Newman Projections

A Way to Analyze Noncyclical Conformations

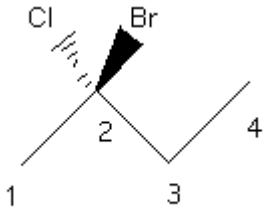
Conformations

Conformations are the different positions a molecule can bend into. Atoms and bonds remain the same on the molecule, the only variation is the angles in which certain parts of molecule are bent or twisted. Molecules have conformations with high strain as well as conformations with low strain. High strain conformations are when certain parts of the molecule that repel are forced to be close to one another. Molecules, therefore, want to have a low strain structure.

Newman Projections are one way to look at the conformation of a noncyclical molecule.

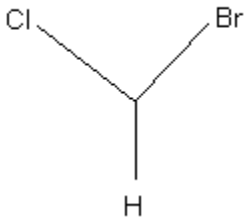
How do I make a Newman Projection?

1) First, you will need a molecule with a small chain of carbons such as this one:

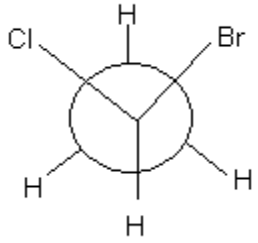


2) Then, you will need to line up two of the center carbons. For this case, we will line up the 2 and 3 carbon as labeled on the above image. The 2 carbon will be in front, and the 3 carbon will be in the back.

3) Draw the front carbon first and all its attachments. The angles between each attachment should be about 120 degrees.



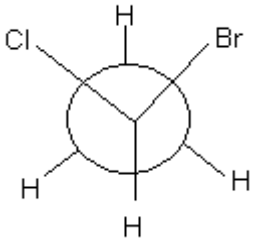
4) Then draw in the back carbon and all its attachments. To do this, first draw a circle to indicate the back carbon, and then add the back carbon's attachments as branches to the circle.



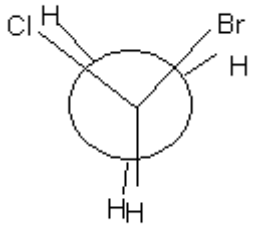
5) Now you have completed one drawing of a Newman Projection. However, this is only one example of a possible conformation a molecule can have. There are various other conformations that can be drawn with Newman Projections.

What are the other possible Newman Projections?

There are two Newman Projections that are of primary concern. The one you drew above is the "staggered" conformation for the molecule. The other projection that is of primary concern is the "eclipsed" structure.



STAGGERED

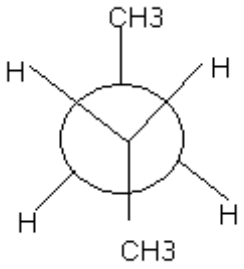


ECLIPSED

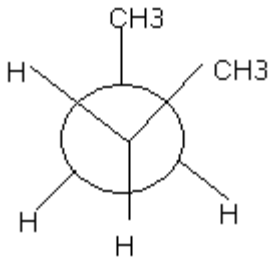
The staggered structure has reduced strain in the molecule because it more evenly spaces out its attachments, reducing repulsion between the front carbon's attachments and the back carbon's attachments.

The eclipsed structure, however, is less favorable because it forces more interactions between the front and back attachments, creating more strain. Angles between the front and back attachments can be anything, creating a huge possibility for New Projections for a single molecule.

There are also other factors that play into the Newman Projection. These include the kind of attachments on a molecule. If there is a chain of carbon as an attachment in both the front and back carbon, and the attachments are 60 degrees apart, this is considered a gauche conformation. If the carbon attachments are on opposite ends, 180 degrees apart, this is considered an anti conformation. The interactions between these chains are carbon are called gauche interactions and anti interactions respectively.



ANTI



GAUCHE

<u>Why are there different Newman Projections for one molecule?</u>

Because the carbons are linked by single bonds, the bond is able to freely rotate, allowing for various conformations to exist.