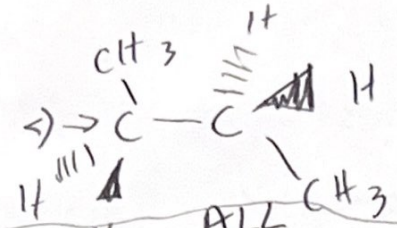
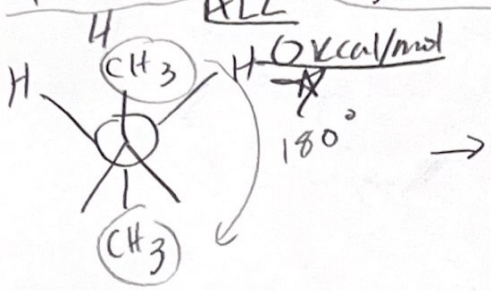
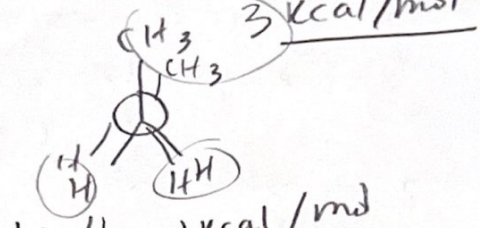
Lecture 9 | Alkanes

Ethane - All staggered & eclipsed conformations = energy

Butane:



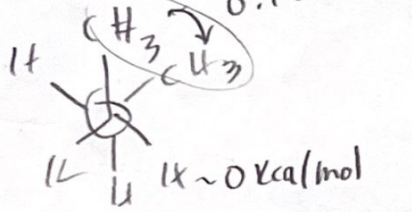


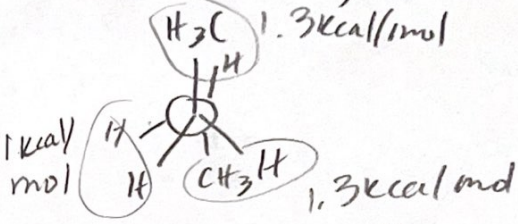


"Anti" ~0 kcal

~5 kcal total

"Totally" Eclipse ~5 kcal





Gauche ~0.9 kcal

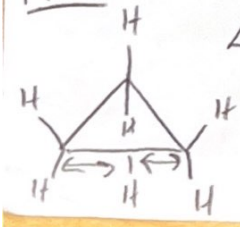
"Eclipse" ~3.6 kcal

Cycloalkanes

Struct. & energy - size & #C on Rings dictate this.

Ex: Cyclopropane

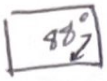
Planar



△ 60° - adds very high Intermolecular Strain on 109.5° ideal bond angle due to ~~sp3~~

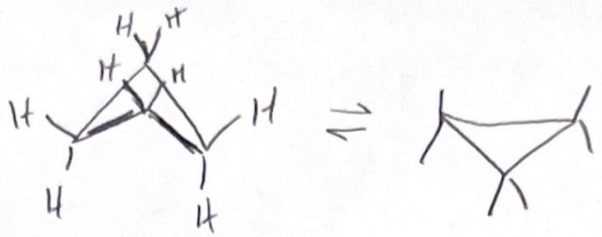
pairs of eclipsed C-H interactions.

Cyclobutane



⇓

not planar in 3D



almost eclipse

Puckered ~~or~~ Butterfly conformations:

(1) - ↓ in torsional strain with eclipsed interactions.

(2) ↑ angle strain caused by comp. of C-C-C bond angles.

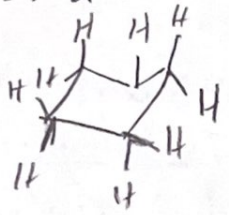
=> 26.3 kcal/mol

Cyclopentane

⇓

not planar

Strain energy: 6.5.



Puckered (envelope) Conformation.

Cyclohexane

⇓

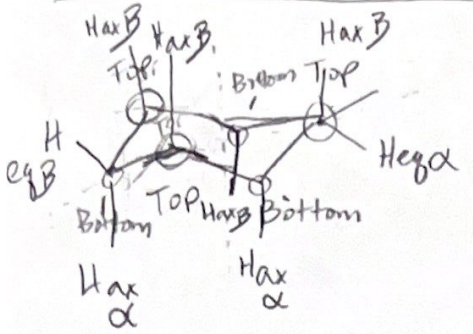
- Not planar
- C-C-C angle aprox 109.5

=> Adopts a # of puckered conformations that interconvert via C-C rotations.

⇓

most stable is chair Conformation

Chair conformation of Cyclohexane

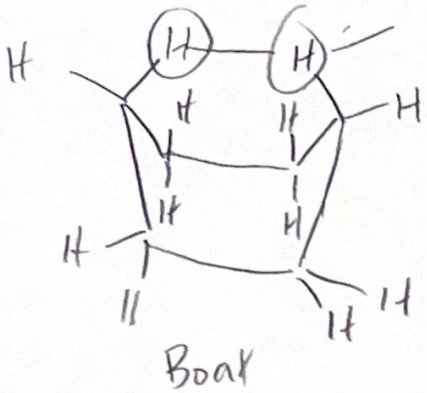


Axial - Vertical

equatorial (eq)

Up - B — eq B

Down - α — eq α



Flagpole H's

Twist - Boat