Properties of Stereoisomers

* Pairs of enantiomers have identical physical properties (mp, bp, nD, density).

* Pairs of diastereomers have different physical properties.

So how can we tell enantiomers apart? Look at how they interact in a chiral environment.

Most common - plane polarized light.

Light source

Normal light oscillates in all directions.

Oscillating filter

Polarized light oscillating in a single plane.
We use a polarimeter to measure optical rotation of a sample.

- Light source
- Filter polarized light
- Sample
- Detector

If the sample is achiral, it will not interact with light - $0^\circ$ rotation.

1. Molecules themselves are achiral.
2. Sample is racemic - contains equal amounts of the two enantiomers.

* There is no correlation between R/S and $\pm$. But, if the R enantiomer rotates $+8.37^\circ$, the S will rotate $-8.37^\circ$. The number is the same.
Specific rotation: \[ \alpha = \frac{\alpha}{c \cdot l} \rightarrow \text{observed rotation} \]

\[ g_{\text{ml}} \rightarrow \text{pathlength in dm (usually 1)} \]

If the sample contains both enantiomers in unequal amounts, describe it by \( \% \text{ ee} \) (enantiomeric excess)

ex. 50% ee = 50% of the sample is enantiomerically pure

50% is racemic

\[ \Rightarrow 75\% \text{ of one, } 25\% \text{ of the other} \]

\[ \% \text{ ee} = \frac{[\alpha]_{\text{obs.}}}{[\alpha]_{\text{pure}}} \times 100\% \]

Example:

\[ [\alpha]_{\text{obs.}} = +1.151 \]

\[ [\alpha]_{\text{pure R}} = +5.754 \]

\[ \frac{+1.151}{+5.754} \times 100\% = 20\% \text{ ee} \]
synthesis of chiral molecules

\[
\text{achiral} \xrightarrow{\text{Nabh}y, \text{EtOH}} \text{racemic mixture.}
\]

Enantioselective synthesis - achiral precursor but one enantiomer is favored.

* enzymes
* steros

\[
\text{favored}
\]