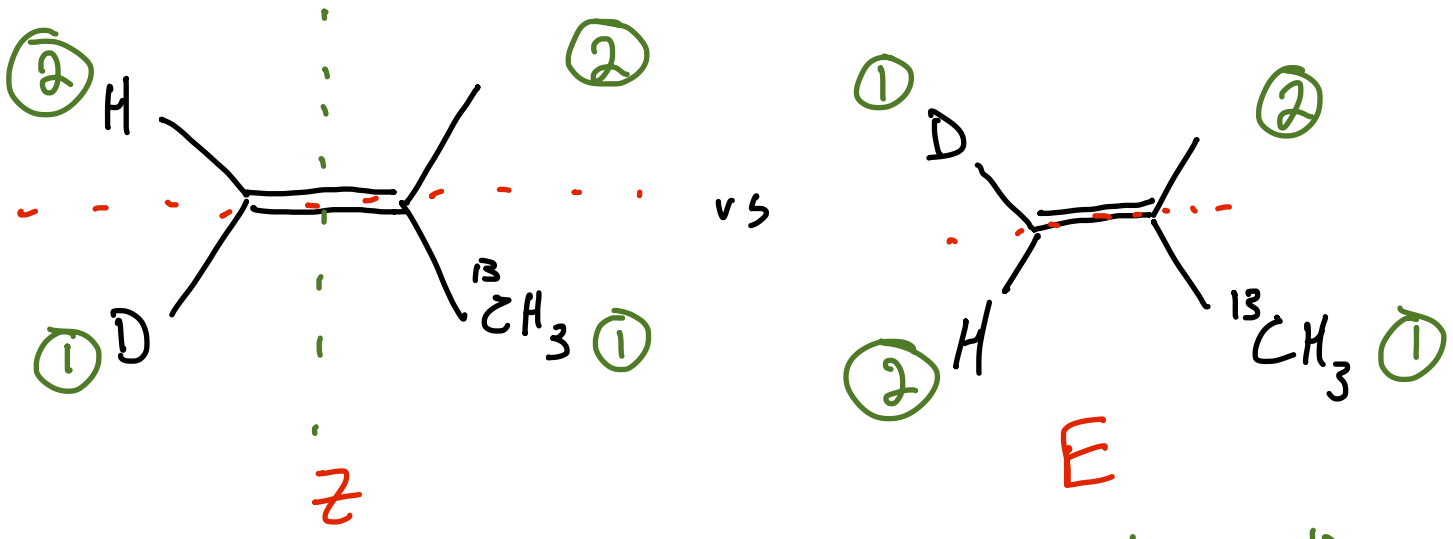
if the element that is attached to the sp^2 carbon has a doubly bonded or triply bonded atom attached to it the element is treated like there are two or three elements singly bonded to the element that is bonded to the sp^2 carbon

when comparing isotopes, the mass number is used (D vs H, ^{12}C vs ^{13}C)

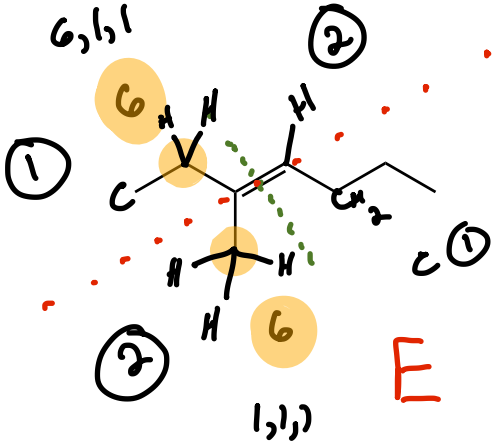
Second: If the high priority groups at each end of the double bond are on the **Zame Zide**, the proper designation is **Z**, if they are on **opposite** sides, then **E**.

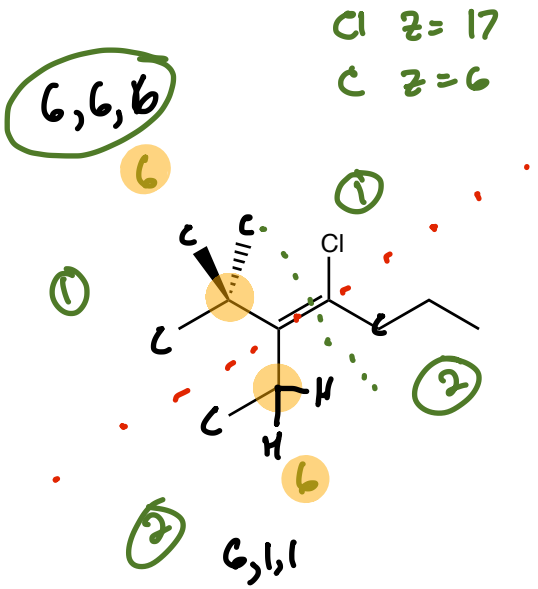


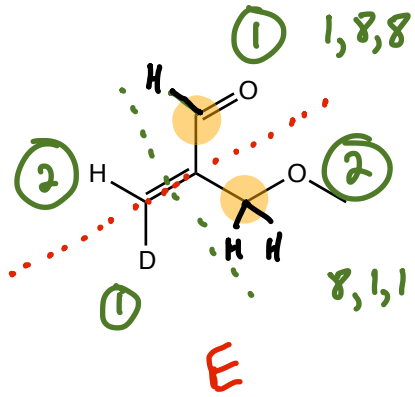




https://www.westfield.ma.edu/PersonalPages/cmasi/Z,E_priority_worksheet.pdf







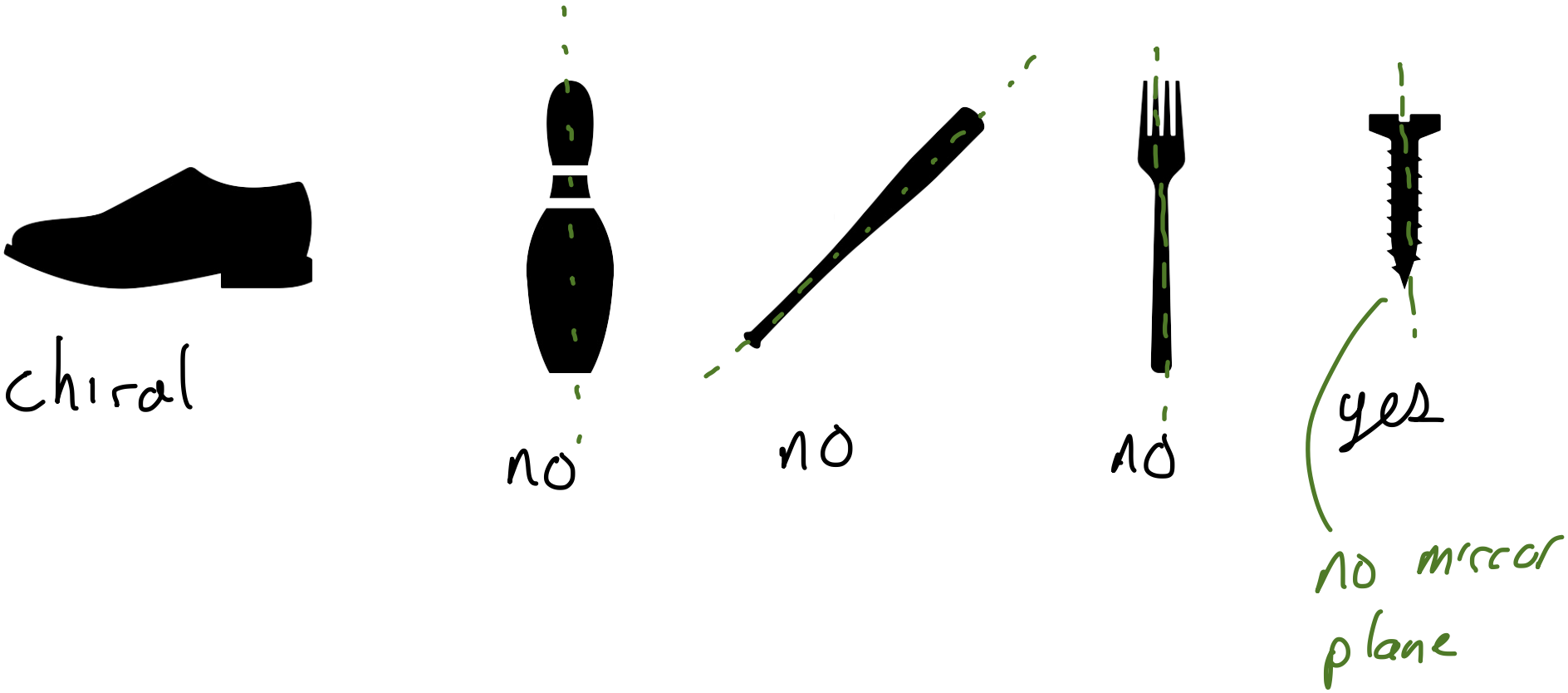
If one end of the db has the same two groups attached to it, then the db is not a stereocenter and will not cause the molecule to have a stereoisomer.

no Z or E for that db

https://www.westfield.ma.edu/PersonalPages/cmasi/Z,E_priority_worksheet.pdf

A chiral object has a non-superposable mirror image

A chiral object does not contain a mirror plane



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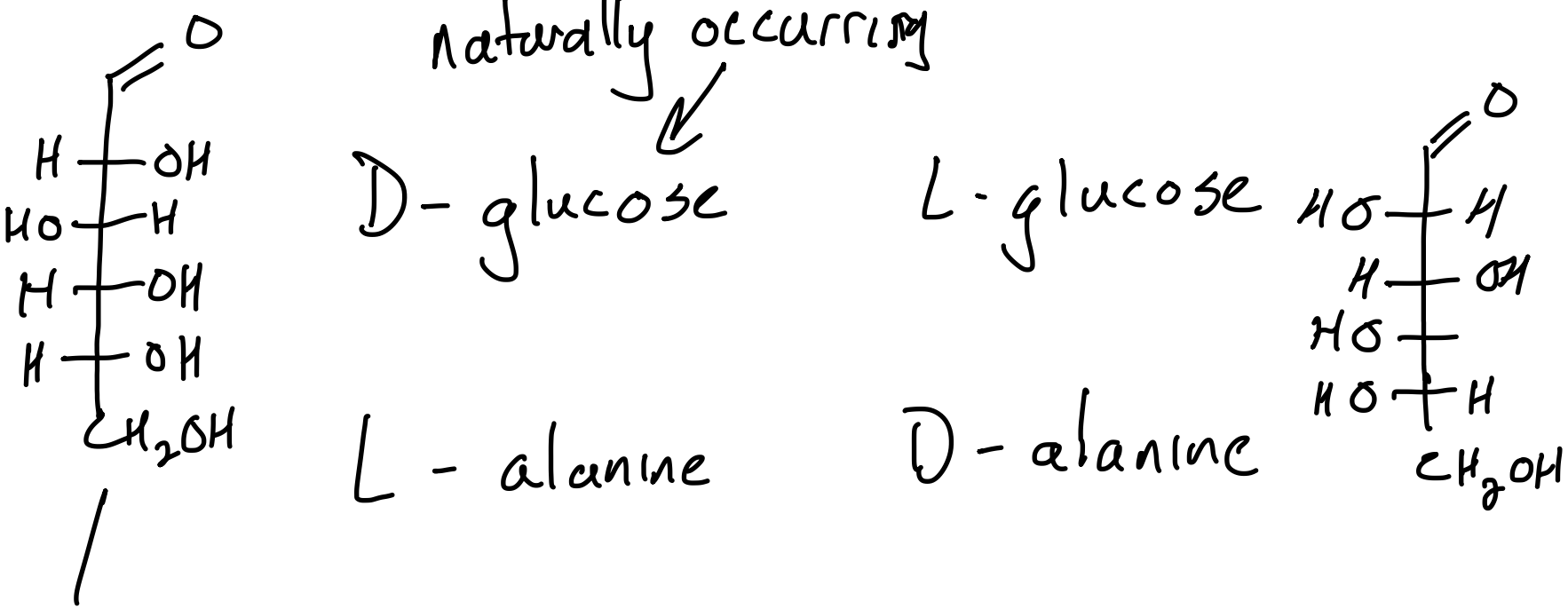
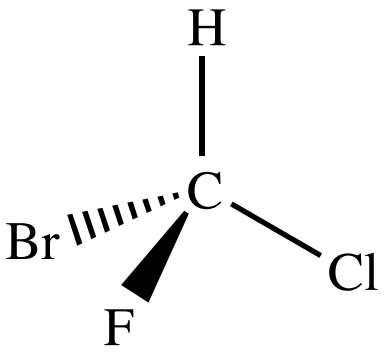
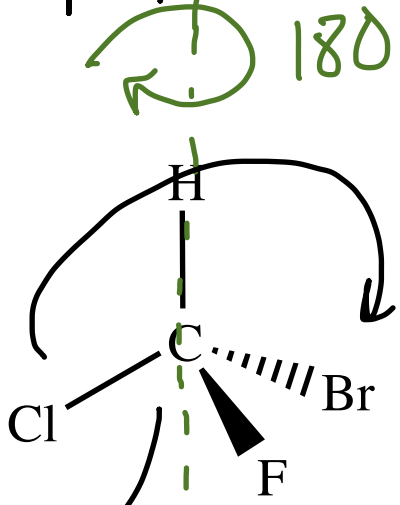


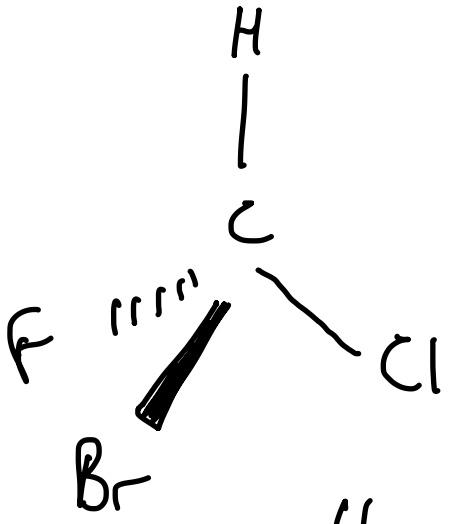
enantiomers are stereoisomers

enantiomers are nonsuperposable mirror images.



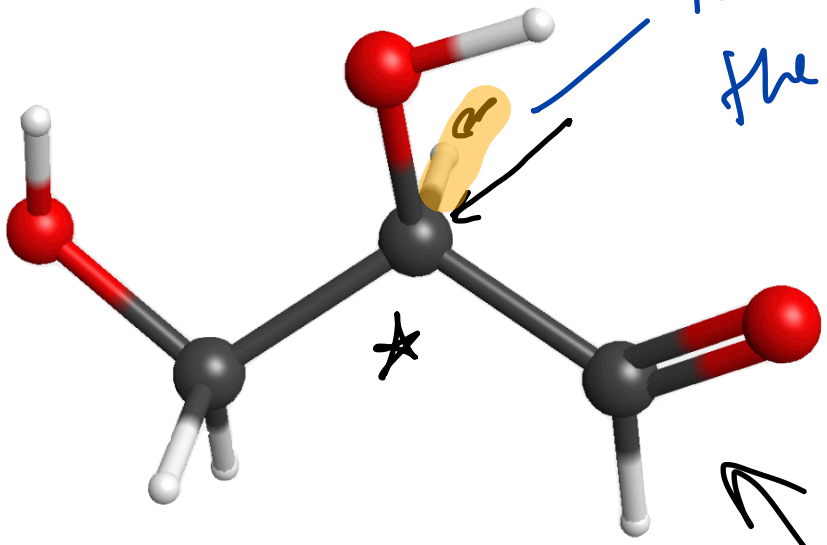


180° rotation on C-H bond

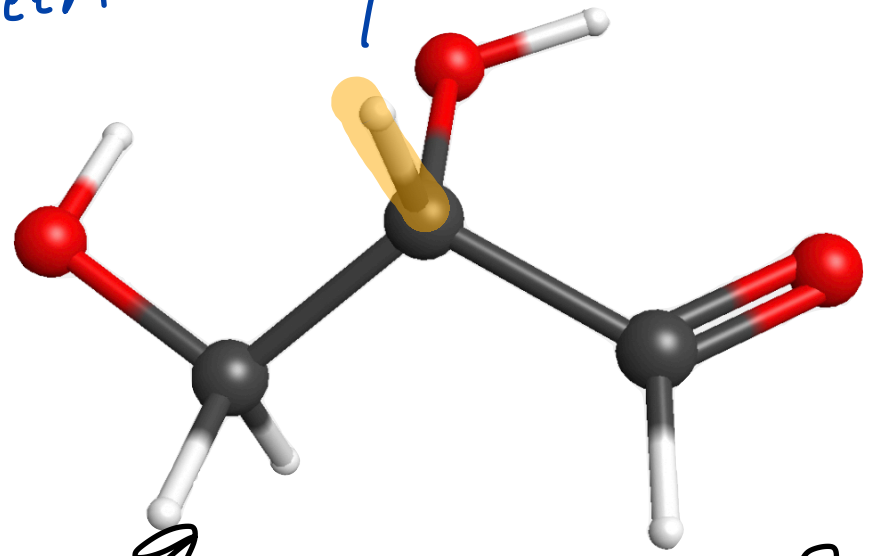


Chiral objects have enantiomers.

4 different groups bonded to a C will make that C chiral.



this H is behind the screen



this H is in front

D-glyceraldehyde

* H
OH
CH_2OH
C=O
H

these molecules are enantiomers of each other

these are chiral molecules

4 different groups bonded to the same C atom makes that C atom a chiral atom

Stereoisomer - same formula, same connectivity, different 3D relationships

Conformational Stereoisomers - rotamers and ring flips

Configurational Stereoisomers - stereoisomers that cannot be interconverted without breaking bonds

Chirality - handedness

Chiral Objects - objects that have a non-superposable mirror image

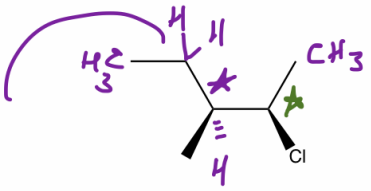
Chiral (or Chirality) Center - a source of chirality in a molecule that may make the molecule chiral; e.g., a C atom bonded to four different groups

Enantiomers - a pair of molecules that are non-superposable mirror images of each other

- a pair of chiral stereoisomers

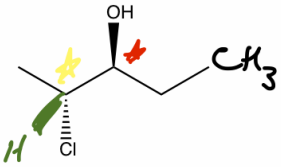
the helmetless Minitig had chiral arms (and legs technically) but was not a chiral object since the mirror image was superposable on the original

Practice Recognizing centers of chirality ★ CH_3, H, Cl, $CH_2CH_2CH_3$ Section 4.4, 4.13

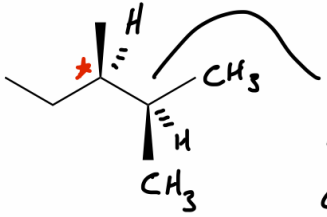


H
H
CH_3
other

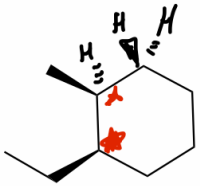
★ H
CH_3
CH_2CH_3
$CH(CH_3)_2$



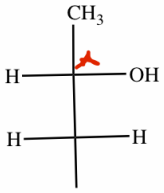
H, CH_3, CH_2CH_3, other $CHClCH_3$

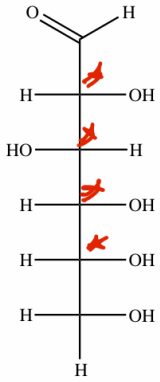


not chiral because 2 CH_3's are the same group



H, CH_3, CH_2 .... not CH_2





Starred atoms are chiral

a C atom is chiral if 4 different groups are connected to C

Determining Configuration (*R* vs *S*)

Same rules as Z + E

Assign priorities to groups connected to chirality center

Point lowest priority group away — 4th place group

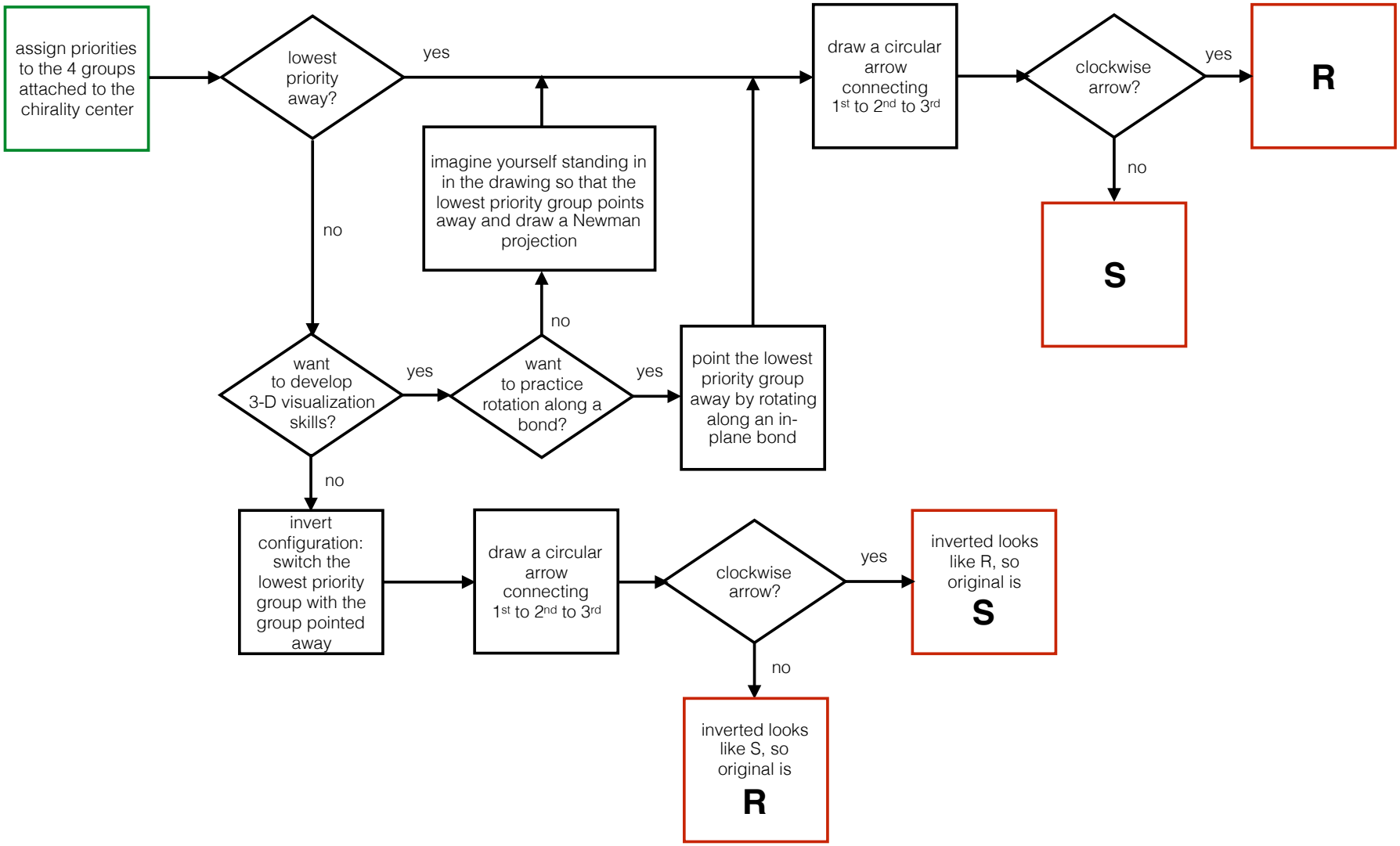
Draw a circle from 1st to 2nd to 3rd priority groups

Clockwise circle is **R** configuration

Counter Clockwise circle is **S** configuration

1, 2, 3, & 4th place for the 4 groups instead of just 1 & 2 place for the 2 groups at the end of the double bond.

Determining Configuration (*R* vs *S*)



Practice Recognizing centers of chirality

4 CH_3, H, Cl, $CH_2CH_2CH_3$