CHAPTER 9

How do we separate enantiomers? Resolution - the separation of enantiomers. This is usually difficult to do because the physical properties of enantiomers are identical. They must be converted into diastereomers. Diastereomers can be made by forming a covalent bond with a stereochemically pure chiral molecule. One example is the formation of an ester.

\[
\begin{align*}
\text{Racemic mixture} & \quad \text{Pure enantiomer} \\
\text{Diastereomeric mixture can be separated}
\end{align*}
\]

Diastereomeric salts can also be prepared using acid-base reactions. These are usually separated by crystallization of one diastereomer from the other.

Reactions which produce new stereogenic centers will always result in racemic products unless some chirality already exists in the starting reactants.

\[
\begin{align*}
\text{optically active} & \quad \text{less crowded side} \\
\text{major} & \quad \text{optically active}
\end{align*}
\]
Note that while achiral, the stereochemistry of a double bond will have an influence on whether a product formed is a racemic mixture of enantiomers or a meso form. For example, the bromination of cis and trans 2-butene.

\[
\text{cis-2-butene} + \text{Br}_2 \rightarrow \text{(R)-Br-Br-(S)} \rightarrow \text{rotate} \rightarrow \text{Br-Br-(S)-Br} \\
\text{trans-2-butene} + \text{Br}_2 \rightarrow \text{(R)-Br-Br-(R)} + \text{Br-Br-(S)-Br}
\]

Asymmetry can exist on other atoms, but sometimes it is not stable. For example, sp\(^3\) hybridized nitrogen atoms would be expected to be chiral, but because the lone pair can interconvert rapidly, a racemic mixture of the two results.

Nitrogen compounds can undergo inversion similar to inverting an umbrella. In this way, the configuration is always racemized.