Compounds with Two Asymmetric Centers

- 2-chloro-3-iodobutane

Note that the absolute configuration for both asymmetric centers is different.
Compounds with Two Asymmetric Centers

- 2-chloro-3-iodobutane

![Chemical structures showing enantiomers and diastereomers of 2-chloro-3-iodobutane](image)
Compounds with Two Asymmetric Centers

- 2-chloro-3-iodobutane

The absolute configuration for one of the asymmetric centers is different, the other is the same.
The reactivity of an enantiomer of a chiral compound depends upon the nature of the other reactants or the enzyme (biological catalyst) or both:

- When reacting with achiral compounds, enantiomers usually have the same reactivity.
- When reacting with chiral compounds or in reactions catalyzed by chiral enzymes, enantiomers usually have very large differences in reactivity.

An analogy to the behavior of reacting chiral and achiral molecules is the relationship of feet (chiral), socks (achiral), and shoes (chiral):

- Either achiral sock will fit onto either chiral foot, or into either chiral shoe.
- Only the left shoe will fit the left foot, and the right shoe the right foot, however.

Most reactions in living cells are catalyzed by protein molecules called enzymes. Enzymes are large molecules containing a surface site, called the active site, where the substrate or reactant binds. For most enzymes this site is chiral.

Chiral active sites are designed to interact strongly with one of the two possible substrate enantiomers, just as a left shoe interacts strongly with a left foot, and more or less excludes a right foot.

This phenomenon is called chiral recognition or chiral discrimination.

Other molecular properties are also used by enzymes to discriminate between substrate molecules: geometrical isomerism, size, shape, polarity, and charge.

Discrimination on these bases is called the complementarity principle.
The enzymes used to catalyze most biological processes have evolved to utilize only one enantiomer in each class of biological compounds. D-carbohydrates L-proteins

Biological synthesis of chiral compounds usually results in the synthesis of only one enantiomer of the two possible enantiomers. Synthetic, laboratory synthesis usually produces racemic mixtures of chiral compounds unless specific reaction conditions are used (asymmetric synthesis).
## PROPERTIES OF ENANTIOMERS

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<thead>
<tr>
<th>Concept checklist</th>
<th><img src="image.png" alt="Image" /></th>
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<tbody>
<tr>
<td>✓ Enantiomers are a pair of stereoisomers whose molecules are nonsuperimposable mirror images.</td>
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<td>✓ The only difference in physical properties of a pair of enantiomers is the direction of rotation of plane-polarized light.</td>
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<td>✓ Enantiomers show no difference in chemical reactivity toward achiral compounds.</td>
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<tr>
<td>✓ Enantiomers show large differences in chemical reactivity toward chiral compounds or in reactions catalyzed by chiral enzymes.</td>
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