

Massachusetts Institute of Technology

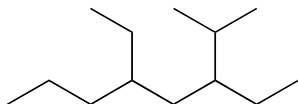
5.12: Organic Chemistry I

Fall 2008, S. O'Connor

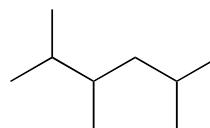
Problem Set 2  
Key Posted: Monday September 15, 2008

1. Provide the correct name for each alkane.

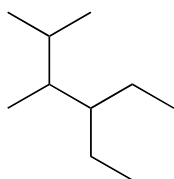
a)



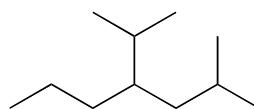
b)



c)



d)



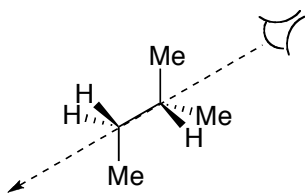
2. For each of the following molecular formulas, provide the degrees of unsaturation and draw two possible constitutional isomers.

a)  $C_5H_8$

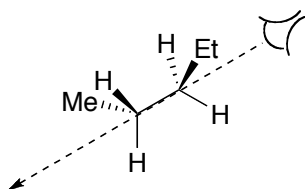
b)  $C_6H_{10}$

3. For each of the following molecules, draw a Newman projection to represent the conformer shown with respect to the indicated bond.

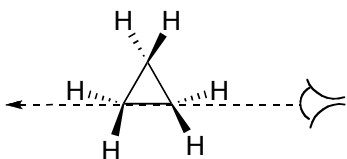
a)



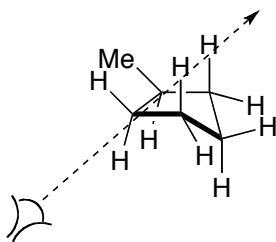
b)



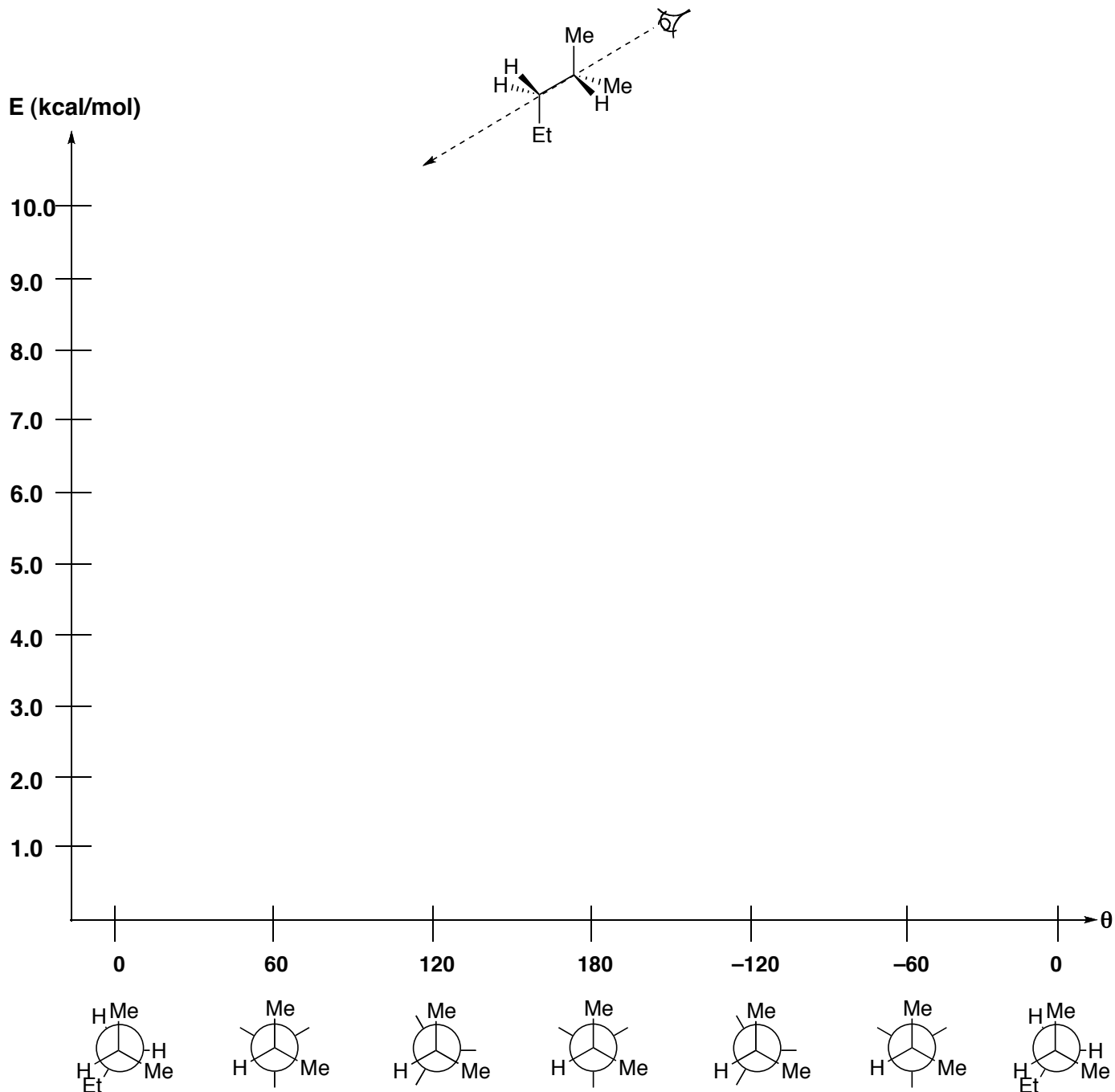
c)



d)

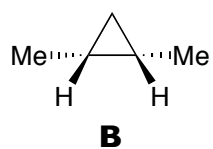
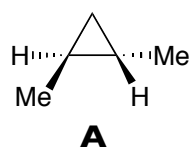


- 4. a)** Draw a potential energy diagram for rotation around the C2–C3 bond of 2-methylpentane. (Assume that the ethyl group behaves like a methyl group.)
- b)** Fill in the substituents on the Newman projections below ( $\theta$  = the dihedral angle between Et and H). (This should help you to predict the energies of the different rotamers.)





- c)** What is the barrier to rotation around the C2–C3 bond?

5. Which would you expect to be **more stable**, 1,2-*trans*-dimethylcyclopropane **A** or 1,2-*cis*-dimethylcyclopropane **B**? Use Newman projections to explain your answer.





6. a) The ring strain of cyclopropene is much higher than that of cyclopropane. Using the definition of ring strain, provide an explanation for this large difference in ring strain.

**Ring Strain**

<b>cyclopropane</b>	<b>cyclopropene</b>
	
<b>27.6</b> kcal/mol	<b>55.2</b> kcal/mol

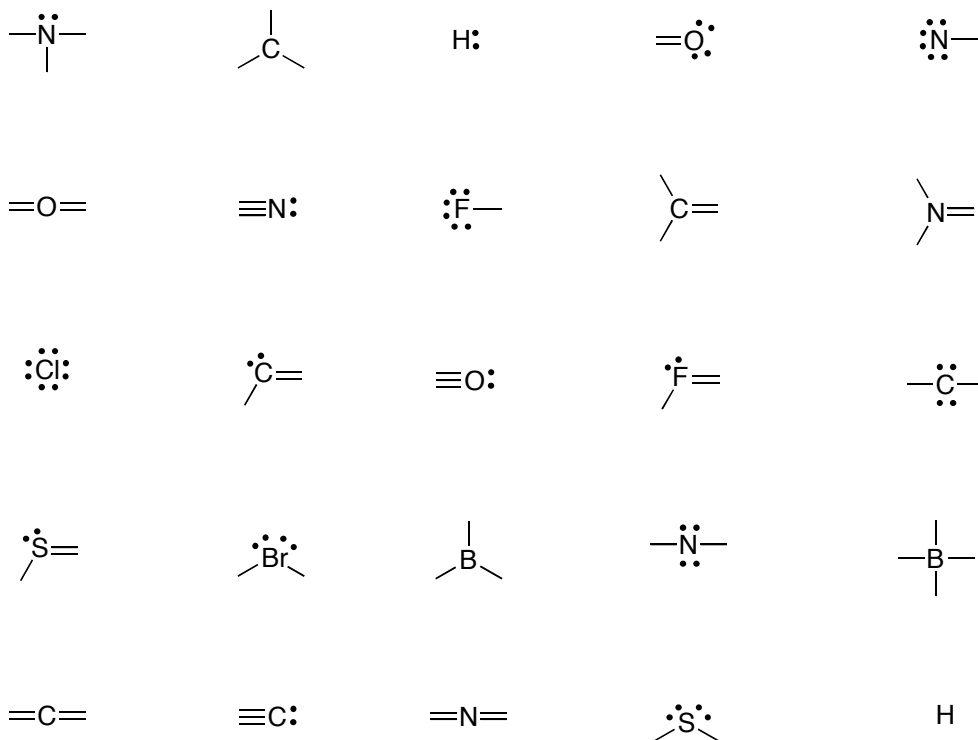
b) In contrast to the three-membered ring analogue, cyclopentene is slightly **less strained** than cyclopentane. Once again, provide an explanation for this observation.

**Ring Strain**

<b>cyclopentane</b>	<b>cyclopentene</b>
	
<b>6.5</b> kcal/mol	<b>4.1</b> kcal/mol

And a review from last week.

7. Assign formal charges to each atom below. Note that formal charges of greater than + or - 1 are generally not considered reasonable.



Draw in all lone pairs of electrons. Provide the missing acids and bases for the reaction. Circle the side of the reaction that is favored at equilibrium.

