Chapter 33 — Stereoselective reactions of cyclic compounds: Part A

- Stereoselective reactions for acyclic and cyclic compounds
  (25 picoseconds in the life of a ketone)
- 4-membered rings
- 5-membered rings, and stereoselectivity in epoxidations
- Enantiomers, diastereomers, and reaction selectivity
- Saturated 6-membered rings: chair conformations, A-values
- Equatorial vs. axial selectivity for small and large reagents

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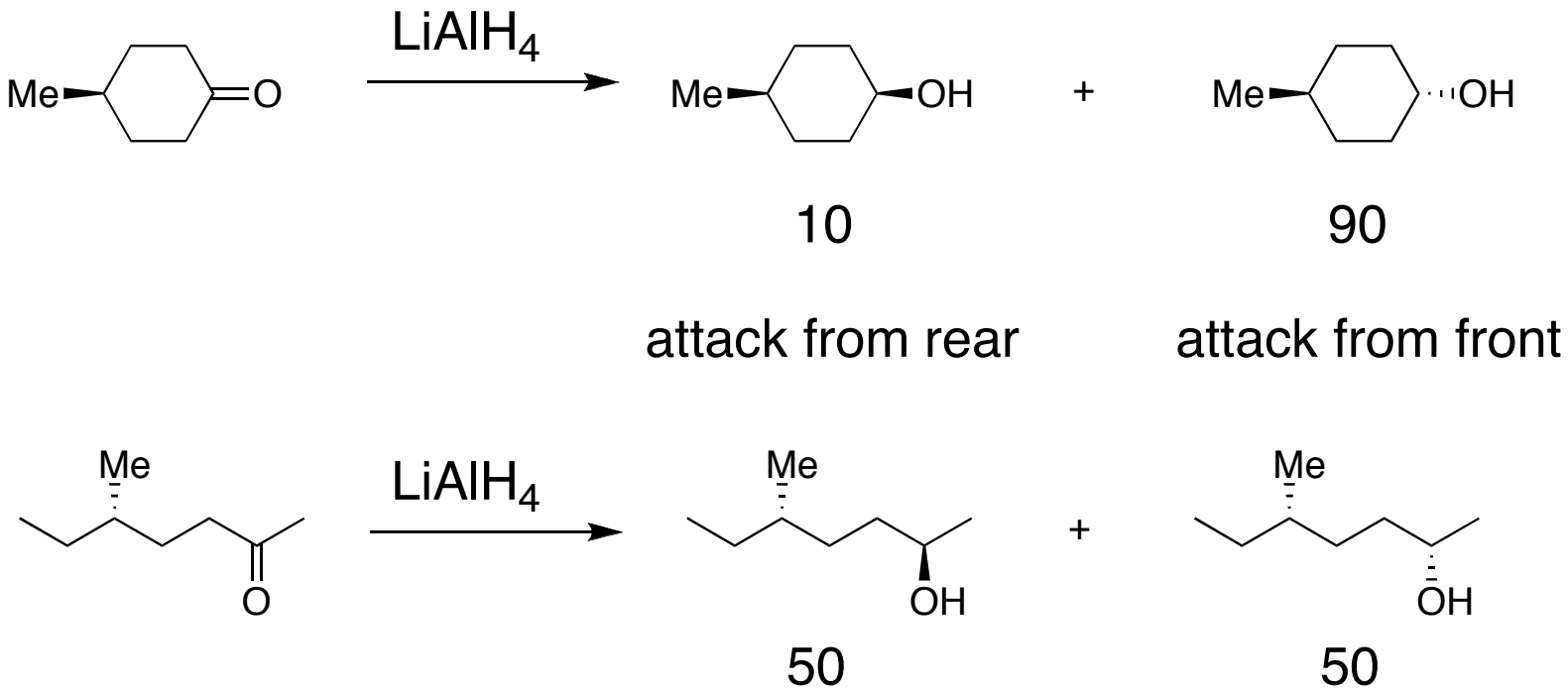
Reading guide:

Ch. 18 Read only pages 457–474

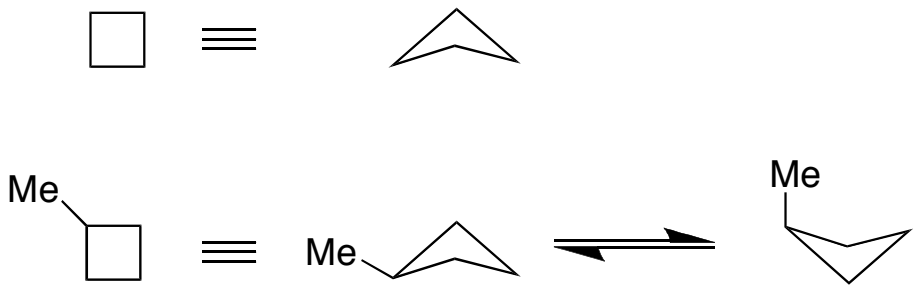
Ch. 33 Skip section on unsaturated 6-membered rings (858–861)

Cyclic vs. Acyclic



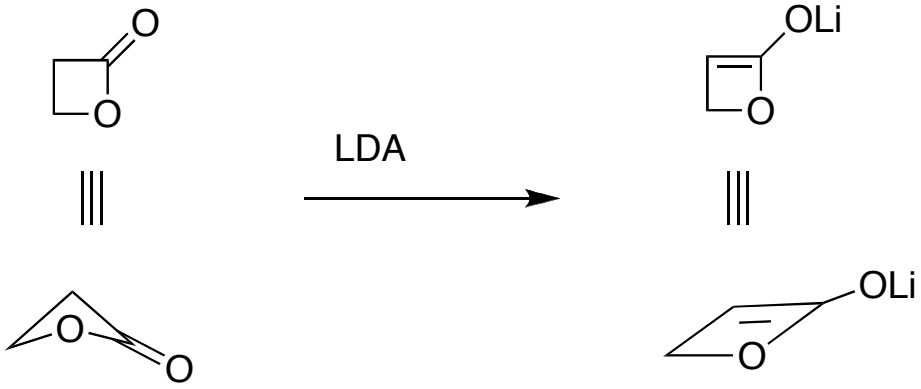
Stereoselectivity in flexible acyclic compounds is possible, but much harder to understand… we'll handle cyclic compounds in this chapter

4-membered rings



Saturated 4-membered rings:

puckered squares

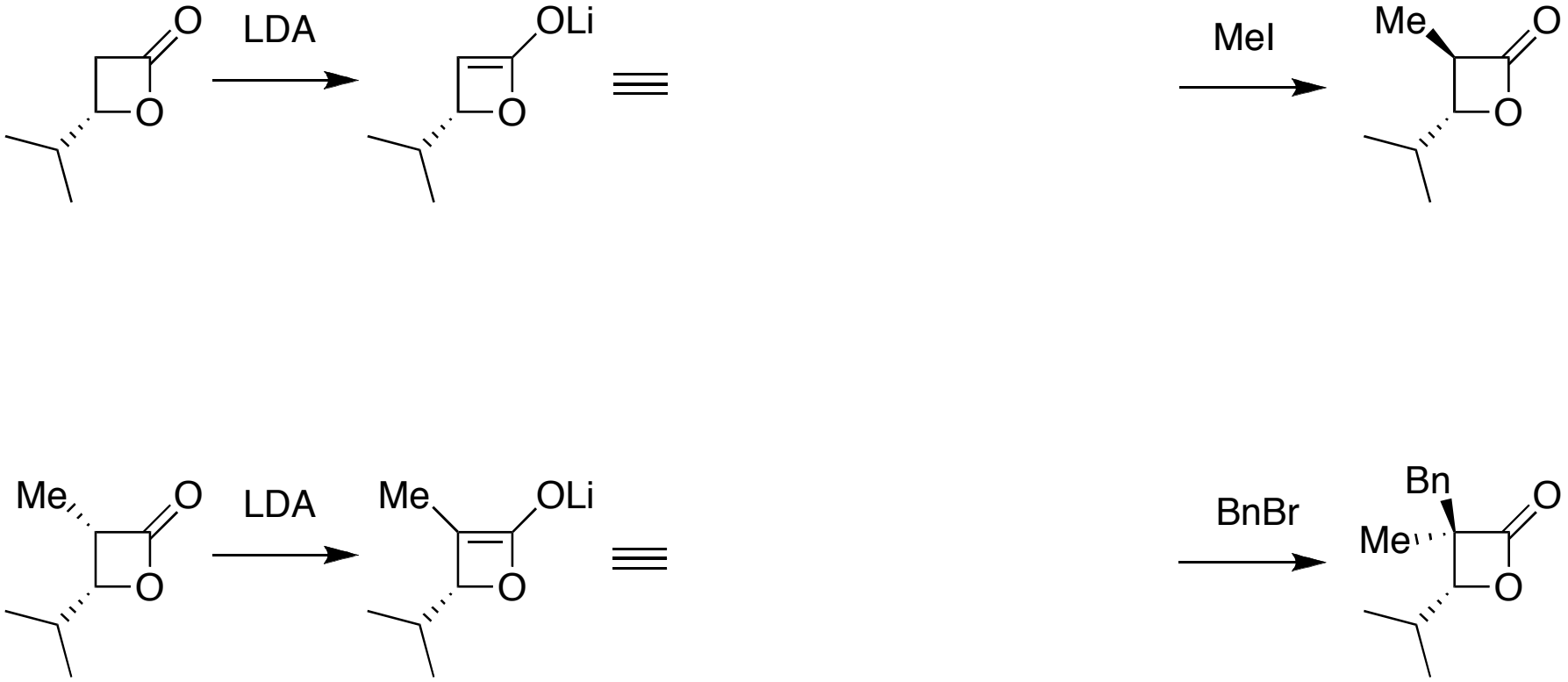


Unsaturated 4-membered rings:

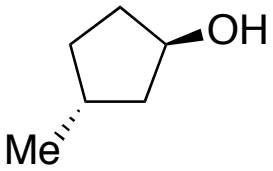
essentially flat

Reactions of unsaturated (flat) 4-membered rings

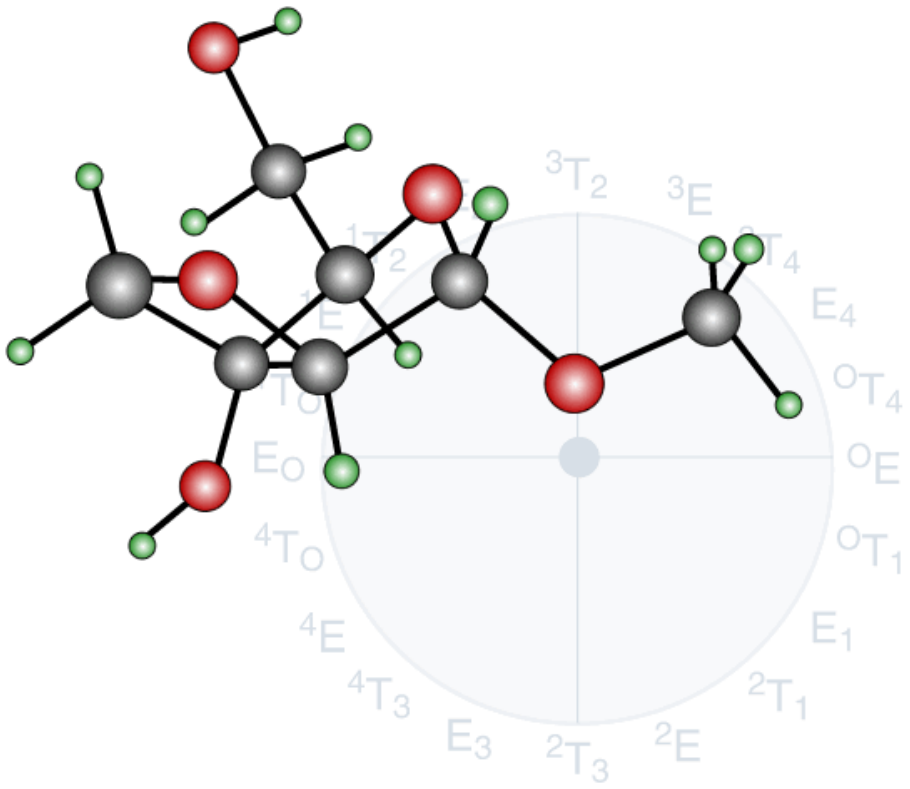
Attack of Nucleophile or Electrophile from least hindered face

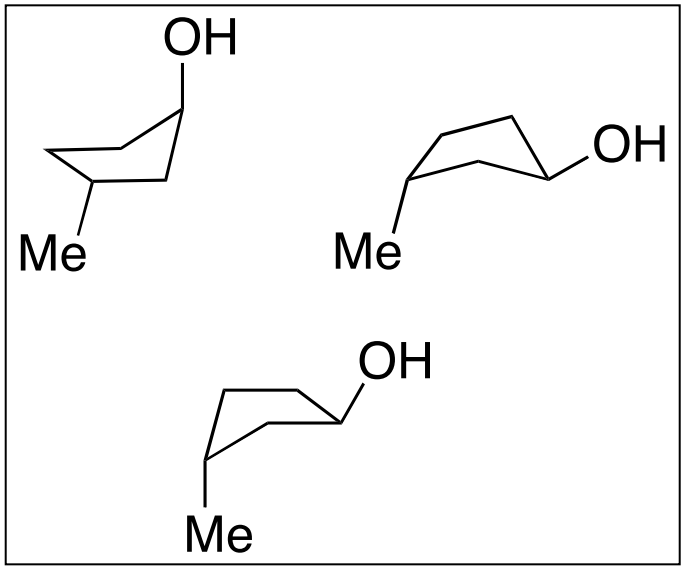


Saturated 5-membered rings: envelopes

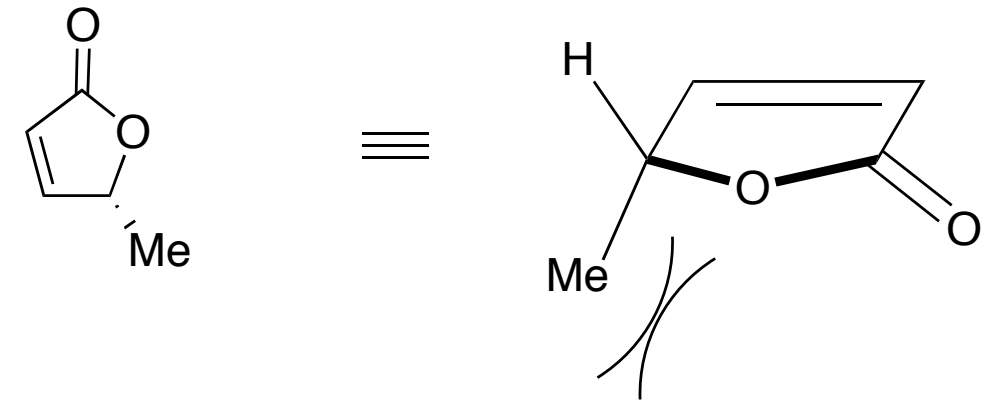


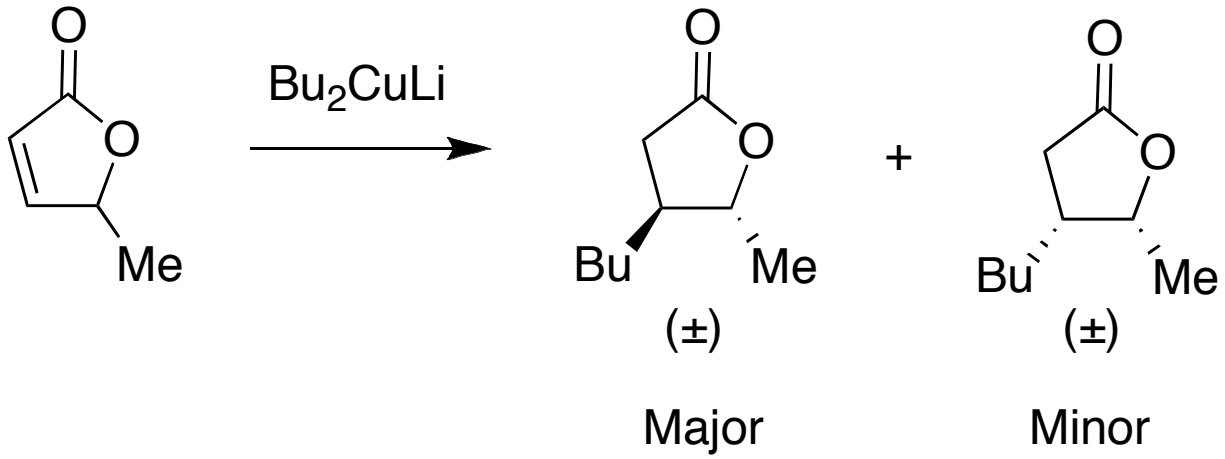
≤ 20 conformations





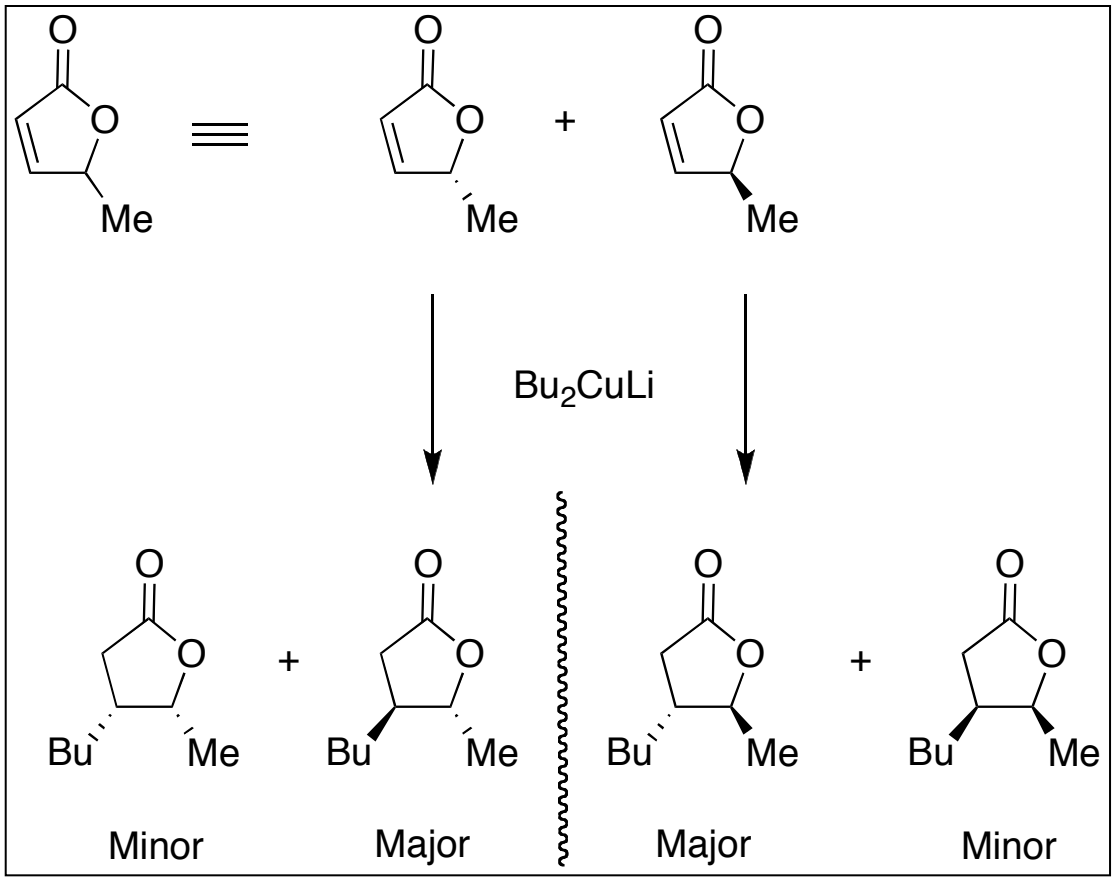
Unsaturated 5-membered rings — basically flat





Enantiomers, Diastereomers, and Stereoselectivity 1.

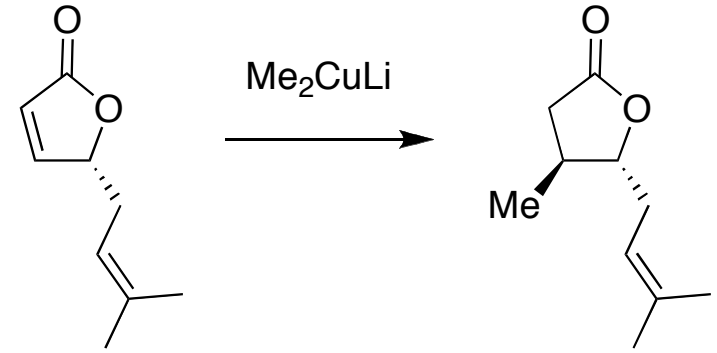
Racemic starting materials give racemic products

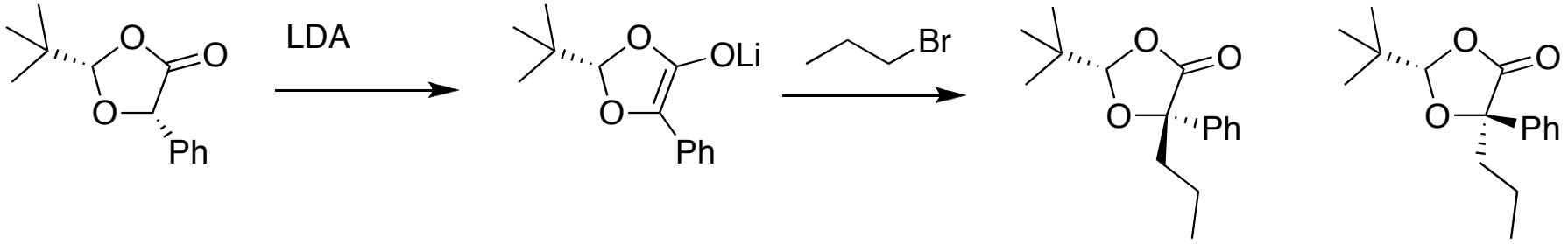


Marking a racemic product with **(±)** is used to avoid having to draw every enantiomer of a molecule with ≥ 2 stereocenters. For molecules with a single stereocenter, don't specify the stereochemistry or use a wiggly line

Enantiomers, Diastereomers, and Stereoselectivity 2.

Enantiopure starting materials can give enantiopure products

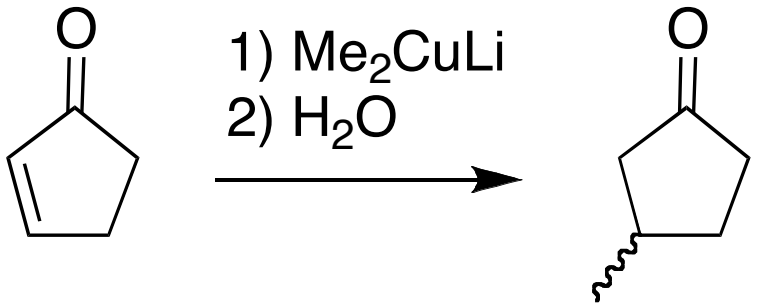


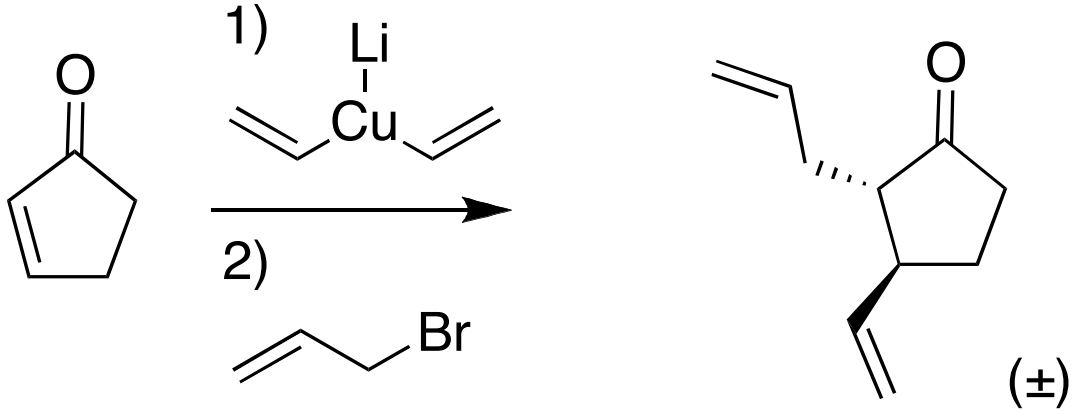


Major Minor

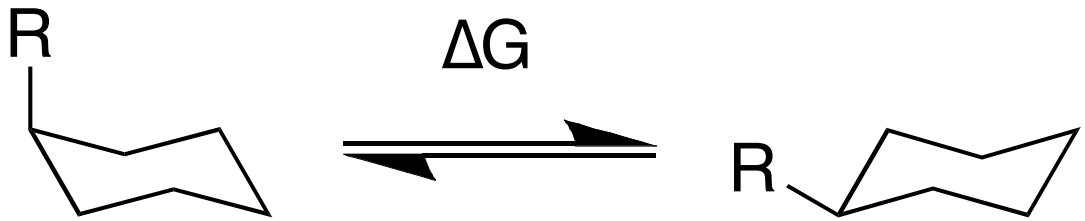
Enantiomers, Diastereomers, and Stereoselectivity 3.

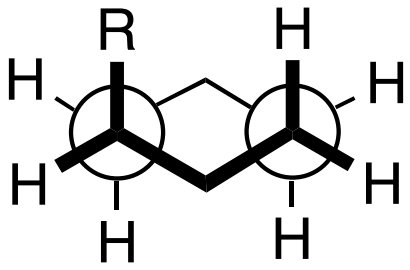
Achiral starting materials give racemic products

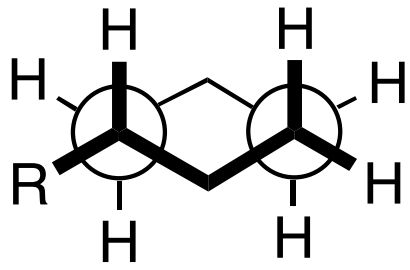




Saturated 6-membered rings (Good-old chair)



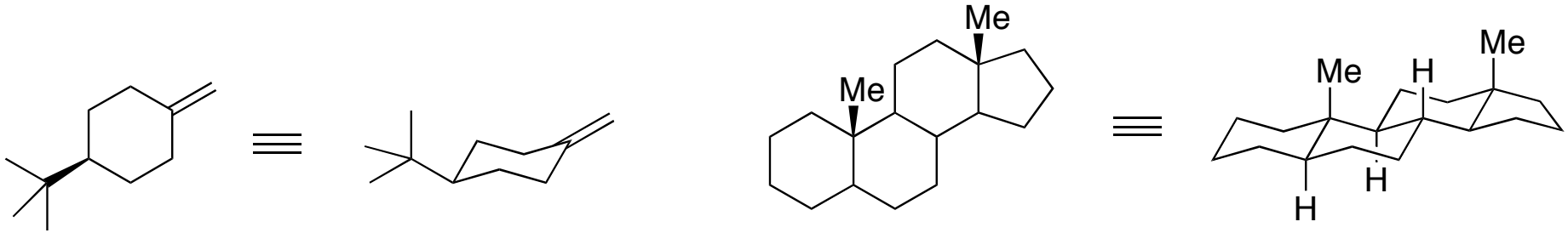




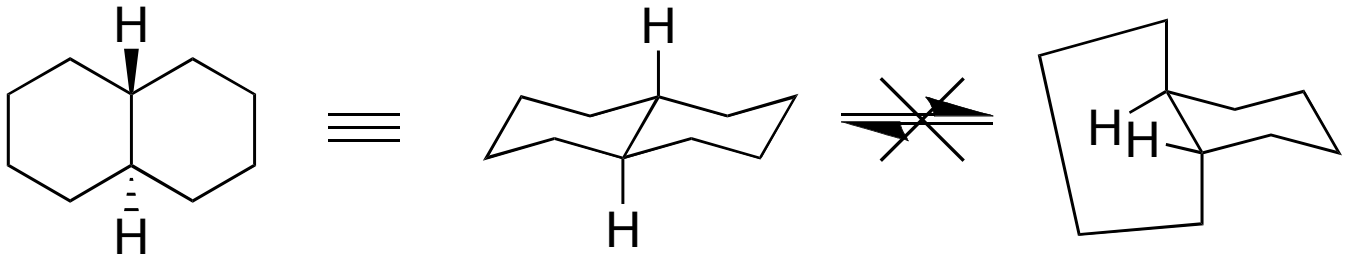
Conformational control is measured by the energy of the ring flip equilibrium, also called “A-value.”

R	A-value (–ΔG, kcal/mol)
Me	1.8
Et	1.8
i-Pr	2.1
t-Bu	> 4.5
OMe	0.6
COOH	1.4
COOEt	1.2
Ph	2.9
CN	0.2
CCH	0.5

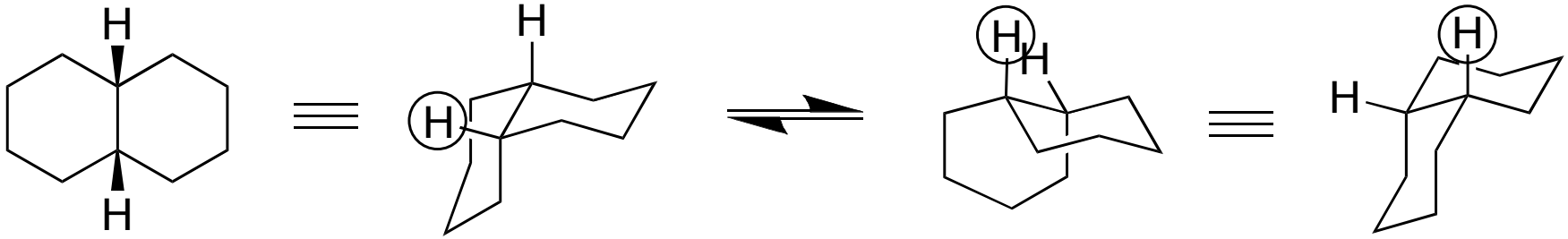
“Locked” cyclohexane rings (won’t ring flip)



Trans-decalins are locked, but cis*-decalins can ring flip!*



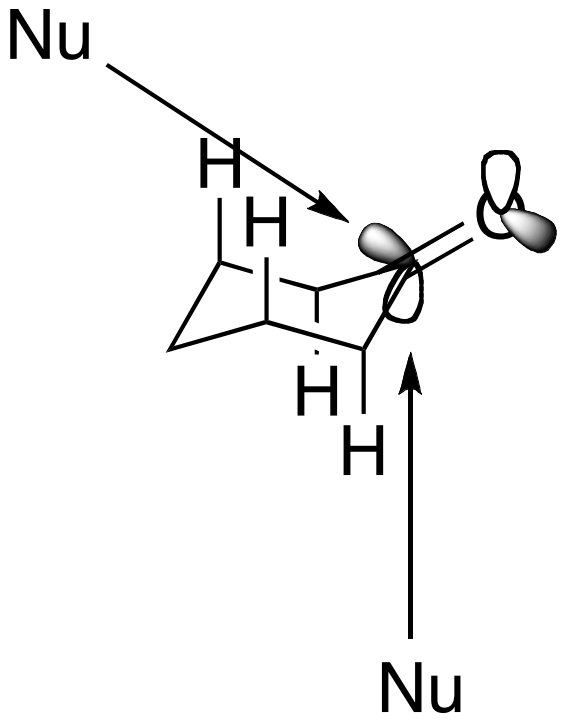
trans-decalin



cis-decalin

Reactions, orbitals, and axial vs. equatorial attack

Small nucleophiles attack axially



Carbonyl attack: π^*

Large nucleophiles attack equatorially