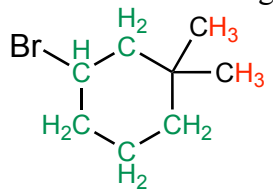
Organic Chemistry for Life Sciences: CHM 223 Section A

Problem Set Chapter 4

Name_____

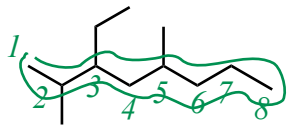
DUE: Wednesday September 20 @ 8 am

1. Answer the following questions based on the structure of the molecule below:

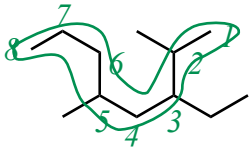


a. Number of primary hydrogens present? 6. (in red)
b. Number of secondary carbons present? 5 (in green)
c. Number of tertiary hydrogens present? 0. There are no 3° carbons, so there are also no 3° hydrogens

2. Systematically name the two compounds below and determine their relationship:



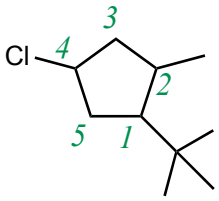
3-ethyl-2,5-dimethyloctane



3-ethyl-2,5-dimethyloctane

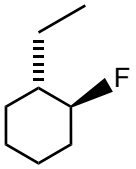
same name = **identical molecules!**

3. Provide the IUPAC name for the compound below as completely as possible:



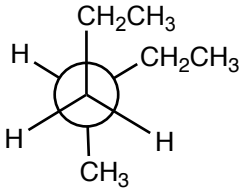
1-tert-butyl-4-chloro-2-methylcyclopentane

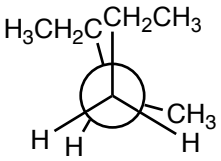
4. Provide the IUPAC name for the compound below as completely as possible:



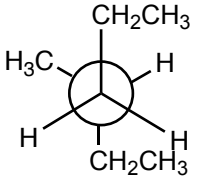
trans-1-ethyl-2-fluorocyclohexane

5. Predict the LEAST and MOST stable conformation (draw a Newman projection) for the compound given below using the templates provided:





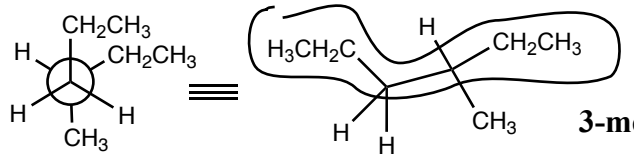
LEAST STABLE



MOST STABLE

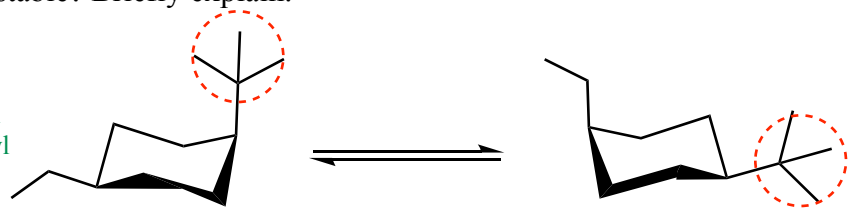
- the least stable Newman projection will ALWAYS be a eclipsed conformation where torsional strain energy is maximized
- the least stable eclipsed conformation is the one in which the largest groups (in this case the ethyl groups) are eclipsed on top of one another
- the most stable Newman projection will ALWAYS be a staggerred conformation where torsional strain energy is minimized
- the most stable staggered conformation will be where the two largest groups are anti relative to one another

6. Provide the IUPAC name for the compound in question 5.



3-methylhexane

7. Draw the two chair forms for cis-1-tert-butyl-4-ethylcyclohexane.
Which is most stable? Briefly explain.

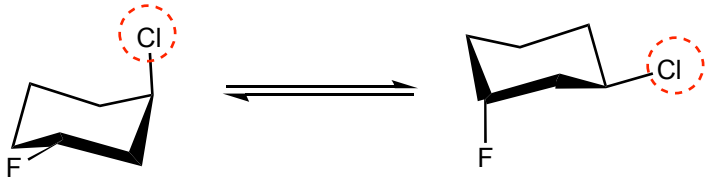


• axial tert-butyl
• equatorial ethyl

• axial ethyl
• equatorial tert-butyl

MORE stable chair conformation because it places the larger tert-butyl group in the equatorial position where 1,3-steric interactions are minimized

8. Draw the two chair forms for trans-1-chloro-3-fluorocyclohexane.
Which is most stable? Briefly explain.



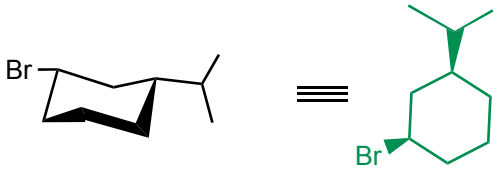
• axial Cl substituent
• equatorial F substituent

• axial F substituent
• equatorial Cl substituent

size Cl > F

MORE stable chair conformation because it places the larger Cl substituent in the equatorial position where 1,3-steric interactions are minimized

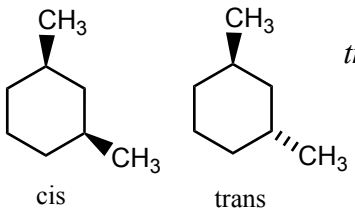
9. Name the following compound as completely as possible according to IUPAC rules:



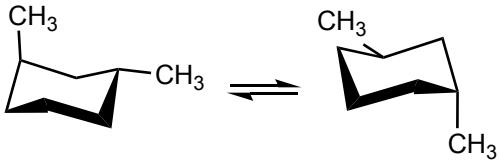
***cis*-1-bromo-3-isopropylcyclohexane**

10. After 3 seconds of hard thought (i.e. 3 more seconds than usual), Jimmy says *cis*-1,3-dimethylcyclohexane is less stable than *trans*-1,3-dimethylcyclohexane since the two methyl groups in the *cis* isomer, being on the same side of the ring, are closer together than they are in the *trans* isomer. According to Jimmy, if the two methyl groups are closer together, the steric energy will be greater, making the *cis* isomer less stable. Is Jimmy correct? why or why not? (HINT: consider the MOST STABLE chair forms of the two compounds).

Jimmy

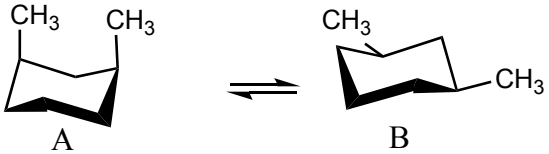


trans isomer:



•in both chairs, one methyl is equatorial and one axial

cis isomer:



• in chair form A, both groups are axial (very bad), but in B, both groups are equatorial! This is much more stable than the best situation for the trans isomer, so the cis isomer is more thermodynamically stable! Sorry Jimmy!