

Marcos San Segundo, PhD

# **100 Solved Problems in Organic Chemistry**

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## Preface

This book contains 100 carefully selected problems in organic chemistry, each accompanied by a detailed solution. It brings together material from my earlier shorter volumes, now compiled into a single, more comprehensive resource. In preparing this edition, I've made small changes and improvements to some problems and solutions to enhance clarity and consistency.

Whether you are an undergraduate, a master's student, or someone looking to refresh and deepen your understanding of organic chemistry, these problems are designed to strengthen your conceptual foundation and problem-solving skills. The solutions aim to guide your reasoning and help you build confidence in tackling a wide range of problems.

I hope this book serves as a valuable companion in your academic or professional journey.

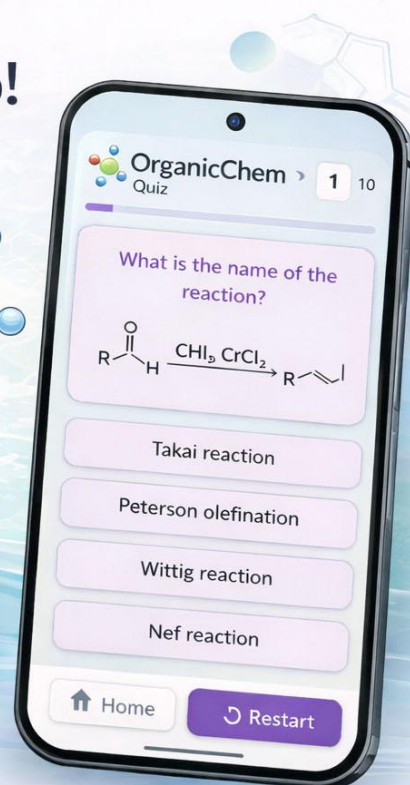
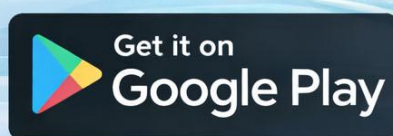
— *Marcos San Segundo*

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# Problems

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## **Solutions**

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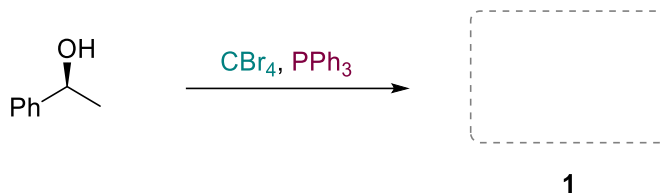
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# Problems

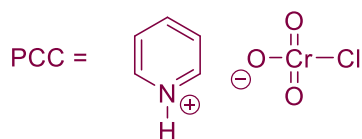
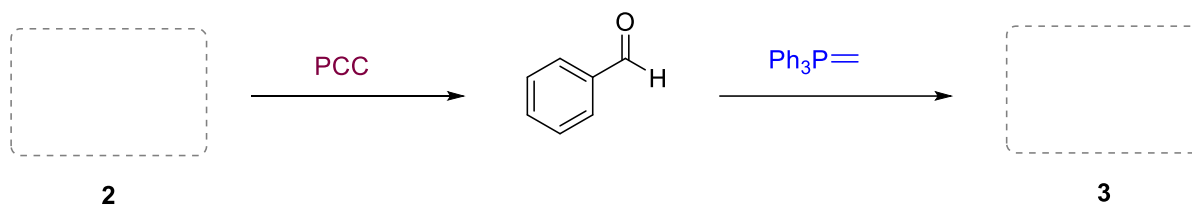
## Problem 1

Draw the structure of compound **1** with the correct stereochemistry.



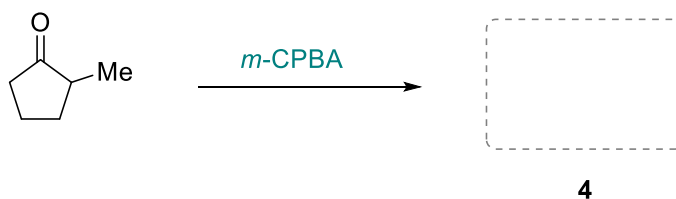
## Problem 2

Draw the structures of compounds **2** and **3**.



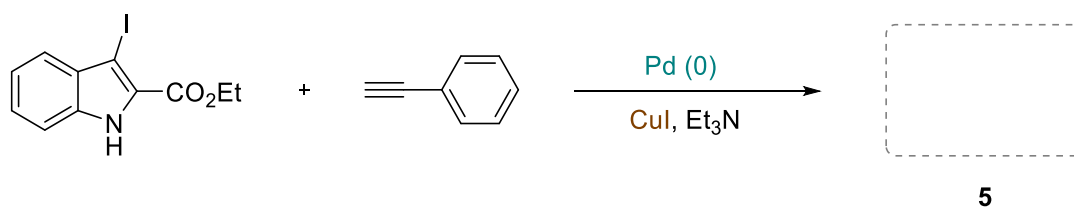
## Problem 3

Draw the structures of *m*-CPBA and compound **4**.



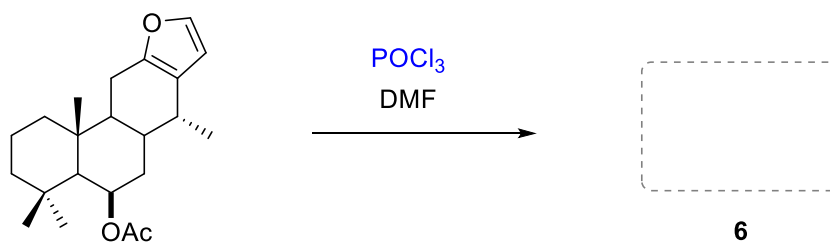
## Problem 4

Draw the structure of compound **5**. What is the name of the reaction?



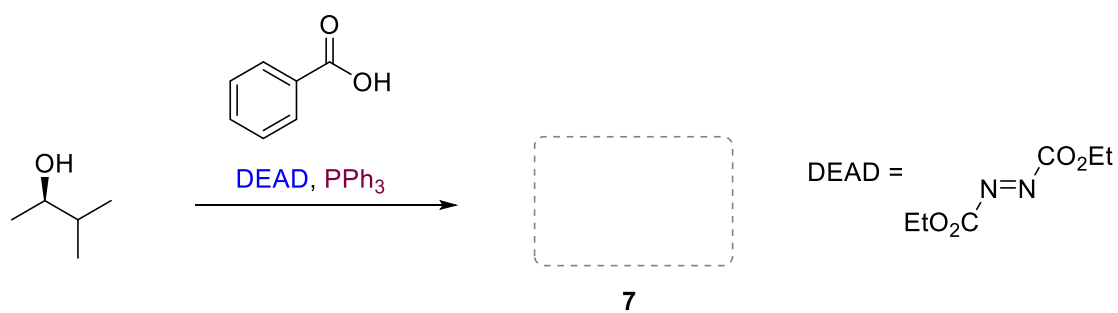
### Problem 5

Assuming this is the Vilsmeier–Haack reaction, draw the structure of compound **6**.



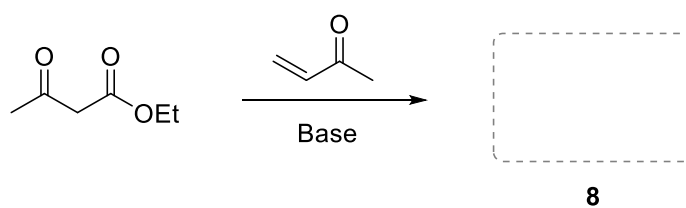
### Problem 6

Draw the structure of compound **7** with the correct stereochemistry. What is the name of the reaction?



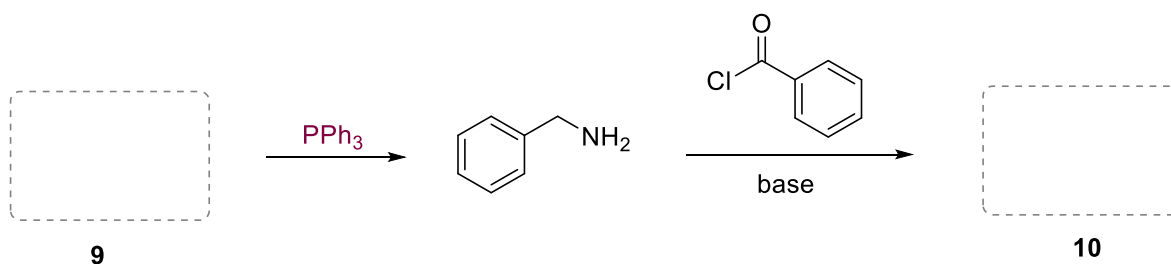
### Problem 7

Write the name of the reaction and draw the structure of compound **8**.



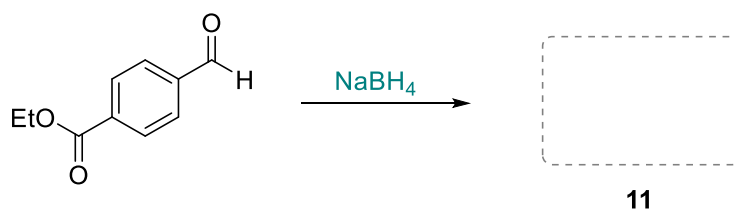
### Problem 8

Draw the structures of compounds **9** and **10**.



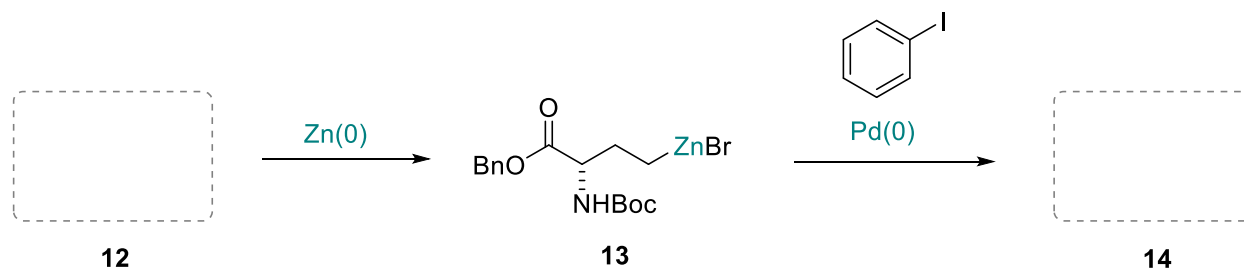
*Problem 9*

Draw the structure of compound **11**.



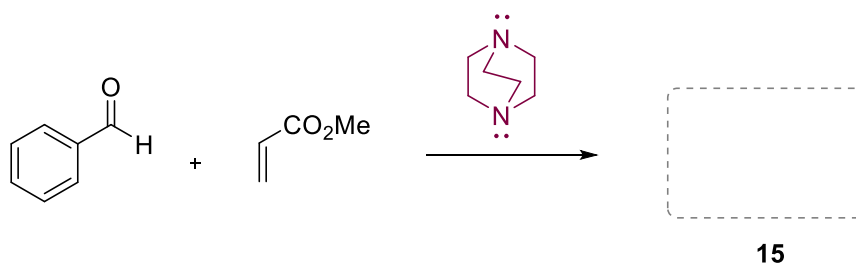
*Problem 10*

Draw the structures of compounds **12** and **14**. Determine the oxidation state of zinc in compound **13**.



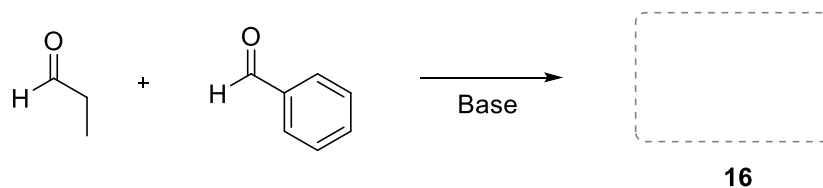
*Problem 11*

Draw the structure of compound **15**. What is the name of the reaction?



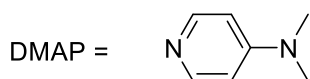
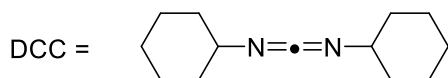
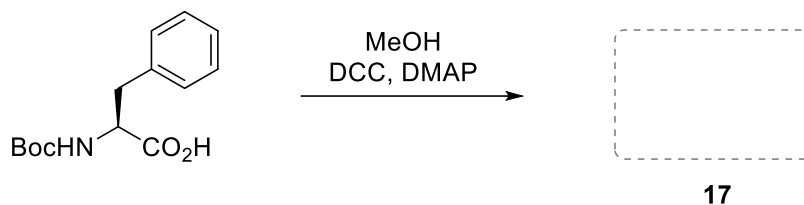
*Problem 12*

Write the name of the reaction and draw the structure of compound **16**.



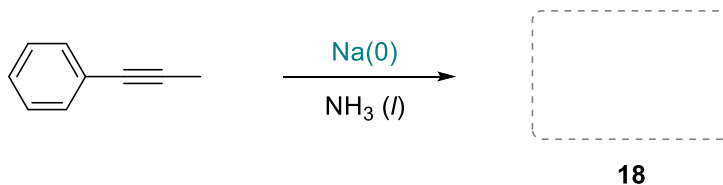
*Problem 13*

Draw the structure of compound **17**.



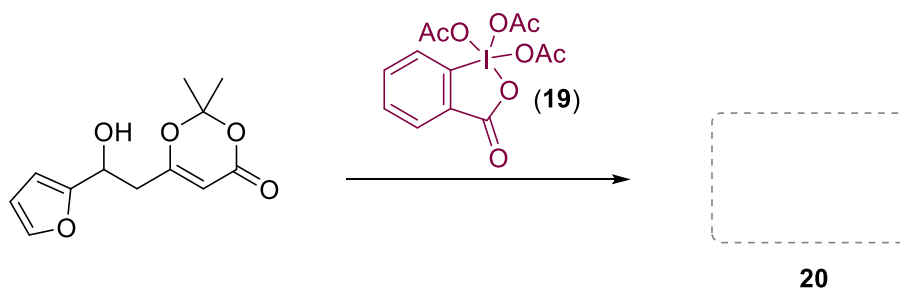
#### Problem 14

Draw the structure of compound **18** with the correct stereochemistry. What is the name of the reaction?



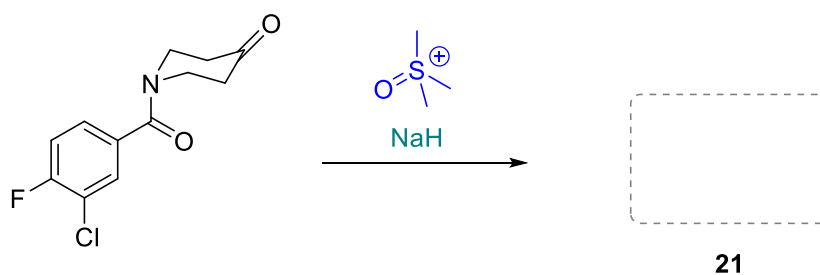
#### Problem 15

Write the name of the reaction and draw the structure of compound **20**. What is the oxidation state of iodine in reagent **19**?



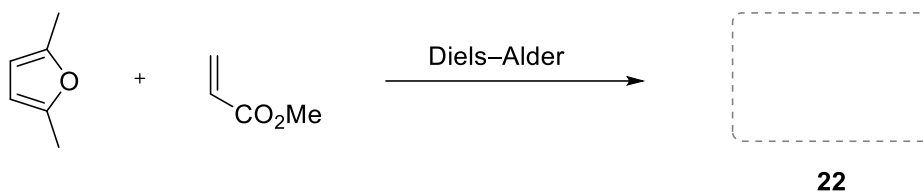
#### Problem 16

Write the name of the reaction and draw the structure of compound **21**.



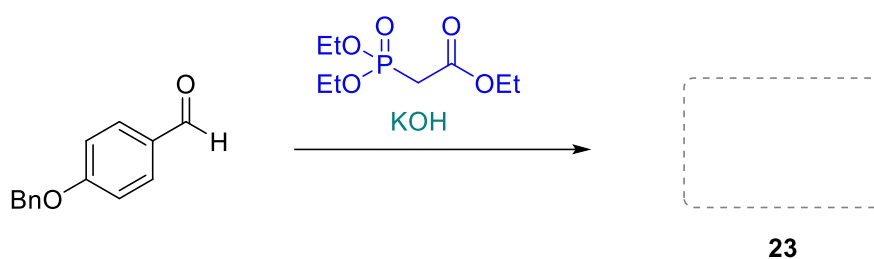
Problem 17

Draw the endo product **22** of this Diels–Alder reaction.



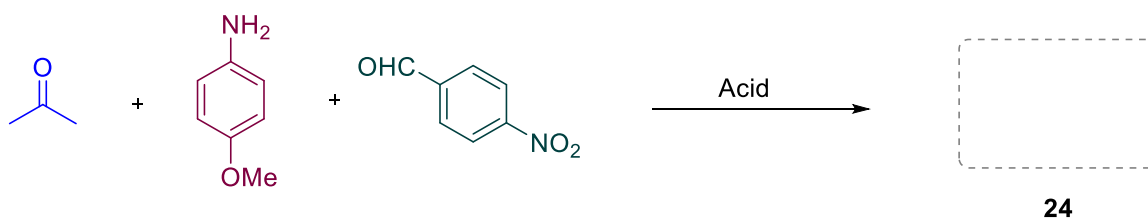
Problem 18

Draw the structure of compound **23**. What is the name of the reaction?



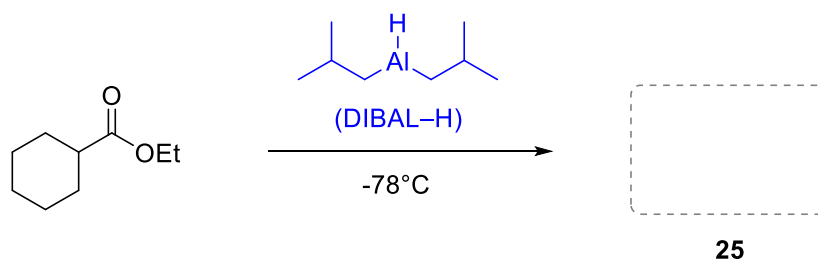
Problem 19

Assuming this is the Mannich reaction, draw the structure of compound **24**.



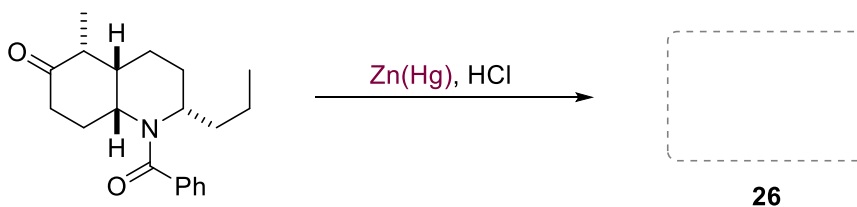
Problem 20

Draw the structure of compound **25**.



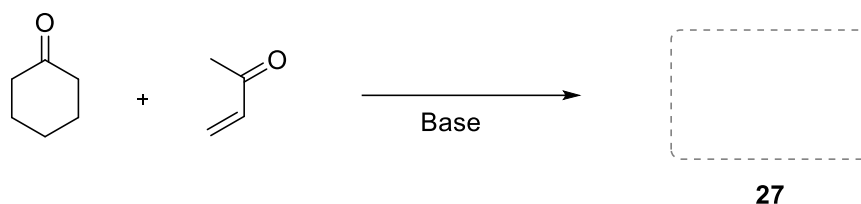
Problem 21

Draw the structure of compound **26**.



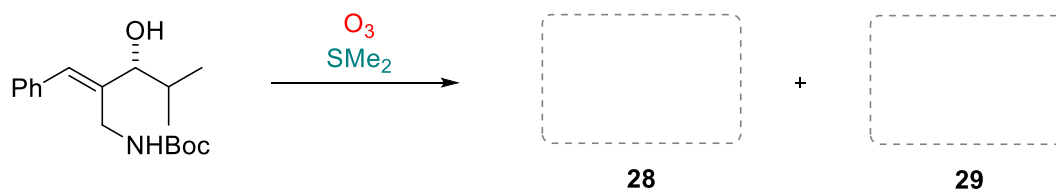
### Problem 22

Assuming this is the Robinson annulation, draw the structure of compound **27**.



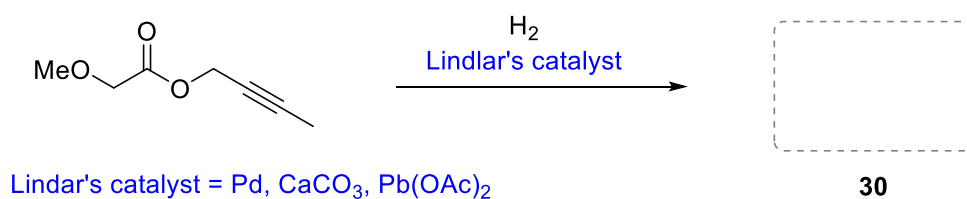
### Problem 23

Draw the two plausible products of this oxidative reaction.



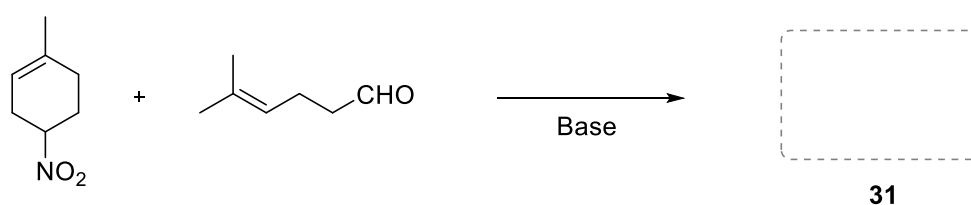
### Problem 24

Draw the structure of compound **30** with the correct stereochemistry.



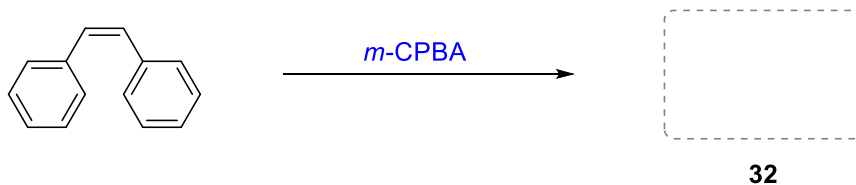
### Problem 25

Assuming this is the Henry Nitroaldol reaction, draw the structure of compound **31**.



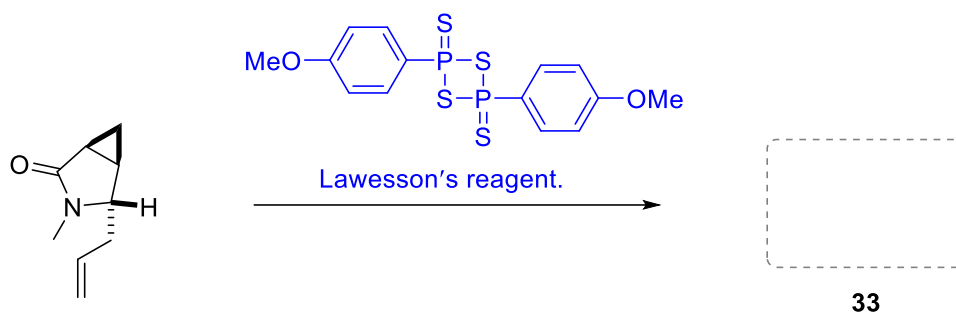
### Problem 26

Draw the structure of compound **32** with the correct stereochemistry.



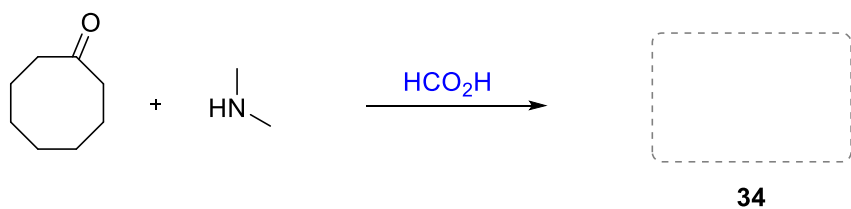
*Problem 27*

Draw the structure of compound **33**.



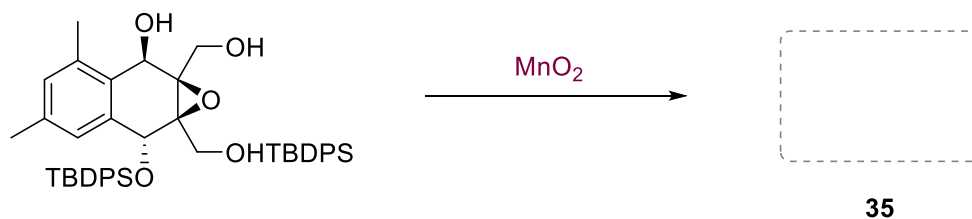
*Problem 28*

Write the name of the reaction and draw the structure of compound **34**.



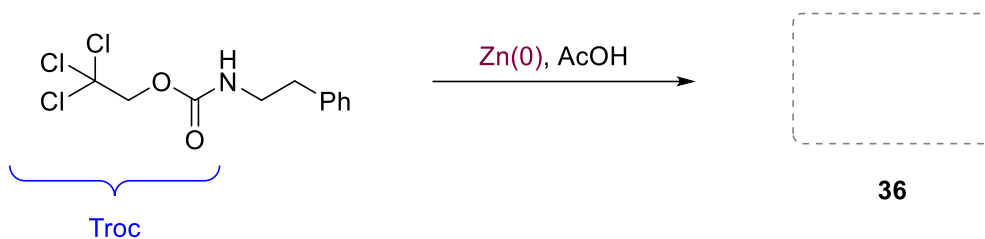
*Problem 29*

Draw the structure of compound **35**.



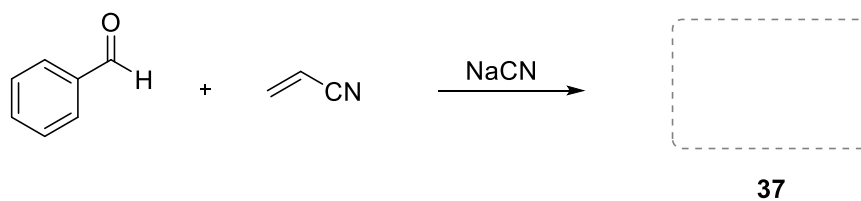
*Problem 30*

Draw the structure of compound **36**.



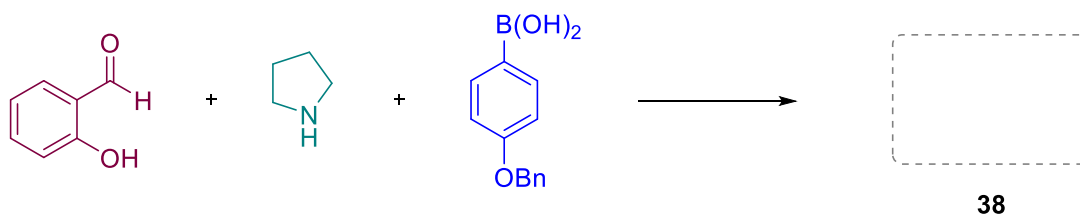
### Problem 31

Draw the structure of compound **37**. What is the name of the reaction?



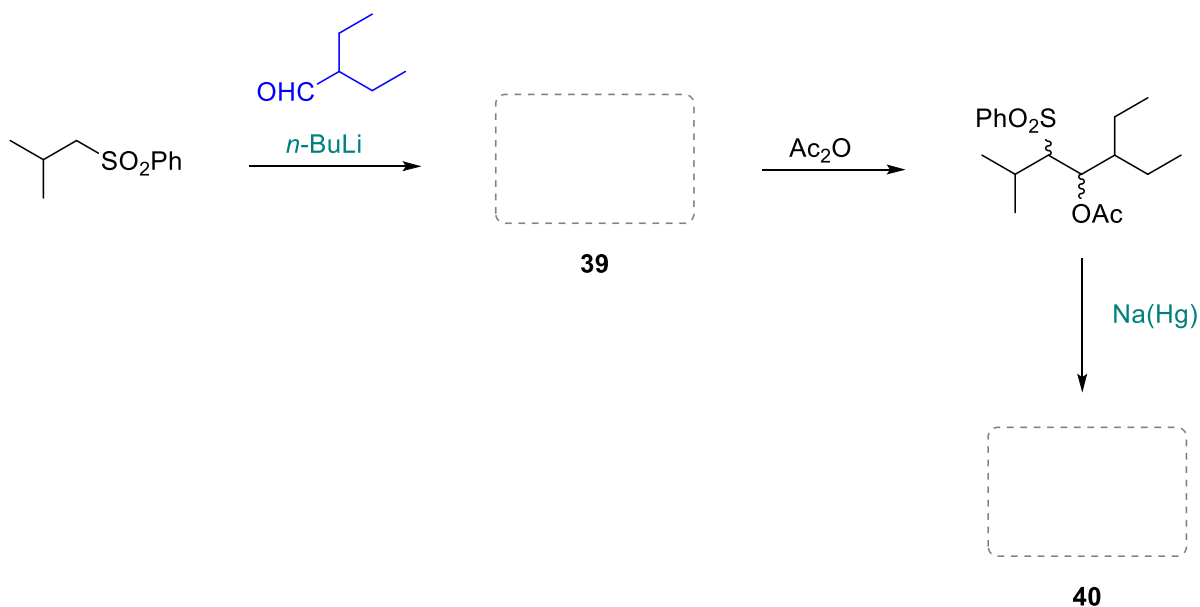
### Problem 32

Draw the structure of compound **38**.



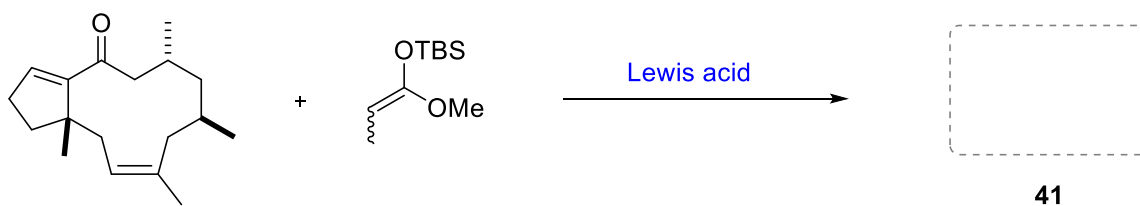
### Problem 33

Draw the structures of compounds **39** and **40**.



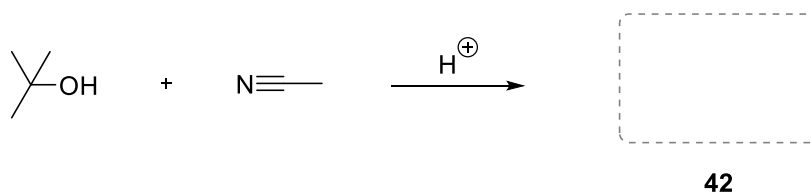
Problem 34

Draw the structure of compound **41**.



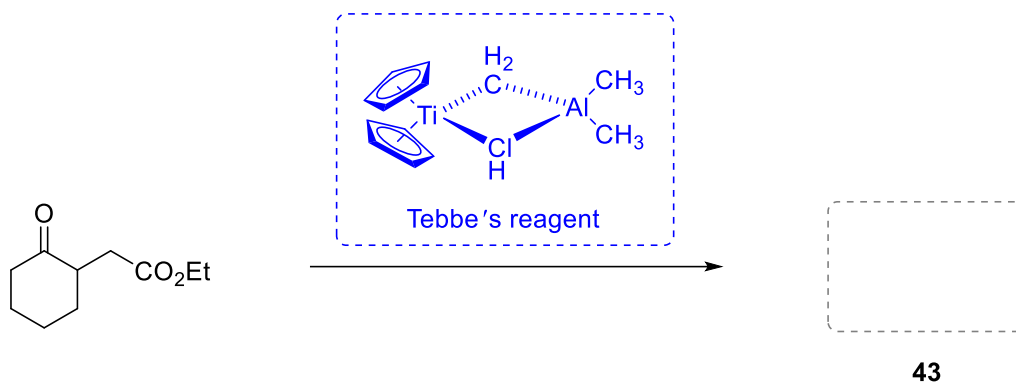
Problem 35

Assuming this is the Ritter reaction, draw the structure of compound **42**.



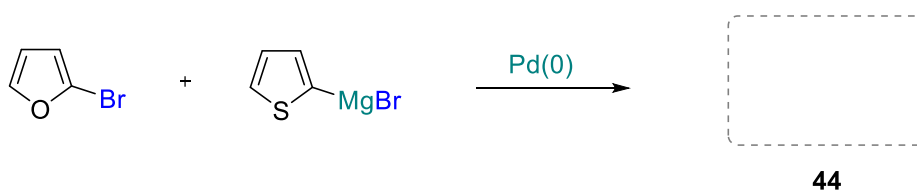
Problem 36

Draw the structure of compound **43**.



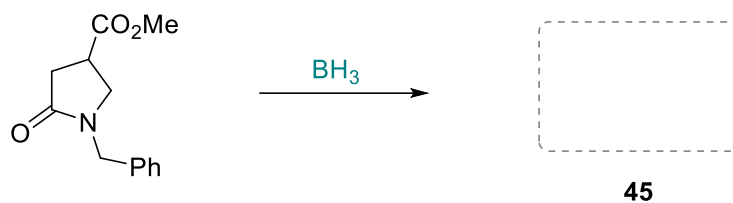
Problem 37

Draw the structure of compound **44**. What is the name of reaction?



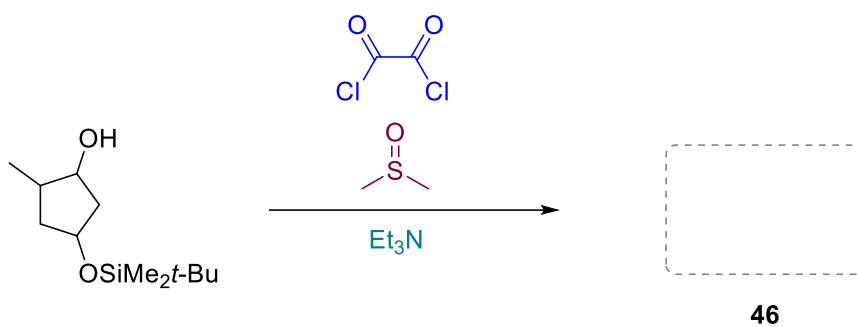
Problem 38

Draw the structure of compound **45**.



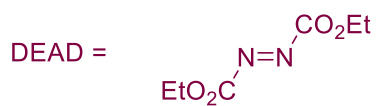
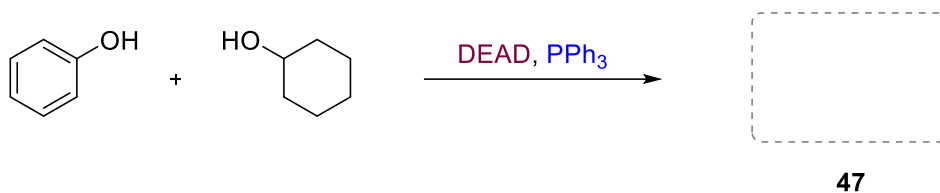
*Problem 39*

Draw the structure of compound **46**. What is the name of the reaction?



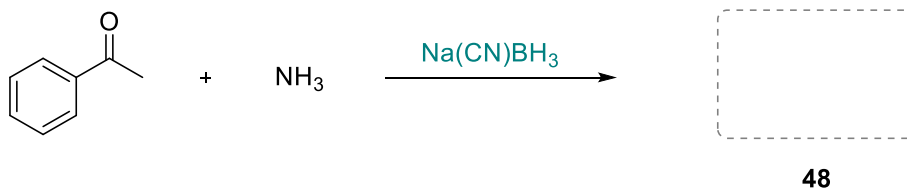
*Problem 40*

Draw the structure of compound **47**.



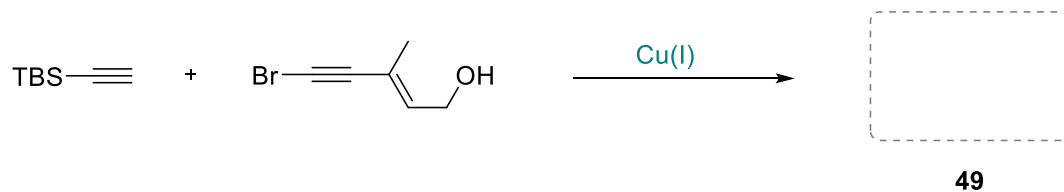
*Problem 41*

Draw the structure of compound **48**.



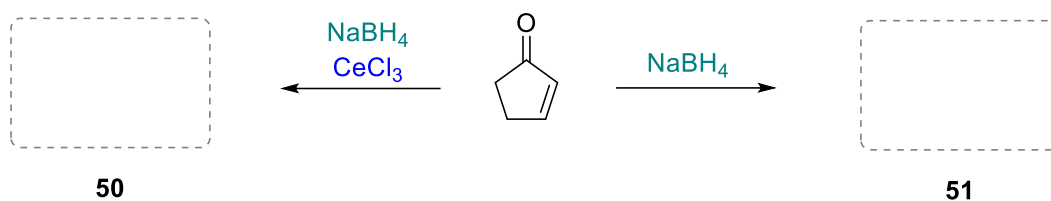
*Problem 42*

Draw the structure of compound **49**.



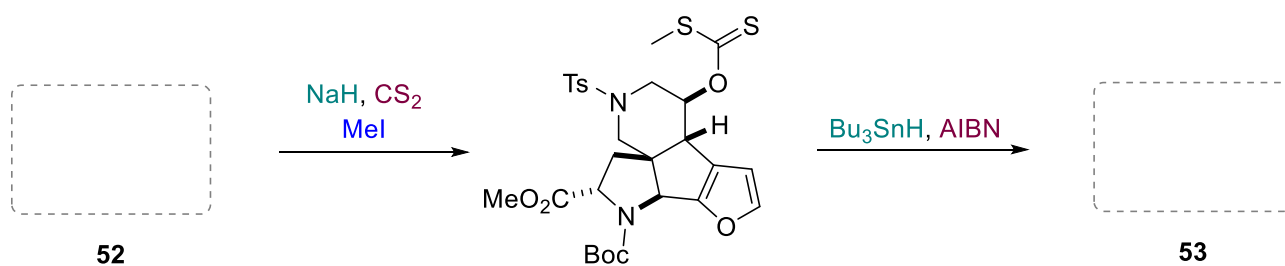
*Problem 43*

Draw the structures of compounds **50** and **51**. What is the role of  $\text{CeCl}_3$ ?



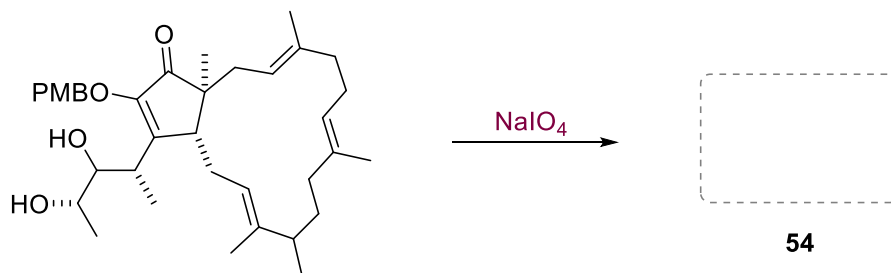
*Problem 44*

Draw the structures of compounds **52** and **53**.



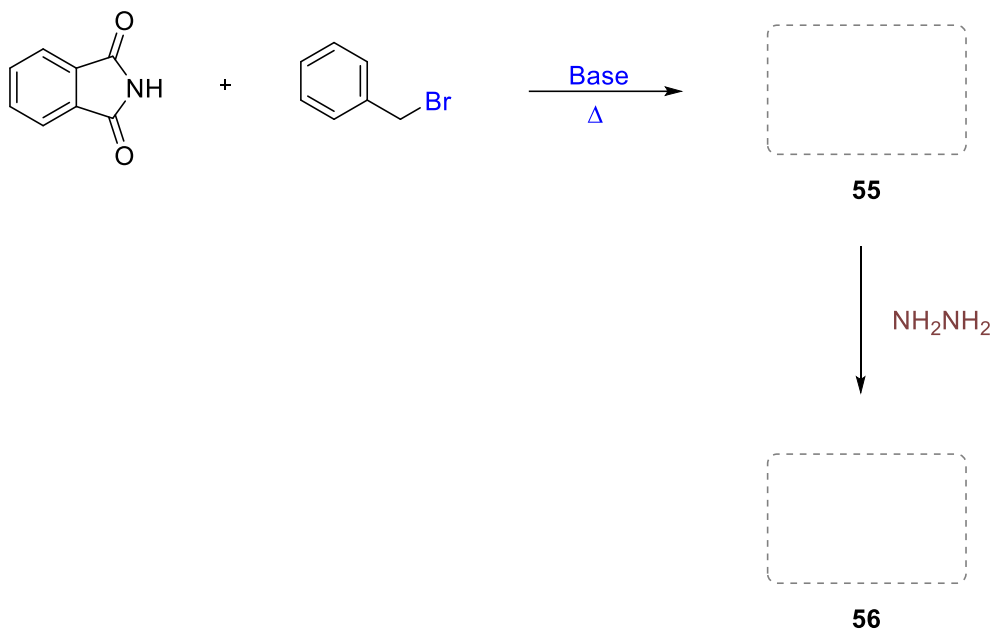
*Problem 45*

Draw the structure of compound **54**.



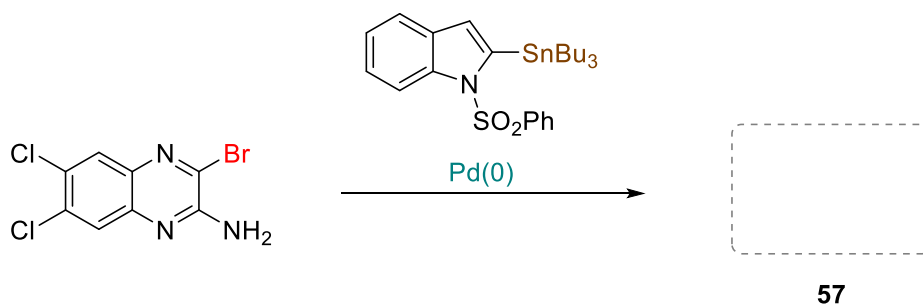
*Problem 46*

Draw the structures of compounds **55** and **56**.



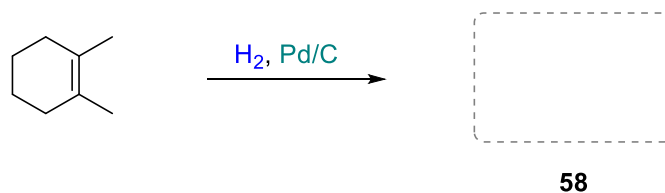
*Problem 47*

Draw the structure of compound **57**.



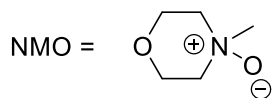
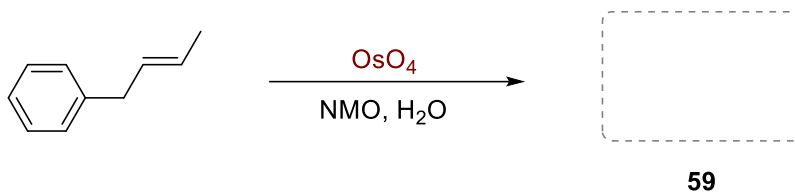
*Problem 48*

Draw the structure of compound **58** with the correct stereochemistry.



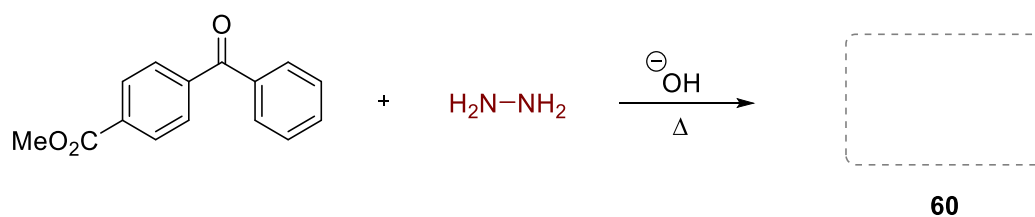
*Problem 49*

Draw the structure of compound **59** with the correct stereochemistry.



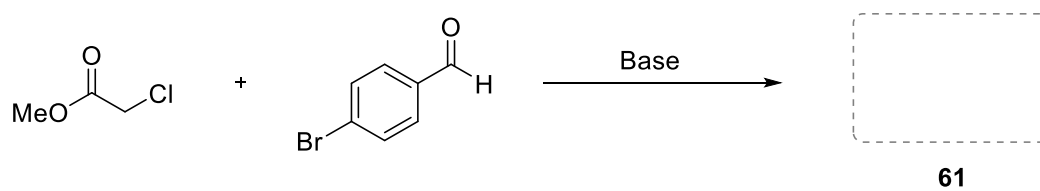
*Problem 50*

Write the name of the reaction and draw the structure of compound **60**.



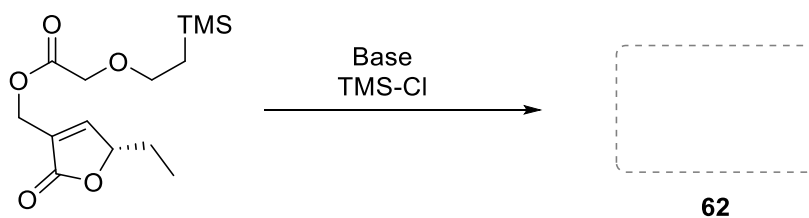
*Problem 51*

Draw the structure of compound **61**. What is the name of the reaction?



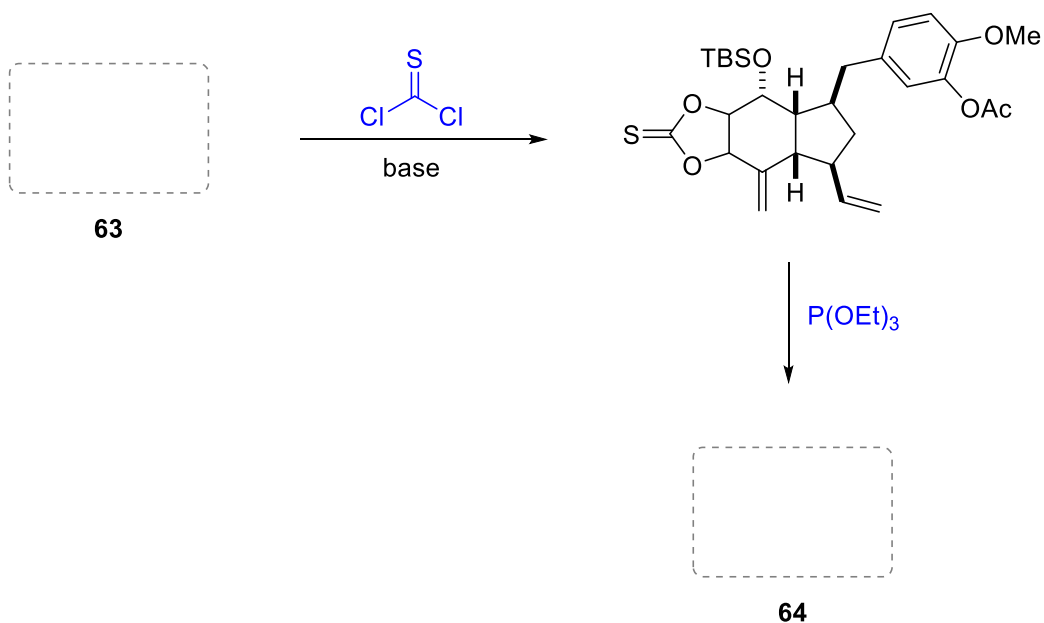
*Problem 52*

Assuming this is the Ireland–Claisen reaction, draw the structure of compound **62**.



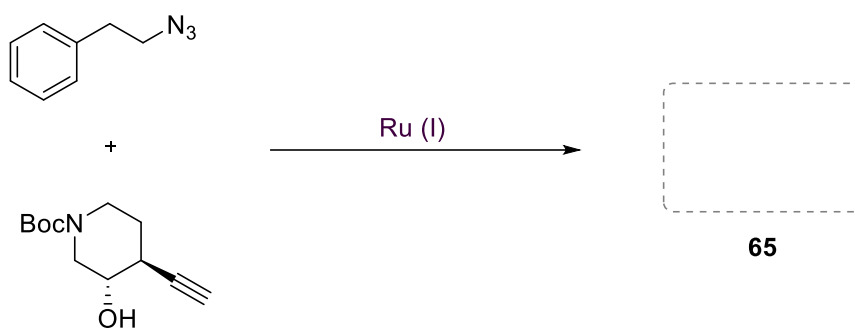
*Problem 53*

Draw the structures of compounds **63** and **64**.



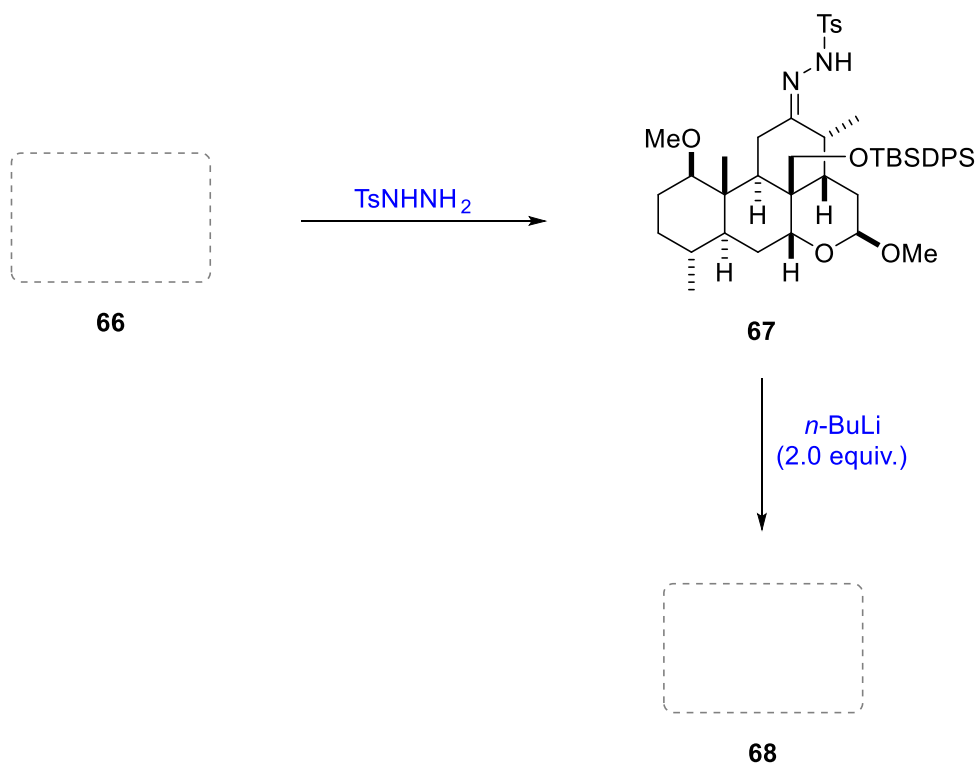
*Problem 54*

Draw the structure of compound **65** with the correct regiochemistry. What is the name of the reaction?



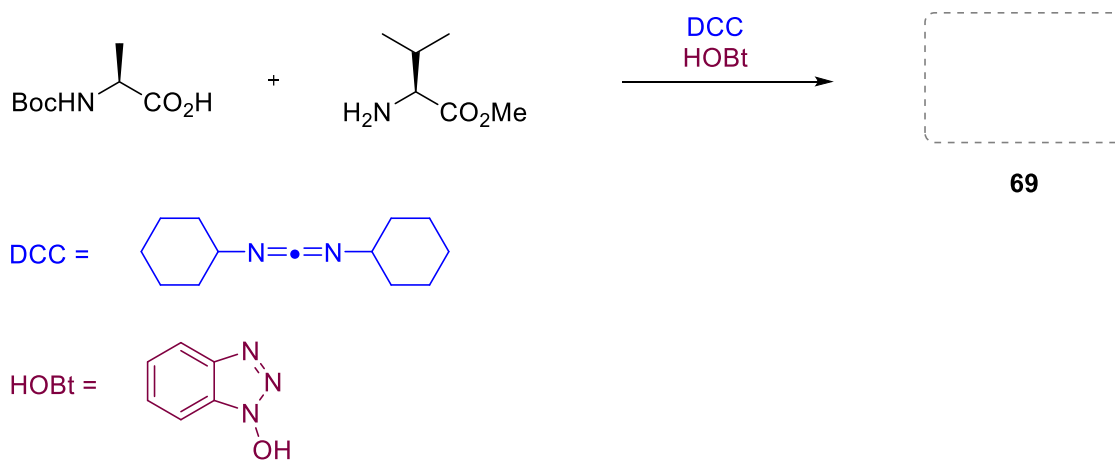
*Problem 55*

Assuming this is the Shapiro reaction, draw the structures of compounds **66** and **68**.



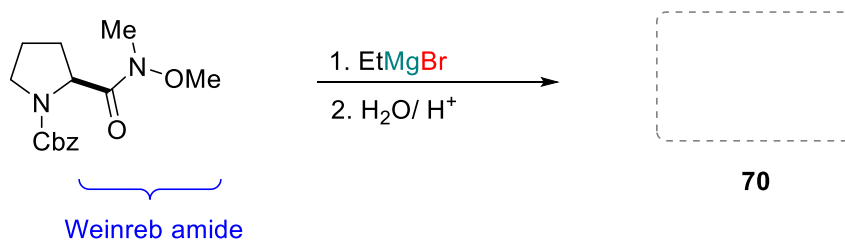
### Problem 56

Draw the structure of compound **69**.



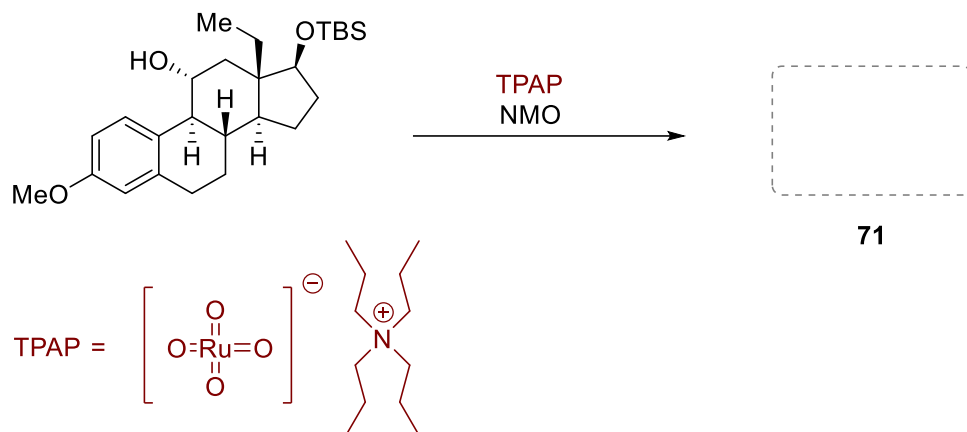
### Problem 57

Draw the structure of compound **70**.



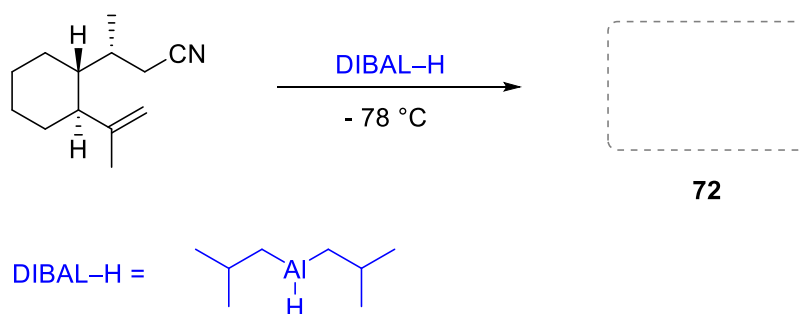
### Problem 58

Draw the structure of compound **71**.



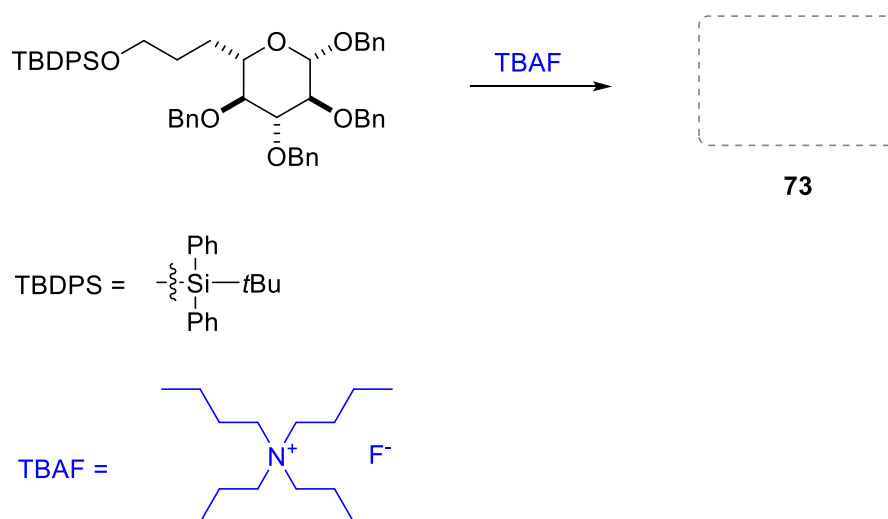
*Problem 59*

Draw the structure of compound **72**.



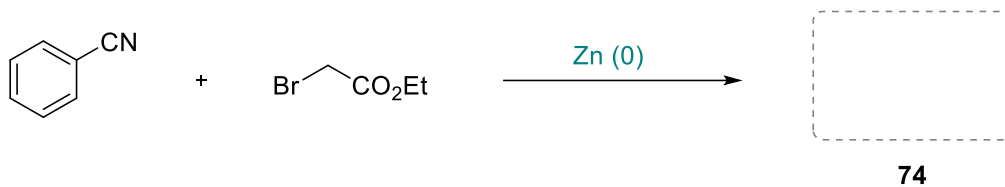
*Problem 60*

Draw the structure of compound **73**.



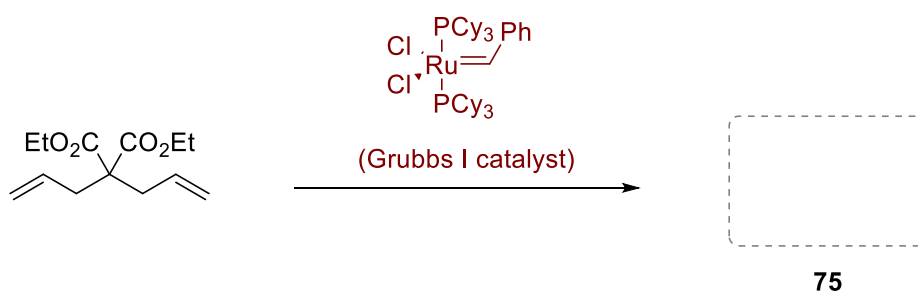
*Problem 61*

Assuming this is the Blaise reaction, draw the structure of compound **74**.



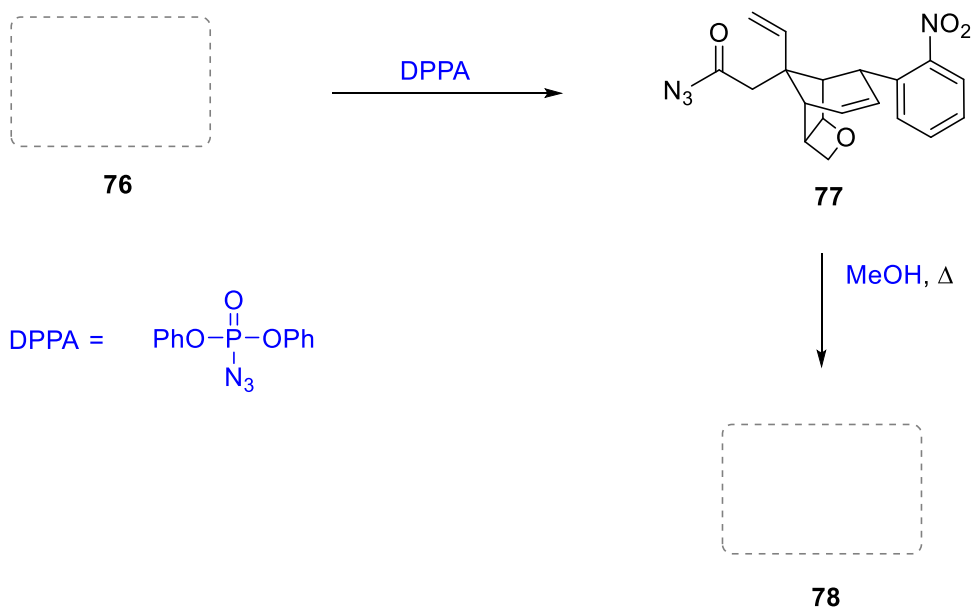
*Problem 62*

Write the name of the reaction and draw the structure of compound **75**.



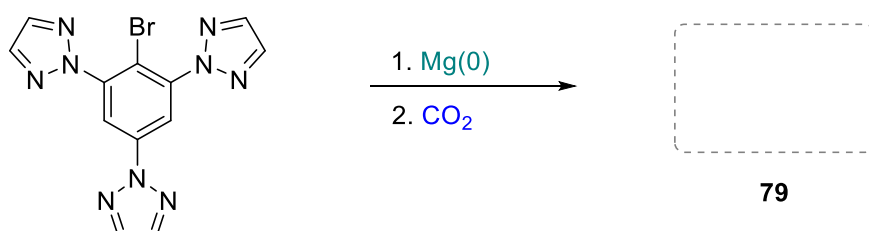
*Problem 63*

Draw the structures of compounds **76** and **78**.



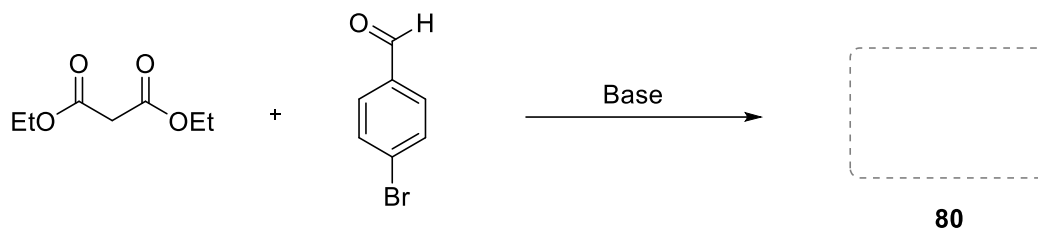
*Problem 64*

Draw the structure of compound **79**.



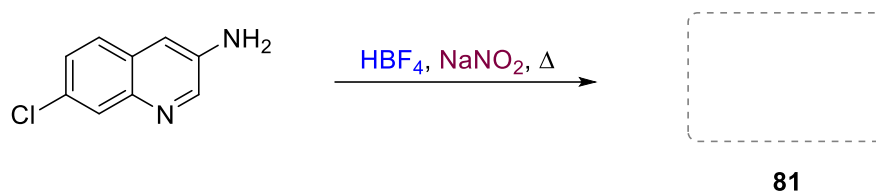
### Problem 65

Draw the structure of compounds **80**.



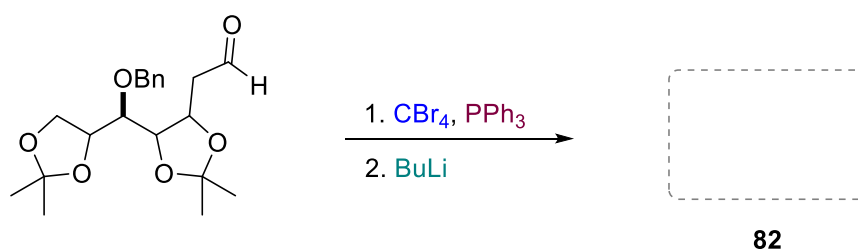
### Problem 66

Draw the structure of compound **81**.



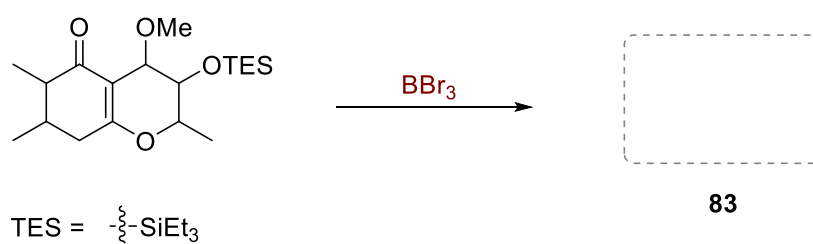
### Problem 67

Draw the structure of compound **82**. What is the name of the reaction?



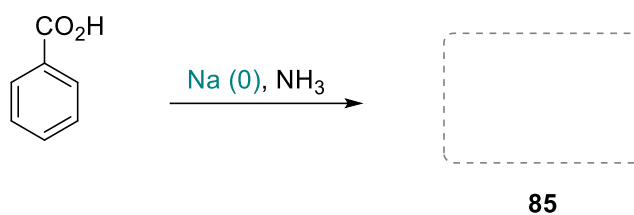
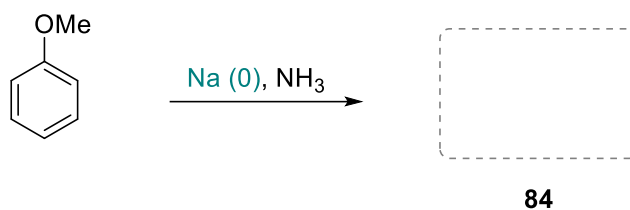
### Problem 68

Draw the structure of compound **83**.



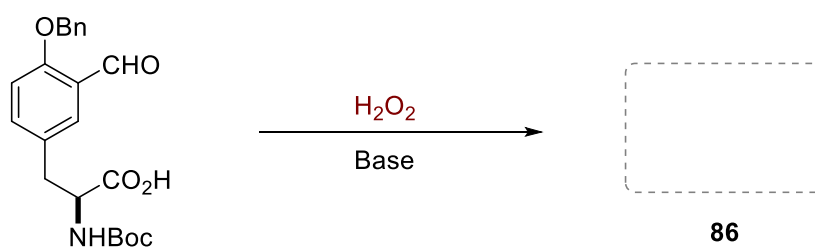
### Problem 69

Assuming these are Birch reductions, draw the structures of compounds **84** and **85**.



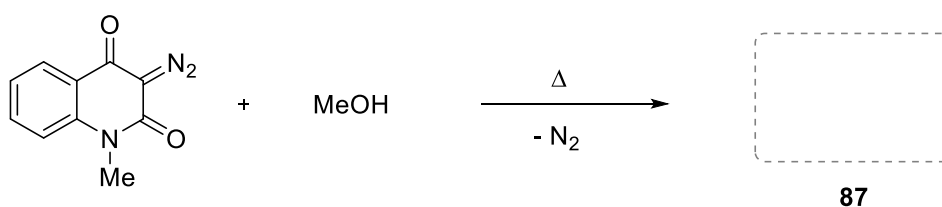
*Problem 70*

Draw the structure of compound **86**.



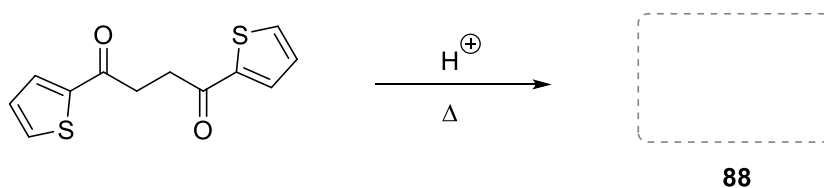
*Problem 71*

Assuming this is the Wolff rearrangement, draw the structure of compound **87**.



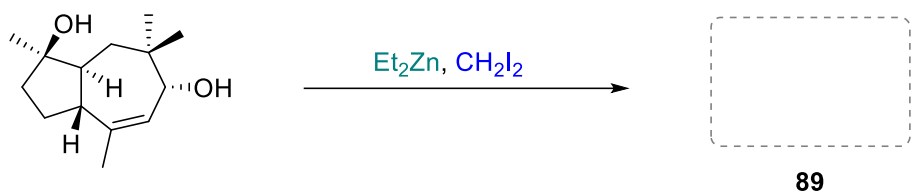
*Problem 72*

Assuming this is the Paal–Knorr reaction, draw the structure of compound **88**.



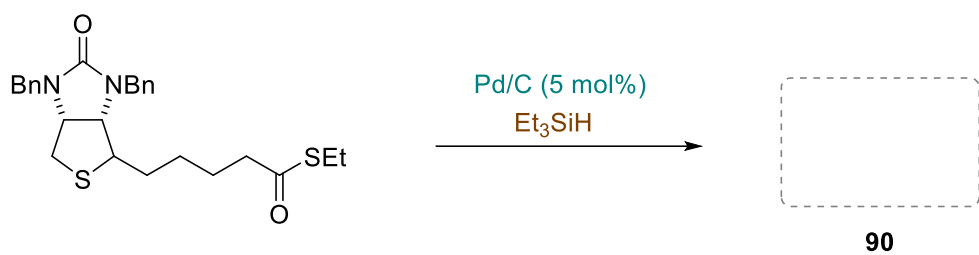
*Problem 73*

Draw the structure of compound **89**. What is the name of the reaction?



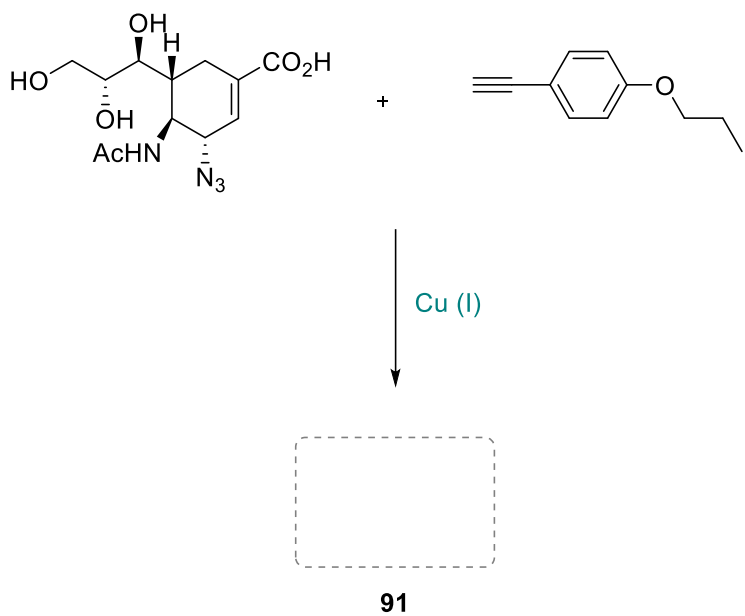
*Problem 74*

Draw the structure of compound **90**.



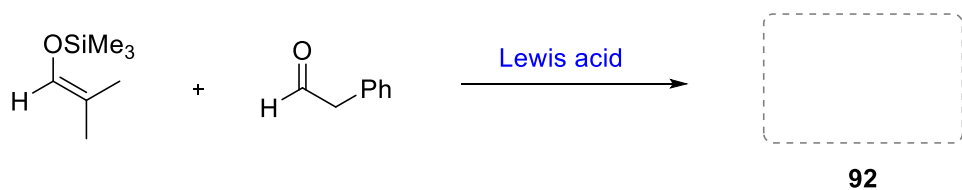
*Problem 75*

Draw the structure of compounds **91** with the correct regioselectivity.



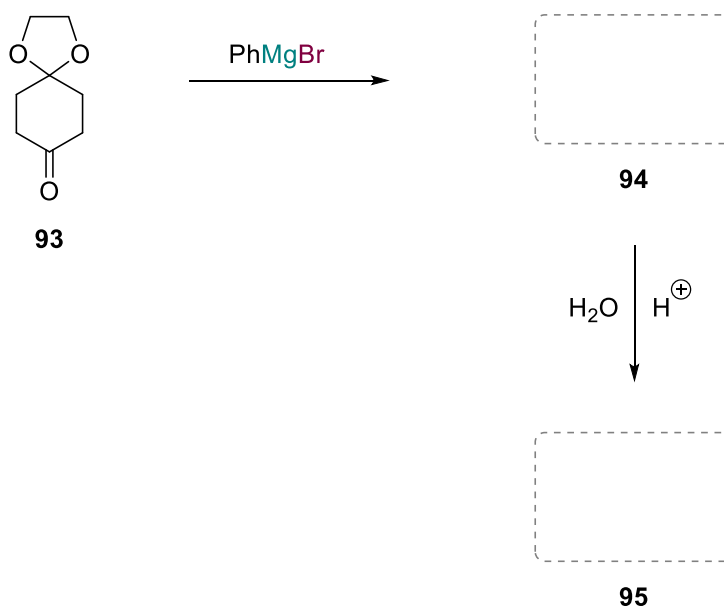
*Problem 76*

Write the name of the reaction and draw the structure of compound **92**.



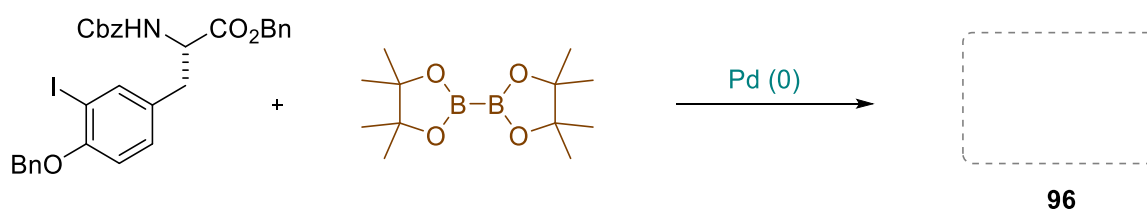
*Problem 77*

Draw the structures of compounds **94** and **95**. Name the protecting group on starting material **93**.



### Problem 78

Write the name of the reaction and draw the structure of compound **96**.



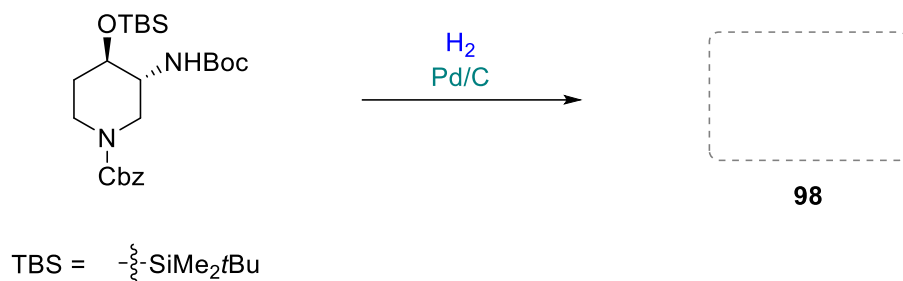
### Problem 79

Draw the structure of compound **97**. What is the name of the reaction?



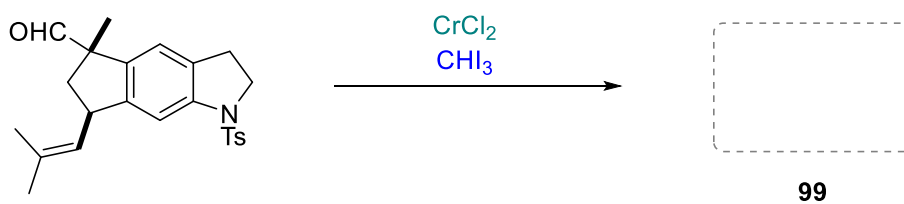
### Problem 80

Draw the structure of compound **98**.



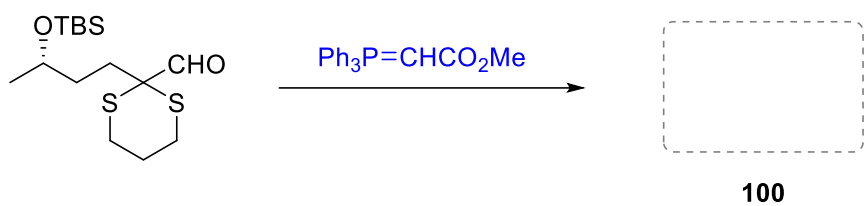
*Problem 81*

Draw the structure of compound **99**.



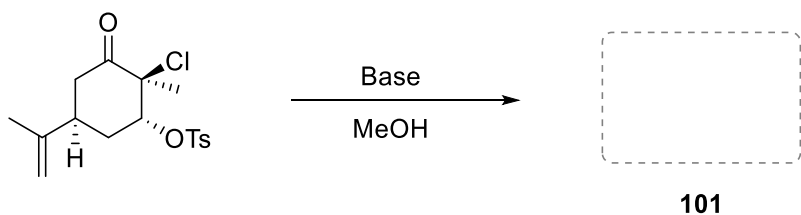
*Problem 82*

Draw the structure of compound **100** with the right regioselectivity.



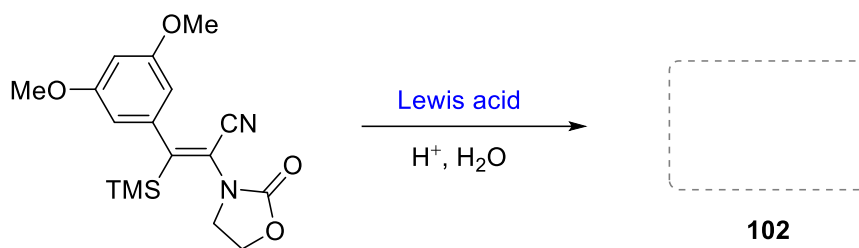
*Problem 83*

Assuming this is the Favorskii reaction, draw the structure of compound **101**.



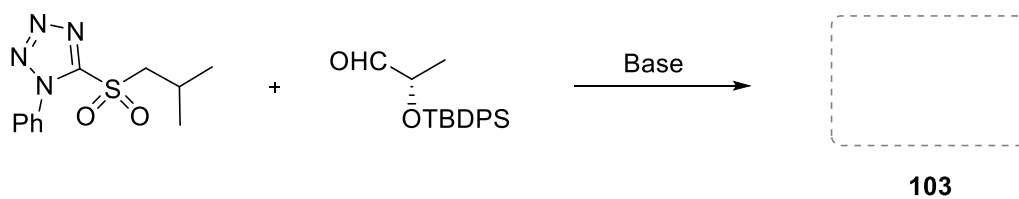
*Problem 84*

Assuming this is the Houben–Hoesch reaction, draw the structure of compound **102**.



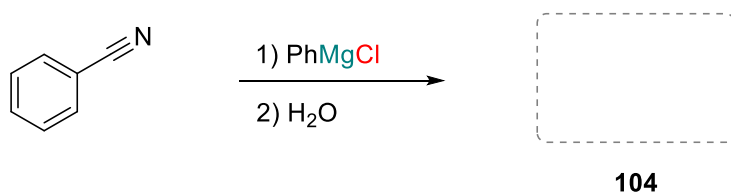
*Problem 85*

Draw the structure of compound **103**.



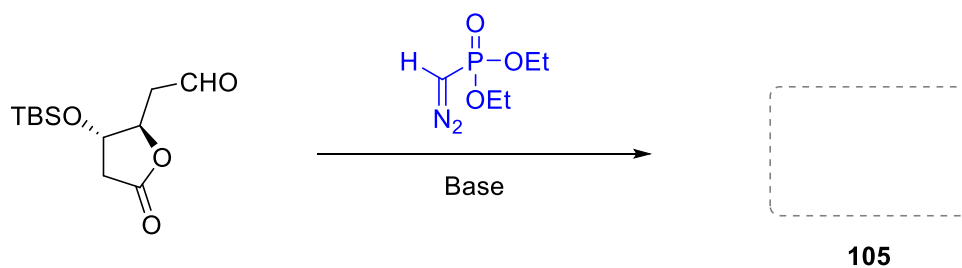
*Problem 86*

Draw the structure of compound **104**.



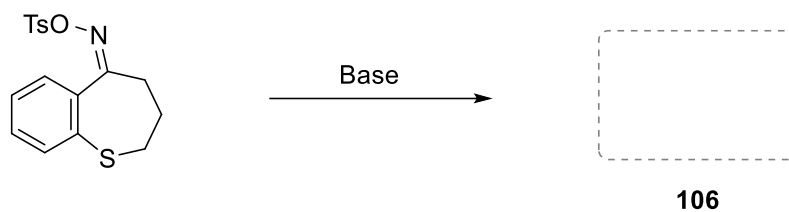
*Problem 87*

Write the name of the reaction and draw the structure of compound **105**.



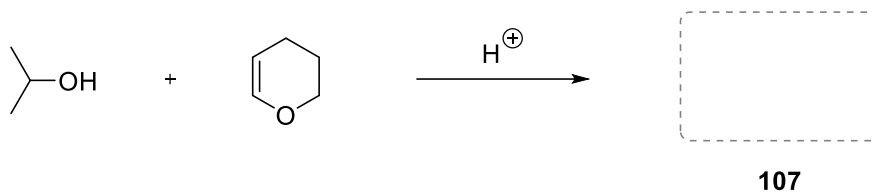
*Problem 88*

Assuming this is the Neber rearrangement, draw the structure of compound **106**.



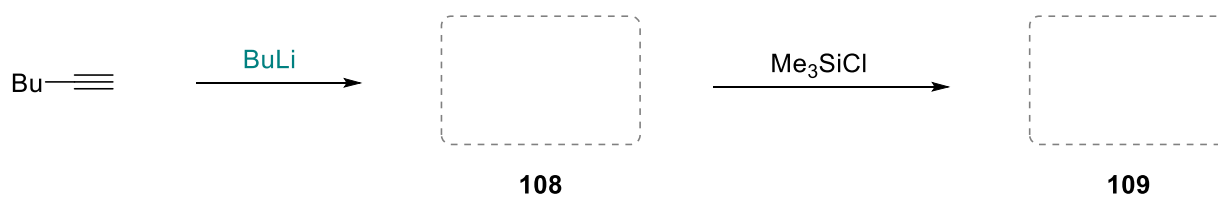
*Problem 89*

Draw the structure of compound **107**.



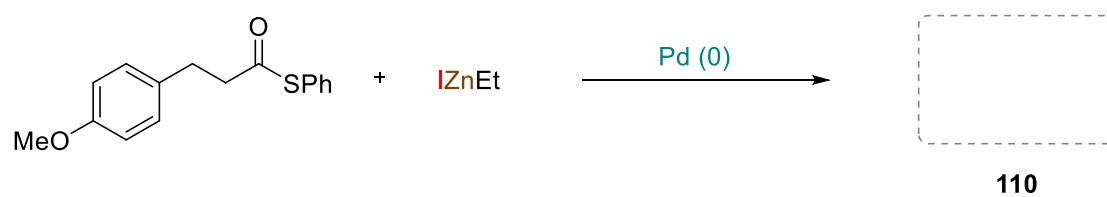
*Problem 90*

Draw the structure of compounds **108** and **109**.



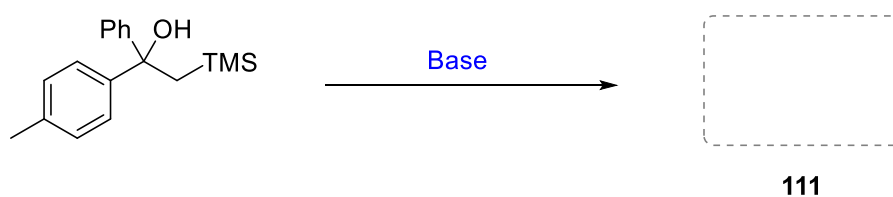
*Problem 91*

Draw the structure of compound **110**.



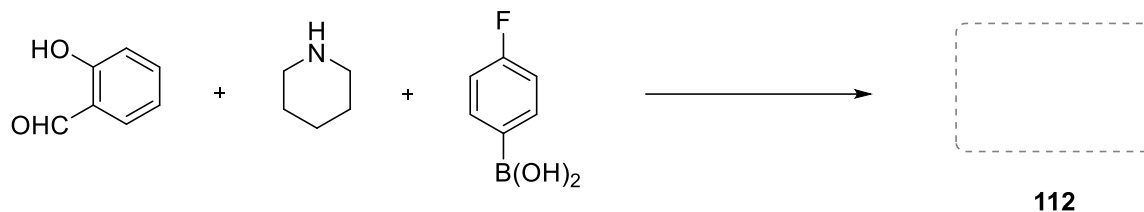
*Problem 92*

Write the name of the reaction and draw the structure of compound **111**.



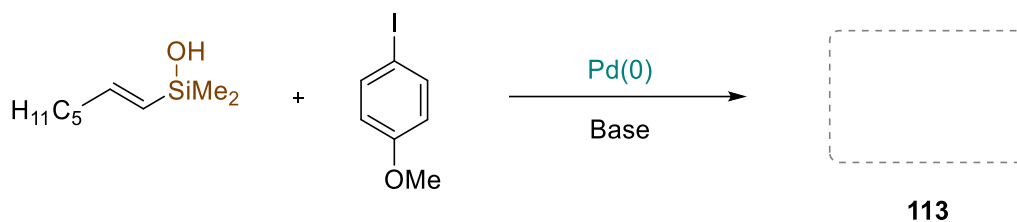
*Problem 93*

Provide the structure of product **112** formed in this multicomponent reaction.



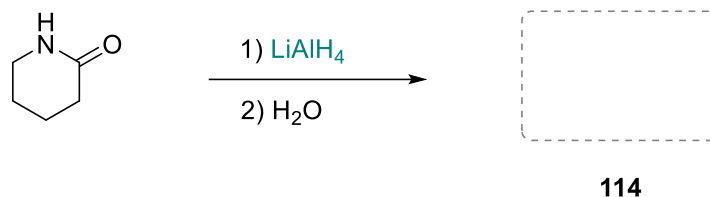
*Problem 94*

Draw the structure of compound **113**.



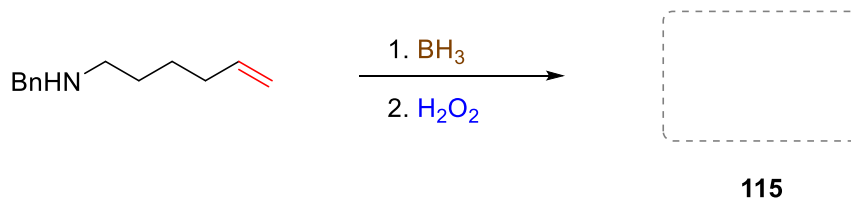
*Problem 95*

Draw the structure of compound **114**.



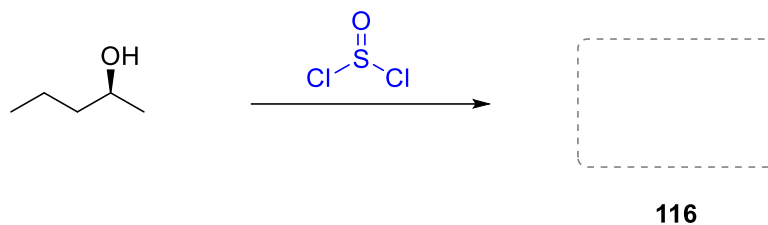
*Problem 96*

Draw the structure of compound **115**. What is the name of the reaction?



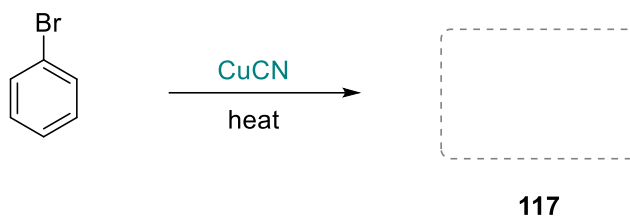
*Problem 97*

Draw the structure of compound **116** with the correct stereochemistry.



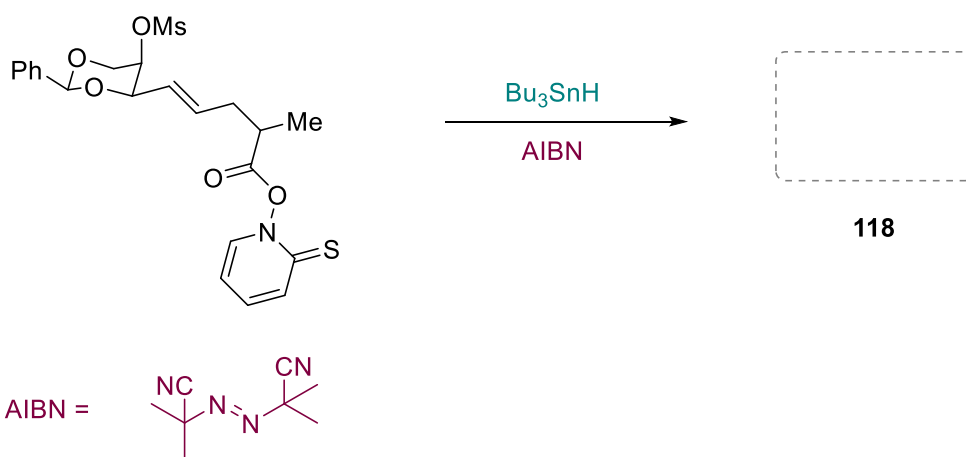
*Problem 98*

Draw the structure of compound **117**.



*Problem 99*

Draw the structure of compound **118**. What is the name of the reaction?



*Problem 100*

Assuming this is the Hofmann rearrangement, draw the structure of compound **119**.

