Course 343 Lecturer Hackenberger

Day Monday Date 10/21/13

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Last Lecture:

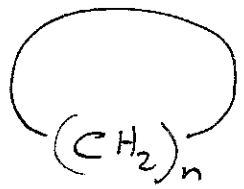
- introduction of diastereomers (2^n stereoisomers)
- meso compounds
- Ways to obtain enantiomers (stereoisomeric salts)

Additional office hours before exams:

Friday, 25th October 12:15pm ~ 1:30pm

Today — Cyclic Compounds

Cyclo alkanes:



$n = 3, 4 \ldots$

- △ cyclopropane
- □ cyclobutane

Stability of cyclo alkanes → look at $(\Delta H_f)^\circ$ for linear alkanes

$CH_3(CH_2)_nCH_3$ with increasing n → $(\Delta H_f)^\circ$ increases 5.0 kcal/mol

look at cyclo alkane (table 7.1 in text)

	ΔH_f per CH_2
△	+42 } high energy strain
□	+17 } high energy strain
⬠	-37
⬡	-5.0 → same ΔH_f as for linear alkanes → very stable
C_{7H} higher	-3.5 ~ -4.6

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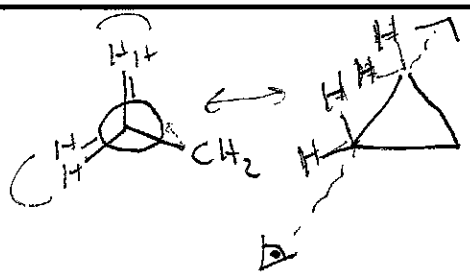
Cyclopropane:

60°

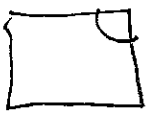
high angle strain



locked into an eclipsed conformation

∴ very high torsional strain

Cyclobutane:



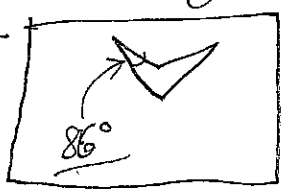
90°

flat molecule would caused high torsional strain (eclipsed)

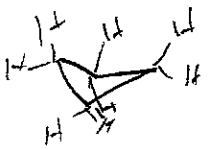
→ but molecule not completely flat

slightly puckered

↳ reduces torsional strain, but increases angle strain



86°



Cyclopentane:

180° → would be okay w/ angle strain if flat compound

puckering effect

envelope conformation to reduce the torsional strain

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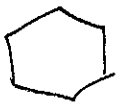
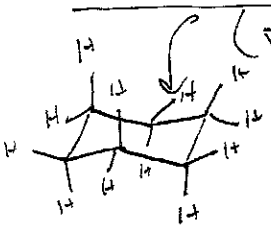
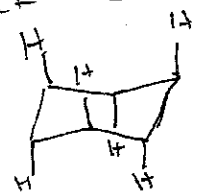
Cyclohexane

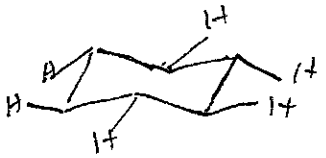


→ chair conformation → no internal strain (perfect ~ 5.0 kcal/mol ΔH_f°)



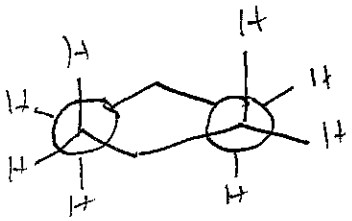


axial hydrogens (ax)



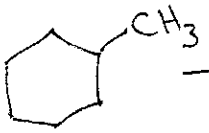
equatorial hydrogens (eq)

newman projection

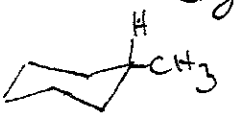


→ staggered conformation energy minimized

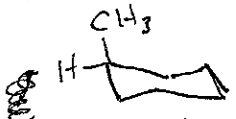
(conformations can flip passing higher E intermediates)



methylcyclohexane → two low energy conformations

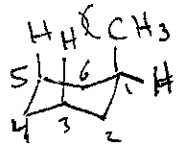


Me is equatorial



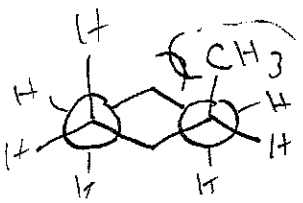
axial

Which conformation is lower in E? → di axial interaction



1,3 diaxial strain (also strain from 1,5) (interaction)

this is non favorable (imagine if another H was a CH_3)



→ gauche interaction when axial

not present when equatorial

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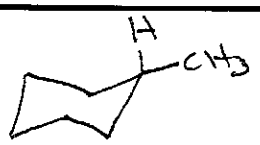
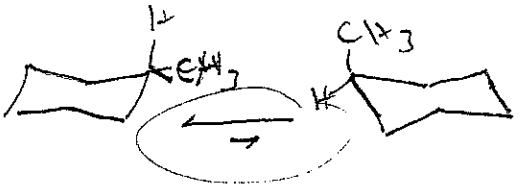
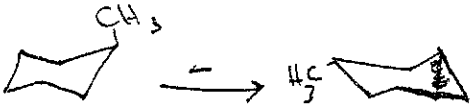


→ equatorial more favorable conformation, lacks 1,3 diaxial strain



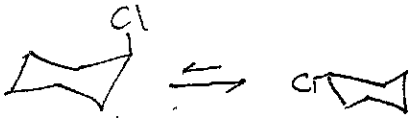
eqlibrium favors the equatorial in solution

look at different substituents

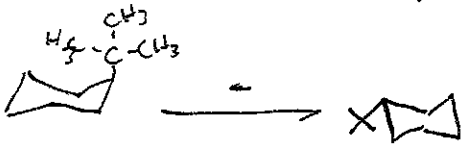


ΔG

−1.8 kcal/mol

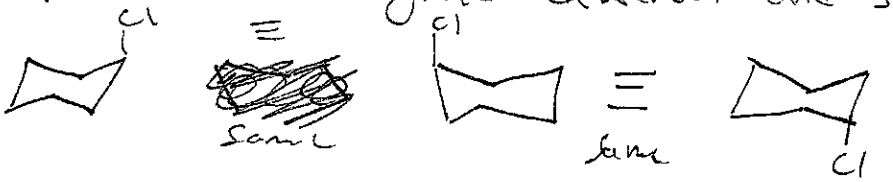


−0.4 kcal/mol (Cl smaller than CH_3)

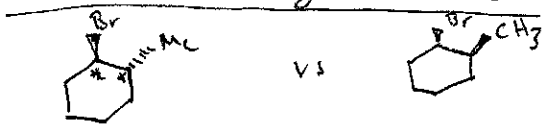


−5.0 kcal/mol (locked in equatorial conformation)

it is important to recognize different and same conformation



D: substituted cyclohexanes



trans

more stable

↓

almost no 1,3 diaxial conformation

cis

→ draw chair conformation for both derivatives