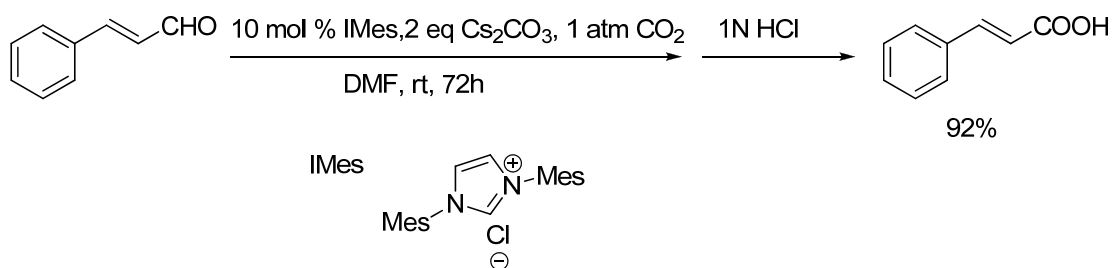


# VanNieuwenhze Group Problem Set

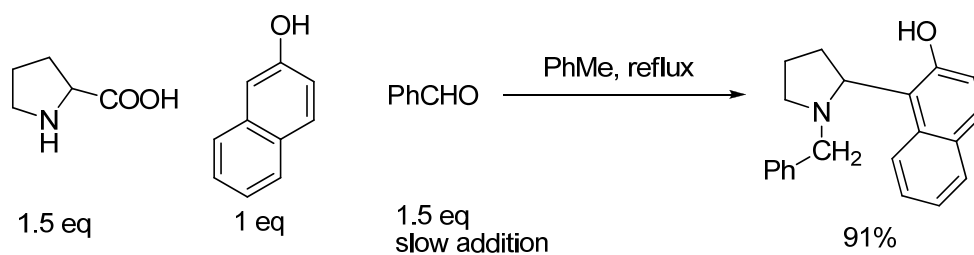
02-16-2010

Please provide mechanism for the following transformations:

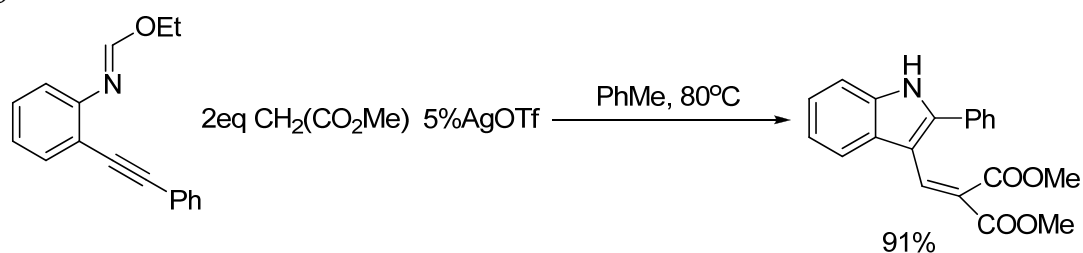
**1** An interesting transformation catalyzed by N-Heterocyclic carbenes. Note that one of the oxygen atoms in the product comes from carbon dioxide.



**2**



**3**



**4** Also give the relative stereochemistry within the product structure

