Course CH343 Lecturer Sam Gellman
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Chapter 6: Stereochemistry

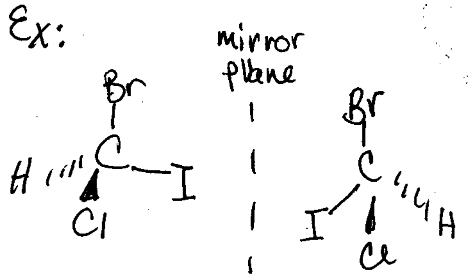
* Rec. Problems: 1, 3-7, 86, 9, 12-25, 27-42, 45-51.

Note: 23, 24 & subsequent: "sawhorse projection" (pg 257)
Focus on other drawing conventions.

Recall: "Stereoisomers" differ from one another in the spatial arrangement of atoms, but not in terms of bonding relationships (e.g. E/Z isomers in alkenes)

Enantiomers: mirror images of eachother that cannot be superimposed.

Ex:



Comments

1. A molecule that differs from its mirror image is a "chiral" molecule
Many molecules are identical to their mirror image; these are "achiral"

2. A Chiral molecule has only one enantiomer.
An achiral molecule has no enantiomers.

3. Most chiral organic molecules are sp^3 C's that have 4 different groups bonded to it.

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This type of carbon can be called a: "stereocenter"
"stereogenic center"
"chiral center"

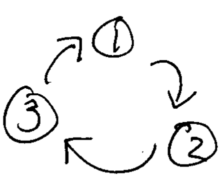
4. <u>However</u>, some molecules that have chiral centers are achiral, and some chiral molecules do not contain an sp3 carbon with 4 different bonding partners

<u>R ; S Nomenclature</u>

- ~~Specifies~~ configuration @ sp^3 stereocenters

<u>3 steps</u>

1. assign priority to the four different groups bonded to the sp3 carbon.
2. Orient the molecule such that lowest priority group is pointing away from us.
3. Rotation of remaining 3 groups



clockwise R

counter clockwise S

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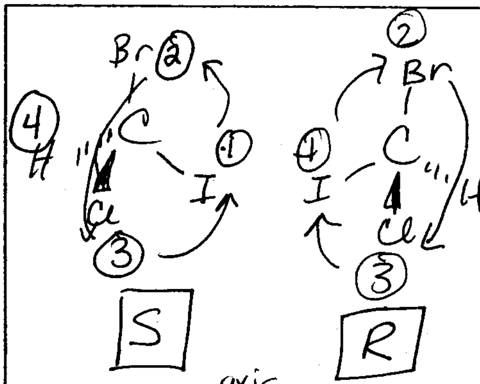

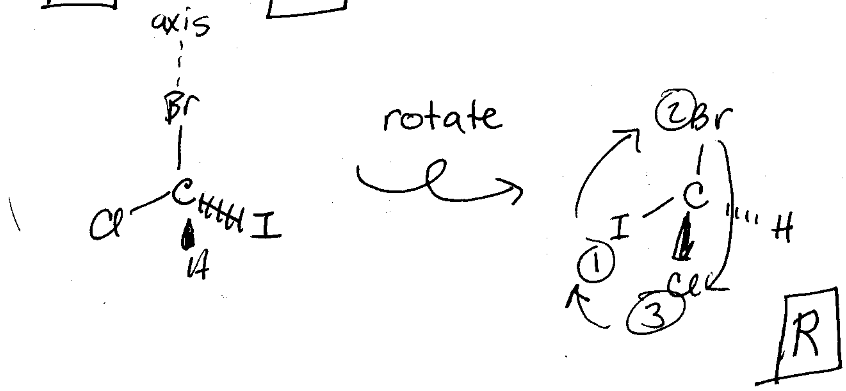

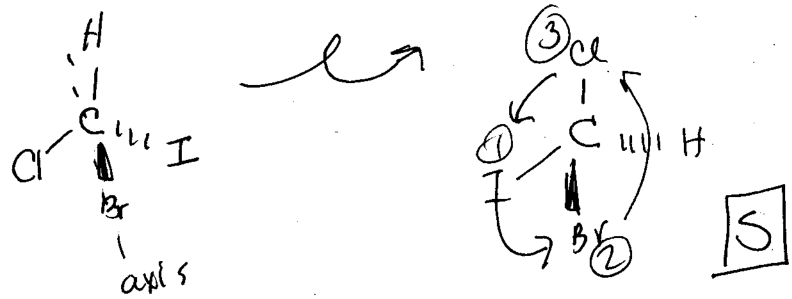

How do we distinguish enantiomers experimentally?

∴ Most physical properties of enantiomers are identical (e.g. melting pt, boiling pt., density)

*Key distinction: rotation of the plane of plane polarized light (optical activity)

See pg 235-238

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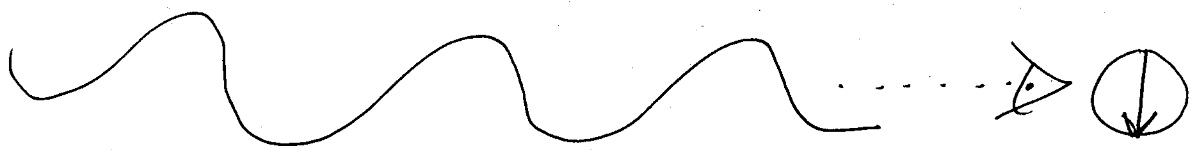
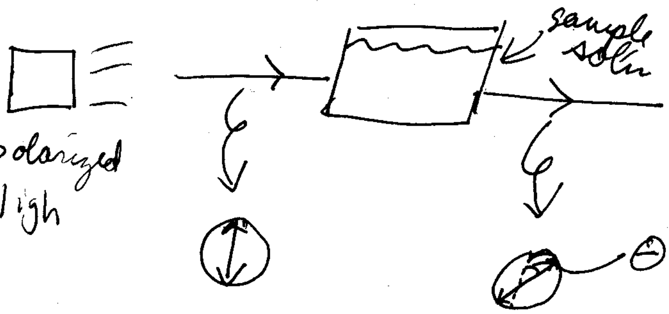
We can generate "plane polarized light"



Observe: pass polarized light through a ~~solution~~ ~~that is~~ of an "enantiomerically pure" sample ⇒ characteristic rotation of plane of polarization

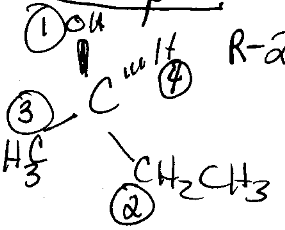


characteristic angle of rotation

Key concept:

clockwise ⇒ rotation > 0 (+ sign)
Counterclockwise ⇒ rotation < 0 (− sign)
↑
have nothing to do w/R + S!

Example:



R-2-butanol

$\boxed{R}$

measure: $[\alpha]_D^{20} = -13.9°$

$[\alpha]$: specific rotation - normalized for concentration and path length of sample

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$[\alpha]_D^{20}$:

20: temp at which measurement taken (20°C)
D: use D line from sodium vapor emission (589.3 nm)
$\therefore [\alpha]_D^{20} = +13.9$ for S-2-butanol
*rotated an equal amt, but opposite direction
so: terminology:
(S)-(+)-2-butanol
(R)-(-)-2-butanol