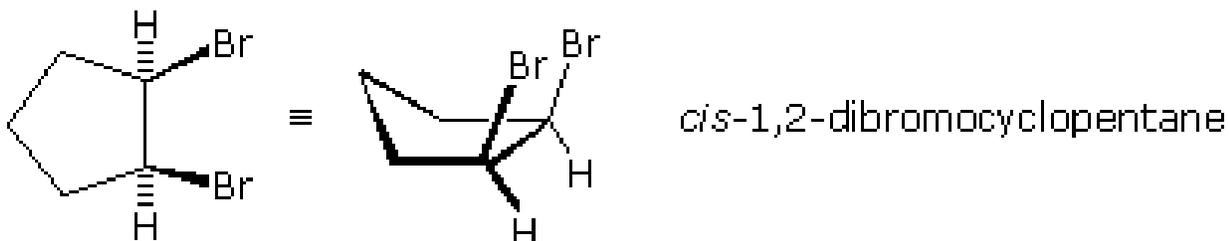
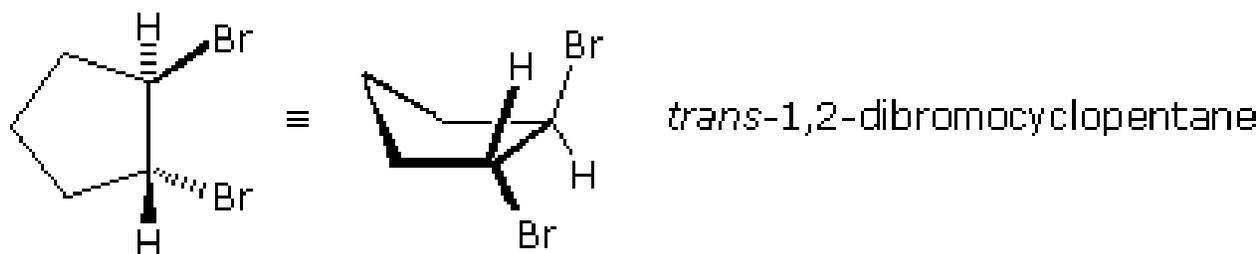


# Cycloalkane and Conformational Stereoisomers

## Configurational Stereoisomers of Cycloalkanes :

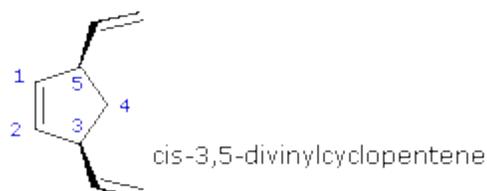
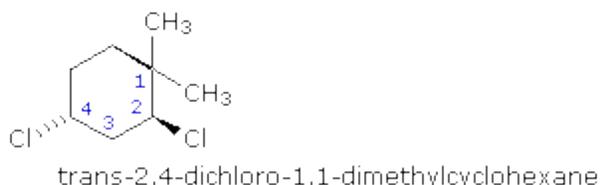
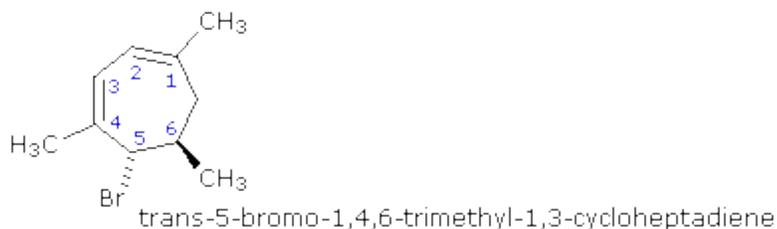
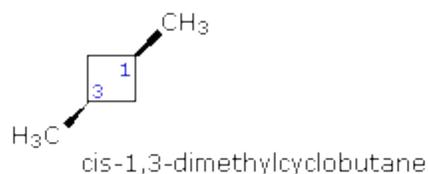


*cis*-1,2-dibromocyclopentane



*trans*-1,2-dibromocyclopentane

Stereoisomers are also observed in certain disubstituted (and higher substituted) cyclic compounds. Unlike the relatively flat molecules of alkenes, substituted cycloalkanes must be viewed as three-dimensional configurations in order to appreciate the spatial orientations of the substituents. By agreement, chemists use heavy, **wedge-shaped** bonds to indicate a substituent located above the average plane of the ring (note that cycloalkanes larger than three carbons are not planar), and a **hatched line** for bonds to atoms or groups located below the ring. As in the case of the 2-butene stereoisomers, disubstituted cycloalkane stereoisomers may be designated by nomenclature prefixes such as *cis* and *trans*. The stereoisomeric 1,2-dibromocyclopentanes shown to the right are an example. In general, if any two  $sp^3$  carbons in a ring have two different substituent groups (not counting other ring atoms) stereoisomerism is possible. This is similar to the substitution pattern that gives rise to stereoisomers in alkenes; indeed, one might view a double bond as a two-membered ring. Four other examples of this kind of stereoisomerism in cyclic compounds are shown below.



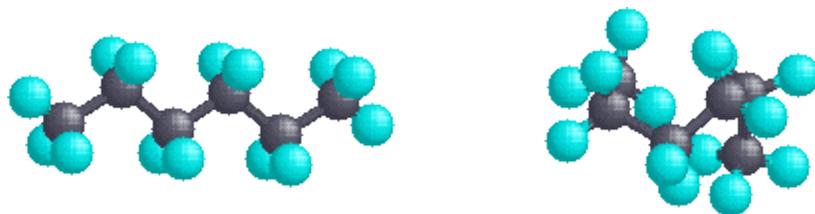
## Conformational Stereoisomers :

Structural formulas show the manner in which the atoms of a molecule are bonded together (its constitution), but do not generally describe the three-dimensional shape of a molecule, unless special bonding notations (e.g. wedge and hatched lines) are used. The importance of such three-dimensional descriptive formulas became clear in discussing configurational stereoisomerism, where the relative orientation of atoms in space is fixed by a molecule's bonding constitution (e.g. double-bonds and rings). Here too it was noted that nomenclature prefixes must be used when naming specific stereoisomers. In this section we shall extend our three-dimensional view of molecular structure to include compounds that normally assume an array of equilibrating three-dimensional spatial orientations, which together characterize the same isolable compound. We call these different spatial orientations of the atoms of a molecule that result from rotations or twisting about single bonds **conformations**.

In the case of hexane, we have an unbranched chain of six carbons which is often written as a linear formula:  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ . We know this is not strictly true, since the carbon atoms all have a tetrahedral configuration. The actual shape of the extended chain is therefore zig-zag in nature. However, there is facile rotation about the carbon-carbon bonds, and the six-carbon chain easily coils up to assume a rather different shape. Many conformations of hexane are possible and two are illustrated below.

Extended Chain

Coiled Chain



Source : <http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/sterisom.htm#start>