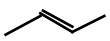
STEREOCHEMICAL REPRESENTATION

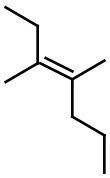
Stereochemistry is an important aspect of Organic Chemistry and you must be able to draw structures which clearly indicate the stereochemical orientation of the various groups on a molecule. For any given compound there will be a right way and many wrong ways to indicate stereochemistry. This handout gives examples of the correct way to show stereochemistry for alkenes and for cyclic and acyclic alkanes. Incorrect examples are also given to illustrate what is not acceptable.

ALKENES: Alkenes contain a carbon-carbon double bond. The carbons are sp^2 hybridized, therefore the geometry at those carbons is trigonal planar: all three substitutents attached to a carbon in a double bond lie in the same plane and are approximately 120˚ apart from each other. Substituents are either cis or Z (same side) or trans or E (opposite side) to each other. You cannot draw an alkene in a linear form and say the groups are cis or trans---it must be drawn correctly.

Correct

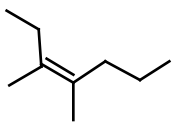


trans



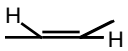
E

cis

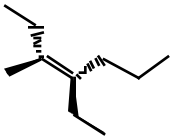


Z

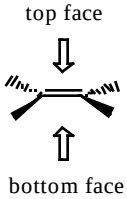
Incorrect



$CH_3CHCHCH_3$---cis

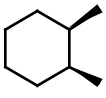


all groups are in the same plane- you don't need to use dashes and wedges on alkenes unless you are making a special point about the faces of the alkene

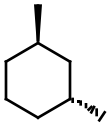


CYCLIC ALKANES: Substituents on a cyclic alkane can be either *cis* or *trans* to each other. You should draw the ring in the plane of the paper (solid lines) and use dashes and wedges to show whether substitutents are above or below the plane of the ring.

Correct

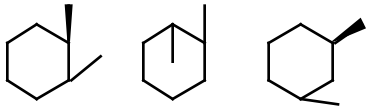


cis

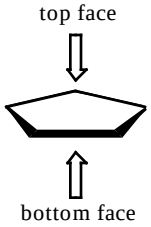


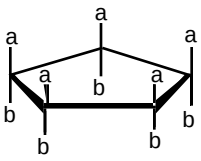
trans

Incorrect

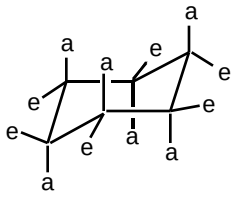


On occassion you may wish to distinguish the faces of a cycloalkane.



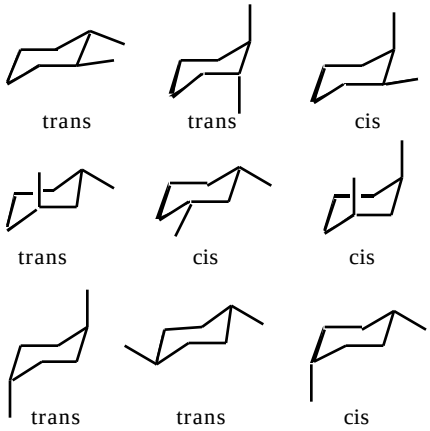


CYCLOHEXANE: For cyclohexanes you may be asked to draw a chair, in which case all substituents must be either axial or equatorial. The following is the correct way to draw chair cyclohexane. Note how the axial and equitorial substituents off each carbon are represented.

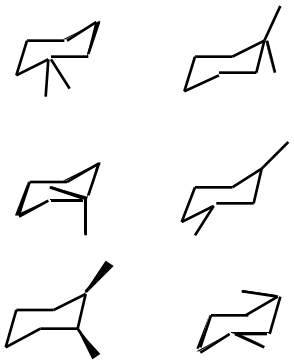


Disubstituted chair cyclohexanes:

Correct

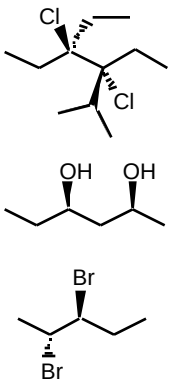


Incorrect

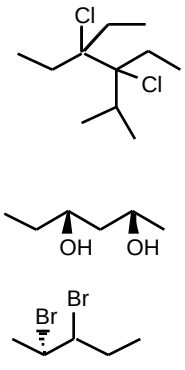


LINEAR ALKANES: You should draw the backbone in the plane of the paper, and draw substituents either coming towards you (with wedges) or going away from you (with dashes). Note that each carbon should look like a tetrahedron.

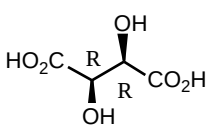
Correct

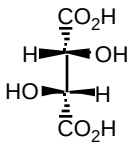


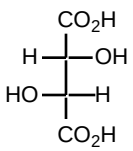
Incorrect



It is also acceptable to represent acyclic structure as Fischer Projections. 2R,3R-tartaric acid can be drawn in the forms below. Familiarize yourself with these representations.







Fischer Projection