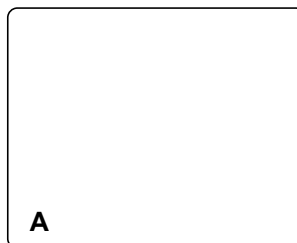


- 1) PBr₃, DMF
- 2) NaH₂PO₄, H₂O₂, NaClO₂(aq.)
- 3) K₂CO₃, MeI

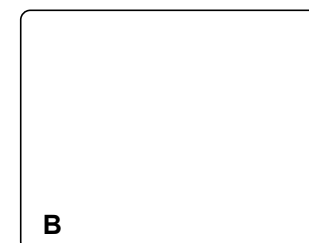
1) **60%**, 2-3) **67%**

Mechanism of 1), names 1) and 2)

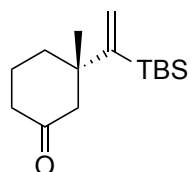


- 4) CrO₃, AcOH
- 5) (*S*)-CBS, BH₃·SMe₂ (2 eq. needed), THF, -40 °C
- 6) NaH (>2 eq.), BnBr (>2 eq.)

4) **45%**, 5) **85%**, **>98% ee**;
6) **67%**



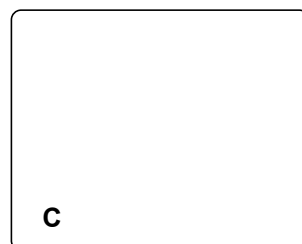
(*R*)-enantiomer



- 7) ICl, HFIP, 40 °C
- 8) Pd(MeCN)₂Cl₂ cat., TMS-ZnBr

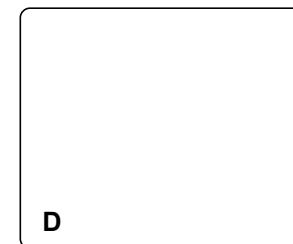
7) **73%**, 8) **76%**

Mechanism of 7), name of 8)



- 9) NaHMDS, Comins' reagent
- 10) Pd(OAc)₂ cat., PPh₃ cat., CO, Et₃N, MeOH,
- 11) *n*-BuLi, MeNHOMe
- 12) DIBAL-H, THF, -78 °C

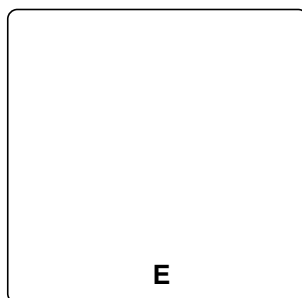
9-10) **63%**, 11-12) **70%**



- 13) *t*BuLi; then **D**
- 14) PDC
- 15) EtAlCl₂

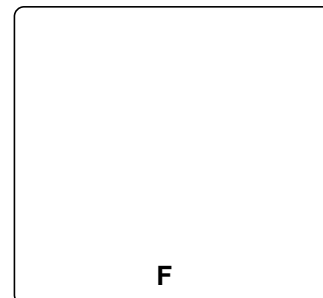
13-14) **61%**

Stereochemistry & names for cascade 15)

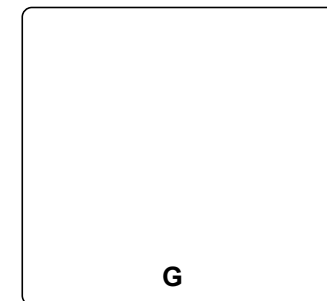


- 16) TPP, O₂; then Ac₂O, pyr

15-16) **43%**



- 17) RhCl(PPh₃)₃, PhCH₃, reflux
 - 18) vinyl-lithium
 - 19) *m*CPBA (1 eq.)
 - 20) NBS
- 17) **67%**, 18-19) **70%**
20) **89%**



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