

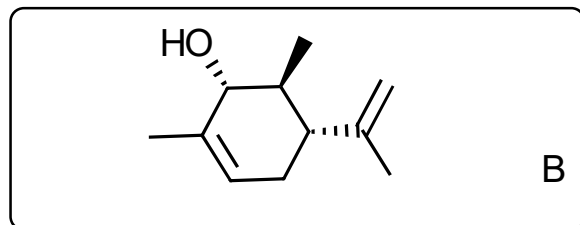
# Synthesis Challenge #80

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(*R*)-Carvone

↓ 2 steps A



↓ 1-3



↓ 4-6



1) NBS (2.0 equiv), methoxyallene (2.0 equiv), CH<sub>2</sub>Cl<sub>2</sub>, -20°C to RT  
2) *t*-BuOK (1.0 equiv), 18-crown-6 (0.05 equiv), pentane, RT  
3) Co<sub>2</sub>(CO)<sub>8</sub> (1.0 equiv), CH<sub>2</sub>Cl<sub>2</sub>, 0°C then, NMO (6.0 equiv), MeCN

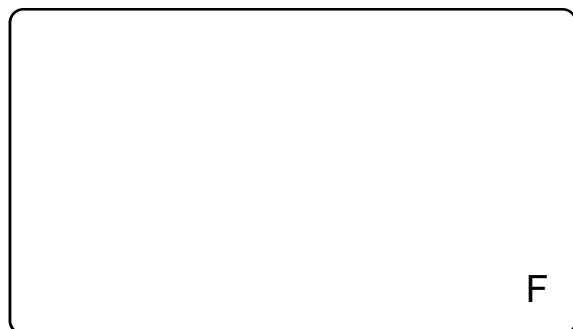
4) MeLi (3.0 equiv), CuI (1.5 equiv), Et<sub>2</sub>O, -20°C to RT, Comins' reagent (1.5 equiv)  
5) *p*-TsOH (1.0 equiv), PhMe, 70°C, then NaHCO<sub>3</sub> (1.0 equiv), O<sub>3</sub>, CH<sub>2</sub>Cl<sub>2</sub>, -78°C, then Me<sub>2</sub>S  
6) Me<sub>2</sub>Zn (3.0 equiv), Pd(PPh<sub>3</sub>)<sub>4</sub> (0.1 equiv), THF, 0°C

Please provide reagents for the transformation from **A** to **B**.

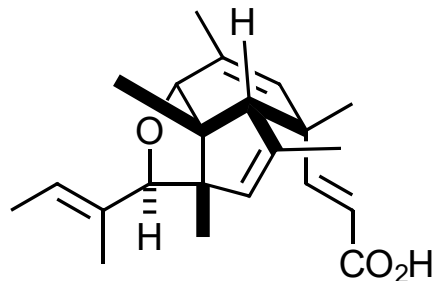
↓ 7-8



↓ 9-10



↓ 11-13



7) DBU (0.2 equiv), 4 Å MS, THF, 80°C, 2 h, then -78°C, (*E*)-2-butenyl-2-magnesium bromide (1.3 equiv)  
8) KH (3.0 equiv),  $\text{CO}(\text{OMe})_2$  (5.0 equiv), THF, reflux, then MeI (5.0 equiv), 0°C

9) KHMDS (2.0 equiv), Comins' reagent (1.5 equiv), THF, -78°C  
10)  $\text{Pd}(\text{OAc})_2$  (0.2 equiv),  $\text{PPh}_3$  (0.4 equiv),  $\text{HCO}_2\text{H}$  (10 equiv),  $\text{Et}_3\text{N}$  (12 equiv), THF, 70°C

11)  $\text{LiAlH}_4$  (2.0 equiv), THF, 60°C  
12) oxalyl chloride (2.0 equiv), DMSO (3.0 equiv),  $\text{Et}_3\text{N}$  (5.0 equiv),  $\text{CH}_2\text{Cl}_2$   
13) NaH (3.0 equiv), *tert*-butyl diethylphosphonoacetate (3.0 equiv), THF, 70°C, 1.5h, then TFA,  $\text{CH}_2\text{Cl}_2$ , RT