Organic Chemistry I – Jasperse Newman Projection Practice
(See page 4 for some summary of operations/steps for handling Newman projections)

A. For each of the following, draw the best and worst Newman projection, relative to the bond indicated.

1. Butane, relative to the C2-C3 bond

2. 1-chloropropane, relative to the C1-C2 bond

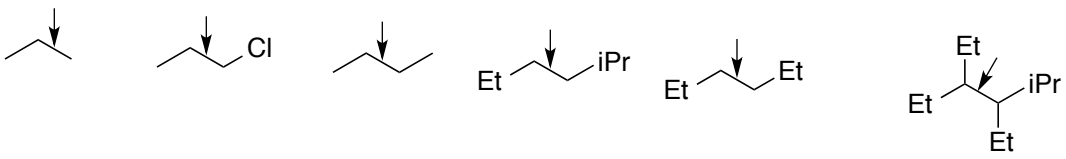
3. 2-methylbutane, relative to the C2-C3 bond

4. 2,2-dimethylbutane, relative to the C2-C3 bond

5. 2-chloro-2-methylpentane, relative to the C2-C3 bond
Note: Cl is smaller than methyl

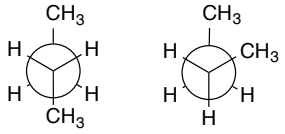
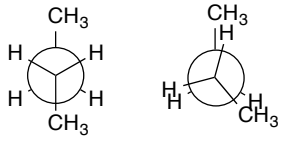
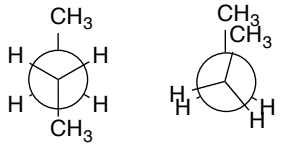
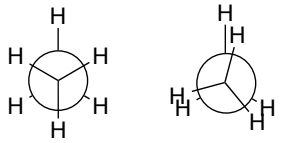
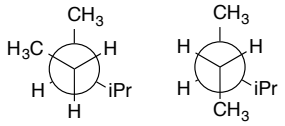
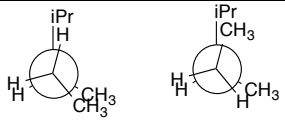
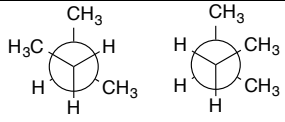
B. Rotation Barriers.

6. Rank the rotation barriers relative to the indicated bonds, with 1 have the largest barrier
   - For convenience, Et = ethyl and iPr = isopropyl
   - Assume that a halogen, OH, or NH_2 is smaller than a CH_3 or any other alkyl group.



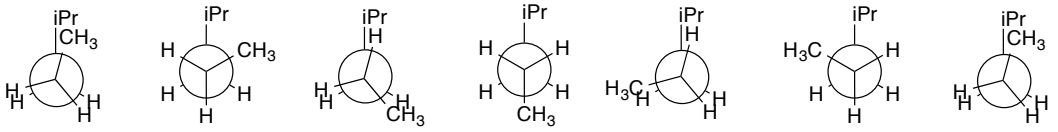
C. For each of the following, use the words torsional and/or steric to explain why the first conformation is more stable than the second. (The answer key and explaining video will be a bit more detailed as appropriate.)

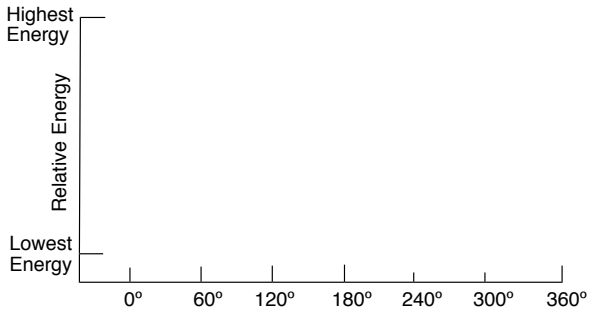
a. For each, note if any "total eclipse" steric interactions exist (two non-hydrogens eclipsing)
b. For each, note if any "gauche" steric interactions exist (two non-hydrogens gauche)

7.		
8.		
9.		
10.		
11.		
12.		
13.		

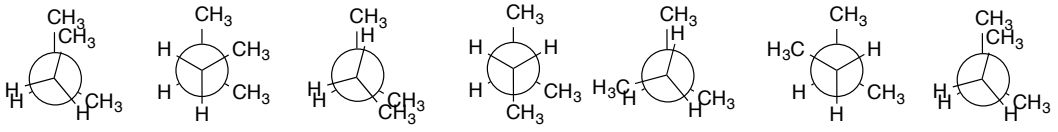
D. Newman Projection Energy Diagrams.

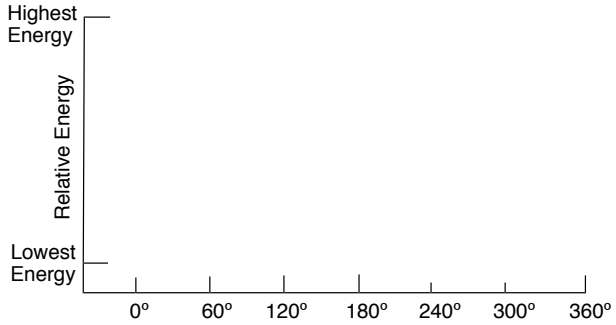
14. Draw a qualitative energy diagram for $CH_3CH_2CH_2CH(CH_3)_2$, relative to the bond between the two CH2 carbons. The Newman projections are drawn below, using "iPr" as an abbreviation for the isopropyl $CH(CH_3)_2$ group. Put "S" (for staggered) by any "staggered" conformation, and "E" (for eclipsed) by an eclipsed conformation.



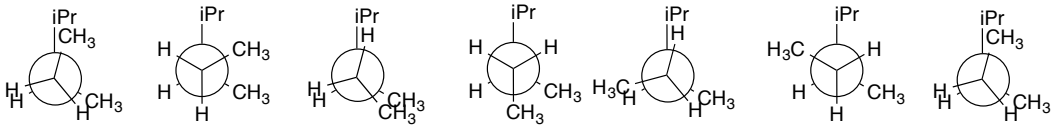


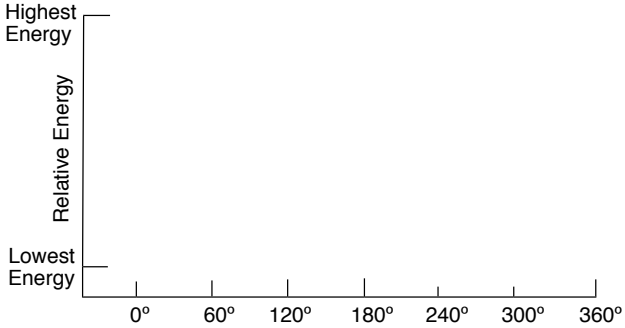
15. Draw a qualitative energy diagram for $CH_3CH_2CH(CH_3)_2$, relative to the C2-C3 bond. The Newman projections are drawn below.





16. Draw a qualitative energy diagram for $CH_3CH_2CH(CH_3)CH(CH_3)_2$, relative to the bond between the CH_2 and CH carbons. The Newman projections are drawn below, using "iPr" as an abbreviation for the isopropyl $CH(CH_3)_2$ group.





Organic Chemistry I Jasperse Newman Projections and Cyclohexane Chairs. Steps.

Steps for processing a di-substituted cyclohexane chair:

Summary: Draw chairs; install sticks; install substituents appropriately

1. Draw both "right-" and "left-handed" chairs
2. Draw in "axial" sticks on the relevant carbons; then draw in "equatorial" sticks on the relevant carbons
   - Use the left-most carbon for your first substituted carbon
3. On the left-most carbon, put your first substituent in on both chairs.
   - It should be equatorial in the "right-handed" chair, and axial in the other.
4. Use "upper/downer" logic to decide whether the second substituent belongs eq or ax on the first chair (then make it the opposite on the second chair)
   - Draw in the H's on the relavent carbons
5. Are the two substituents eq/eq, eq/ax, or ax/ax? This will help recognize relative stability
6. If one subst. is forced axial, the preferred chair has the bigger subst. equatorial
7. The best cis vs trans isomer has both substituents equatorial.
8. **Note: To draw and identify the best cis versus trans, just draw a chair with both groups equatorial, and then identify whether that is cis or trans**

Steps for Drawing the Best Newman projection

Summary: Draw staggered sticks; install substituents appropriately

1. Draw a staggered Newman projection, with three sticks on the "back" carbon and three on the "front". Have a stick up on the back carbon, and one down on the front.
2. Draw your biggest substituent on the back carbon on the "up" stick
3. Draw your biggest substituent on the front on the "down" "anti" stick
4. Fill in the other two back attachments on the other two back-carbon sticks.
5. Fill in the other two front attachments on the other two front-carbon sticks.

Steps for Drawing the Worst Newman projection

Summary: Draw eclipsed sticks; install substituents appropriately

1. Draw an eclipsed Newman projection, with three sticks on the "back" carbon and three on the "front". Have a stick up on both the back and front carbons.
2. Draw your biggest substituent on the back carbon on the "up" stick
3. Draw your biggest substituent on the front on the "up" "totally eclipsed" stick
4. Fill in the other back and front attachments.

Note: The more severe the eclipsing in the "worst" projection, the greater the rotation barrier

Tips for creating a Newman Projection Energy Diagram

1. Use the "worst" (totally eclipsed version) as 0º and 360º.
2. 120º and 240º will be the other "eclipsed" conformations => energy crests.
3. 60º, 180º, and 300º will be the staggered conformations => energy valleys
4. 60º and 300º will be the other two staggered conformations (gauche) => energy valleys.
5. To compared the relative energies of the eclipsed crests, evaluate the sizes of the eclipsing substituents (when two non-hydrogens eclipse) and
6. To compare the relative energies of the staggered valleys, evaluate the number/severity of gauche interactions