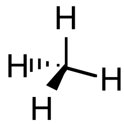
Model Building-Week 1 laboratory

1.) Methane CH_4

tetrahedral

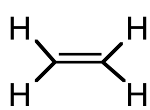
bond angles = 109.5

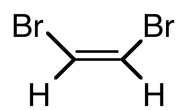
wedge-dash diagrams

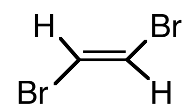


2.) Ethene

CH_2CH_2 — *cis*-1,2-dichloroethene — *trans*-1,2-dichloroethene



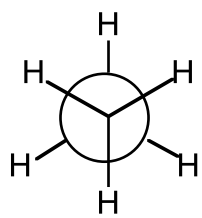


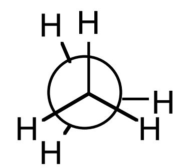


3.) Ethane CH_3CH_3

Newman projections

Eclipsed vs. staggered conformations

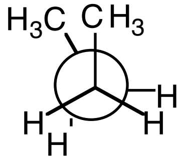


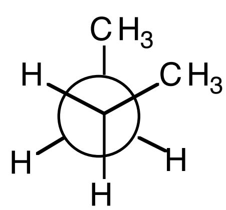


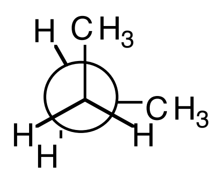
STAGGERED — ECLIPSED

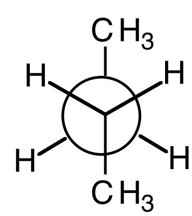
4.) Butane $CH_3CH_2CH_2CH_3$

Eclipsed — Staggered gauche — Eclipsed — Staggered anti





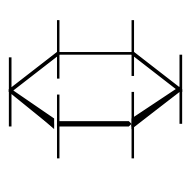


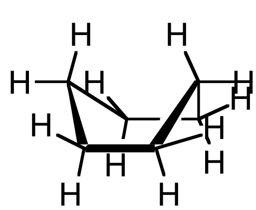


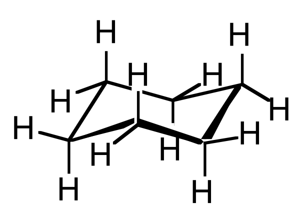
5.) Cyclohexane

Which conformation is the most stable (least strained?)

Planar — Boat — Chair







Arrange the ring into a chair conformation and rest it on the desktop. How many H's are in contact with the desk? How many hydrogens point in a direction 180 degrees opposite to these?

Take your pencil and place it into the center of the ring perpendicular to the desk. Now, rotate the ring around your pencil (the axis of rotation). How many H's are on bonds parallel to this axis? These are called axial hydrogens and the bonds are called axial bonds.

If you look at the perimeter of the cyclohexane system, the remaining H's are roughly in a ring perpendicular to the axis through the center of the molecule. How many H's are on bonds lying in this ring? These are called equatorial hydrogens.

Put a substituent on two adjacent carbons in axial positions. Are they cis or trans to each other? Do a ring flip and see what happens to the substituents. Are they now axial or equatorial? Has the original cis or trans geometry changed? Try this starting with a different substitution pattern.

Replace one substituent with a CH_3 group. Compare different conformations, discussing why one is lower in energy (more stable) than the other.