14.6: Conjugated Dienes

When considering compounds having two or more double bonds in a molecule, it is useful to identify three distinct ways in which these functions may be oriented with respect to each other. First, the double bonds may be separated by one or more sp3-hybridized carbon atoms, as in 1,5-hexadiene. In this circumstance each double bond behaves independently of the other, and we refer to them as isolated. A second relationship has the double bonds connected to each other by a single bond, as in 1,3-hexadiene, and we refer to this arrangement as conjugated. Finally, two double bonds might share a carbon atom, as in 1,2-hexadiene. The central carbon atom in such a system is sp-hybridized, and we call such double bonds cumulated.

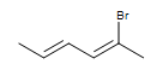
Dienes can adopt two possible conformations through rotation about the single bond joining the two double bonds: the *s-cis* and the *s-trans* conformations.

The energy barrier to isomerization is normally low, and the *s-trans* conformer is often more stable than the s-cis conformer.

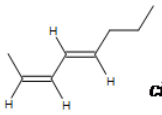
Naming Dienes

First identify the longest chain containing both carbons with double bonds in the compound. Then give the lowest possible number for the location of the carbons with double bonds and any other functional groups present (remember when naming alkenes that some groups take priority such as alcohols). Do not forget stereochemistry or any other orientation of the double bond such as (E/Z,cis or trans).

Examples:

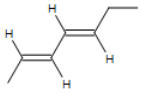


2-Bromo-2,4-hexadiene



cis-2-*trans*-4-octadiene

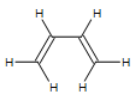
1,3-cyclopentadiene



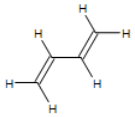
trans-2,4-heptadiene

Different conformations of Conjugated Dienes

There are two different conformations of conjugated dienes which are s-*cis* and s-*trans* conformations. s-*cis* is when the double bonds are cis in reference to the single bond and s-*trans* is when the two double bonds are trans in reference to the single bond. The cis conformation is less stable due to the steric interation of hydrogens on carbon. One important use of the cis conformation of a conjugated diene is that it is used diels-alder cycloaddition reactions. Even though the trans conformation is more stable the cis conformation is used because of the molecule's ability to interconvert and rotate about the single bond.



s-*cis*



s-*trans*

Contributors

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