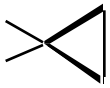
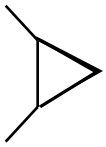
Text Related to Segment 5.03 ©2002 Claude E. Wintner

Here we analyze the set of molecules having constitution defined by the name dimethylcyclopropane. When one attempts to distribute two methyl groups on the framework of a cyclopropane ring, it is evident that from the point of view of constitution there are only two possibilities: 1,1-dimethylcyclopropane and 1,2-dimethylcyclopropane, as in the figure below. The former is an achiral molecule. Furthermore, it will be noted that there is no concern with conformation (other than rotation about the methyl groups), since the three carbon atoms of the ring are limited geometrically to having a rigid planar structure. However, given the constitution 1,2-dimethylcyclopropane, the possibility of configurational variation clearly arises, as a simple geometrical consequence of the plane defined by the ring, in combination with the stereochemical integrity of tetrahedral carbon: the two methyl groups can be on the same side of the ring *(cis),* or on opposite sides *(trans).* These two possibilities are diastereoisomeric. Furthermore, when one addresses the issue of chirality, it is immediately apparent that *cis*-1,2-dimethylcyclopropane is achiral, whereas *trans*-1,2-dimethylcyclopropane is chiral. In fact, at first glance the 1,2-dimethylcyclopropane cases appear to be reminiscent of 3,4-dimethylhexane, and upon closer inspection they certainly are. To see this easily, we have only to imagine tilting the formulae so that the methyl-containing spines of the molecules are facing us in a vertical fashion, as in the alternate view shown in the figure, yielding formulae closely related to the Fischer projection formulae of 3,4-dimethylhexane. As one then would expect by analogy, the stereogenic carbon atoms of the *trans*-1,2-dimethylcyclopropane enantiomers have descriptors R,R or S,S, while the stereogenic carbon atoms of the diastereoisomeric achiral molecule *cis*-1,2-dimethylcyclopropane have descriptors R,S. A convenient, and economical, "dot notation" for such cases also is provided in the figure. **The dot represents "H-up."** (In the video there is, in one place, a "mis-speak" on this point; "H-up" is correct.)

constitution



1,1-dimethylcyclopropane



1,2-dimethylcyclopropane

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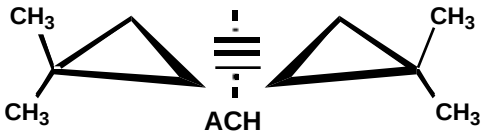
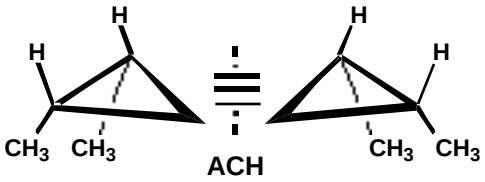
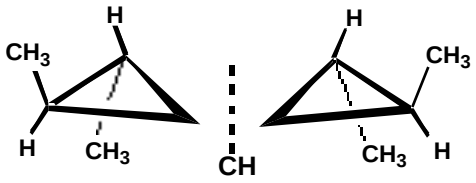
configuration



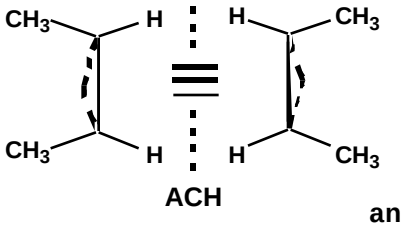
1,1-dimethylcyclopropane



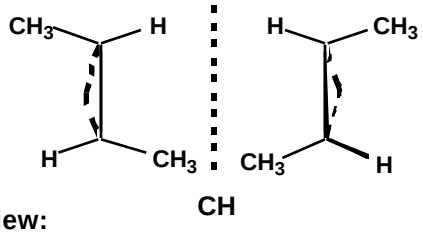
***cis*-1,2-dimethylcyclopropane**

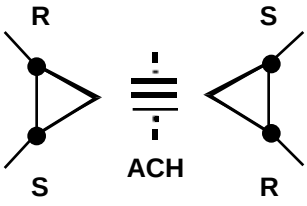


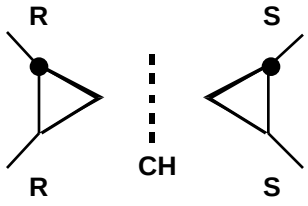
***trans*-1,2-dimethylcyclopropane**



an alternate view:







another convenient notation:

● = "H up"

constitution and configuration of dimethylcyclopropanes