

# *Chem 41c Midterm Exam*

Stoltz, Spring 2009, April 29, 2009

The exam begins when you turn to page 2. You have 55 minutes to complete the exam. This is a closed note and closed book exam with no collaboration. You may use the periodic table at the front of the room or the one on the last page of this packet. You may not use any other materials. The exam has a total of 60 points. Good luck.

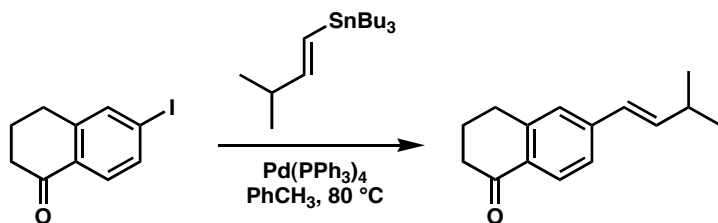
There are 10 pages in this exam packet.

Name: \_\_\_\_\_



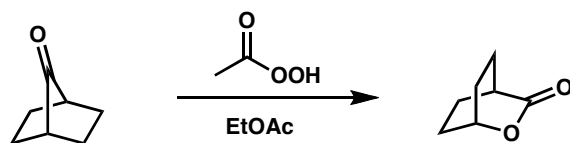
1. Predict the major non-volatile products (if any) of the following reactions or sequences. (3 points each)

a.

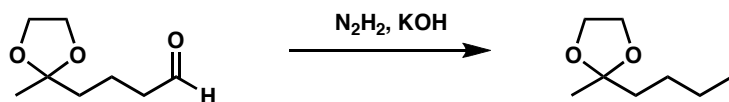


or any other appropriate cross coupling.

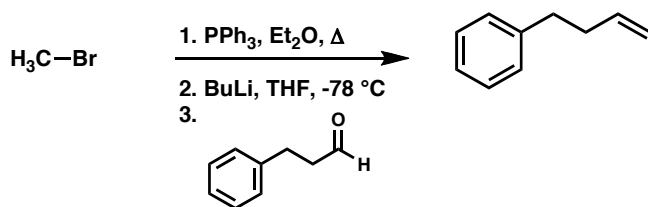
b.



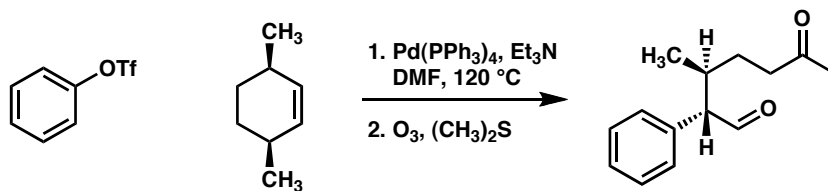
c.



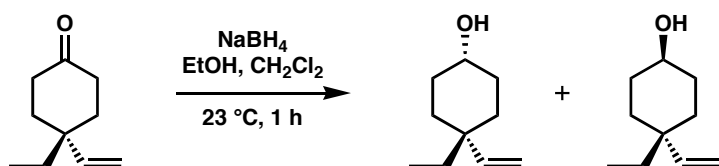
d.



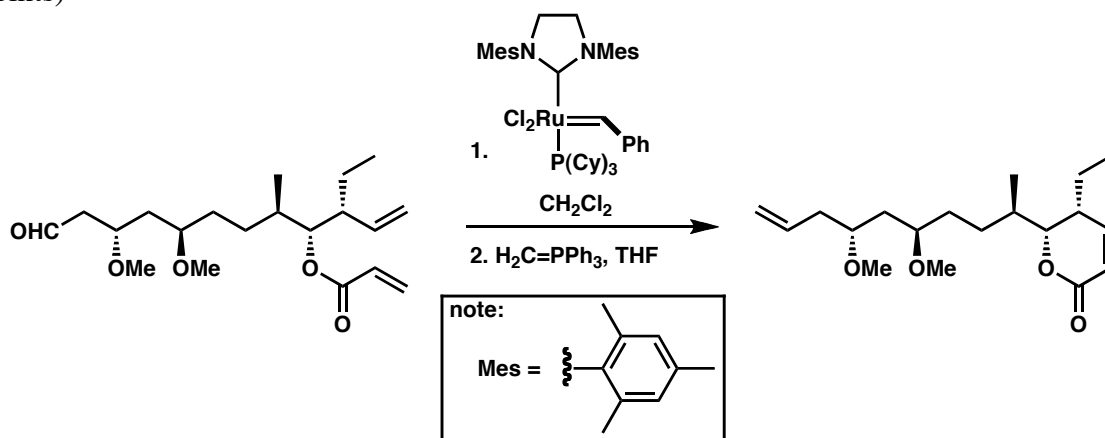
e.



f.

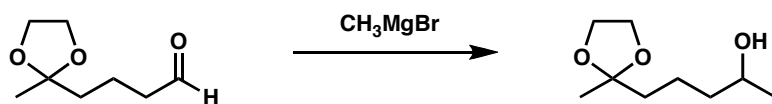
**2 major products**

g. (6 points)

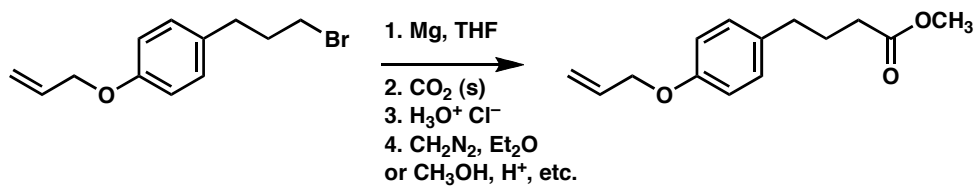


2. Provide reagents for the following transformations. They may be multistep processes. (3 points each)

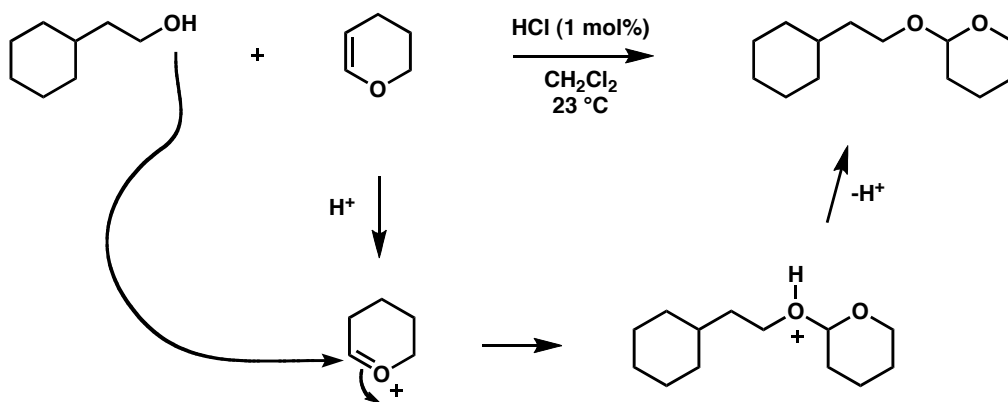
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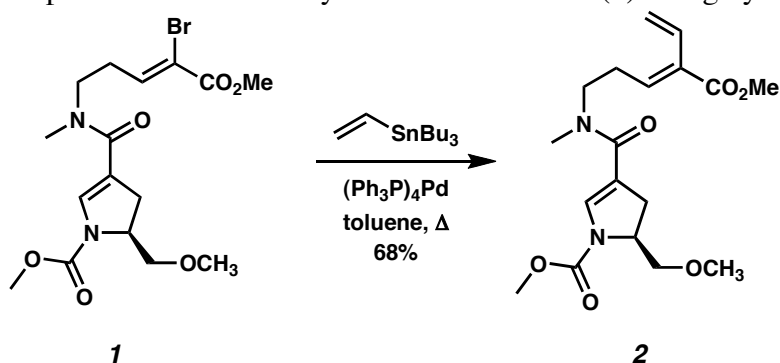
b.



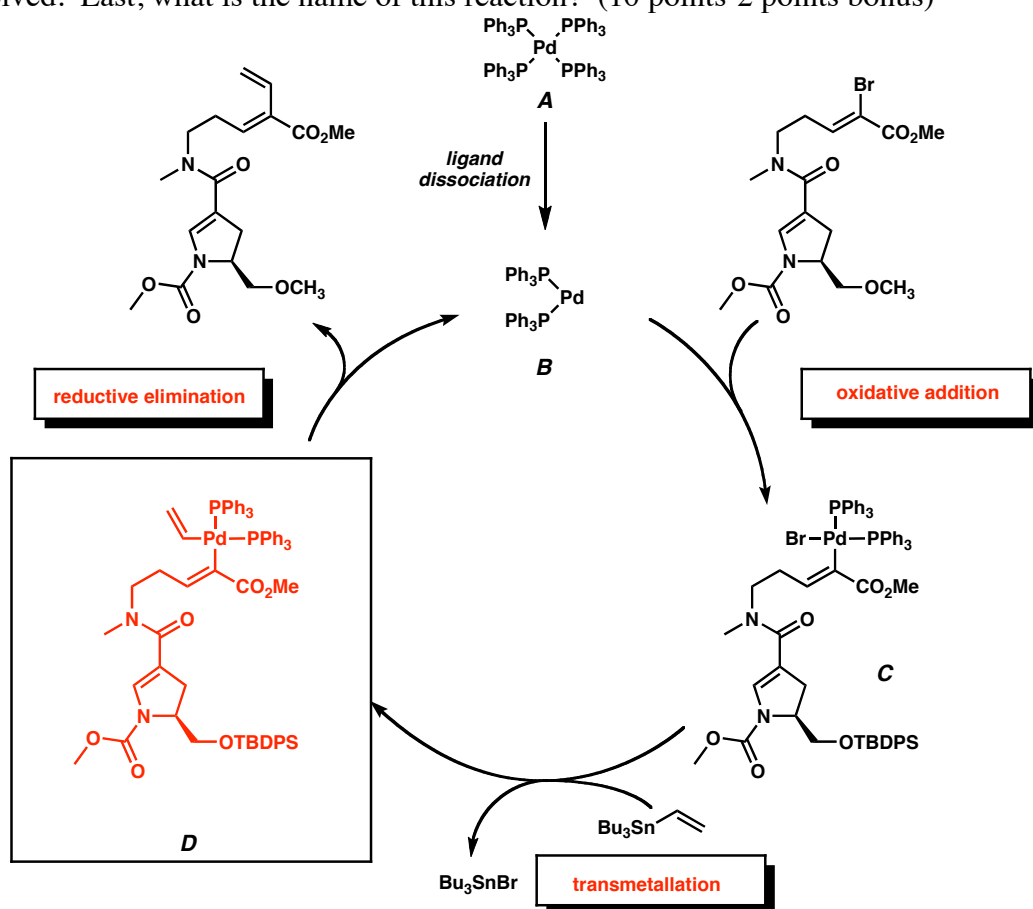
3. Predict the product and provide a reasonable and detailed mechanism for the following reaction (5 points).



4. The following reaction produces a valuable synthetic intermediate (**2**) in high yield.



a) A catalytic cycle for this reaction is shown below. Fill in the boxes with names (e.g., associative ligand substitution) describing each of the key steps and provide the structure of intermediate **D**. Next, fill in the blanks indicating the oxidation state, *d* electron count and the total electron count of the metal species involved. Last, what is the name of this reaction? (10 points-2 points bonus)

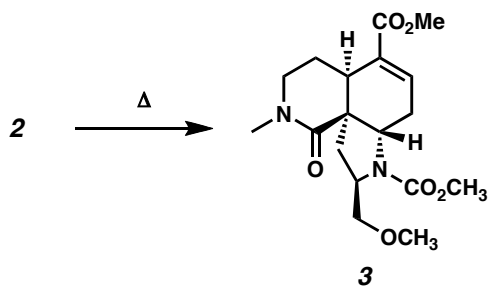


	Compound A	Compound B	Compound C
Metal oxidation state:	0	0	+2
Metal <i>d</i> count:	$d^{10}$	$d^{10}$	$d^8$
Total electron count:	18	14	16

(bonus-2 points) Name of reaction: Stille Coupling

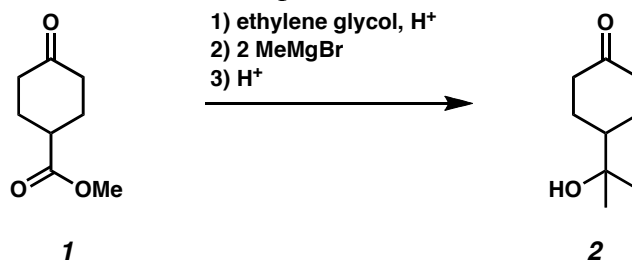


4b. (bonus 5 points) Interestingly, product **2** is not isolated but under the thermal conditions proceeds to a new product (**3**). Predict the structure of **3**.



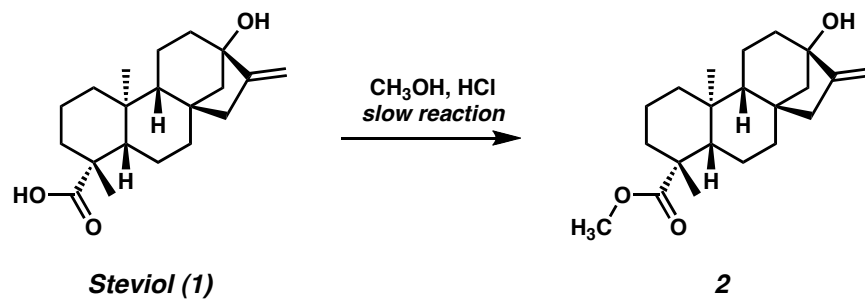
Any Diels Alder adduct is acceptable (stereochem, not important)

5. Provide a reasonable synthesis of **2** from **1**. (7 points)





6. The conversion of the natural product steviol (1) to its methyl ester 2 is a slow reaction under acid catalyzed esterification reaction conditions. Why would you expect this to be so? Under what conditions would you expect a rapid reaction to occur? Draw a mechanism for the successful reaction. (8 points)



–reaction is slow due to sterics

– $\text{CH}_2\text{N}_2$  or MeI, Base would work better. Mechanism as in class for either.

GROUP

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Db

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(266)

Sg

SEABORGIUM

107

(264)

Bh

BOHRIUM

108

(277)

Hs

HASSIUM

109

(268)

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MEITNERIUM

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UNQUADIUM

GROUP NUMBERS IUPAC RECOMMENDATION (1985)

GROUP NUMBERS CHEMICAL ABSTRACT SERVICE (1986)

ATOMIC NUMBER

RELATIVE ATOMIC MASS (1)

SYMBOL

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(1) Pure Appl. Chem., 73, No. 4, 667-683 (2001)

Relative atomic mass is shown with five significant figures. For elements having no stable nuclides, the value enclosed in brackets indicates the mass number of the longest-lived isotope of the element.

However three such elements (Th, Pa, and U) do have a characteristic terrestrial isotopic composition, and for these an atomic weight is tabulated.

Editor: Aditya Vardhan (advardhan@netlinx.com)

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(226)

Ra

RADIUM

89-103

Ac-Lr

Actinide

104

(261)

Rf

RUTHERFORDIUM

105

(262)

Db

DUBNIUM

106

(266)

Sg

SEABORGIUM

107

(264)

Bh

BOHRIUM

108

(277)

Hs

HASSIUM

109

(268)

Mt

MEITNERIUM

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Mg

MAGNESIUM

3

IIIB

4

IVB

5

VB

6

VIB

7

VIIIB

8

VIIIB

9

VIIIB

10

VIIIB

11

IB

12

IIB

13

IIIA

14

IVA

15

VA

16

VIA

17

VIIA

18

VIIIA

19

39.098

K

POTASSIUM

20

40.078

Ca

CALCIUM

21

44.956

Sc

SCANDIUM

22

47.867

Ti

TITANIUM

23

50.942

V

VANADIUM

24

51.996

Cr

CHROMIUM

25

54.938

Mn

MANGANESE

26

55.845

Fe

IRON

27

58.933

Co

COBALT

28

58.693

Ni

NICKEL

29

63.546

Cu

COPPER

30

65.39

Zn

ZINC

31

69.723

Ga

GALLIUM

32

72.64

Ge

GERMANIUM

33

74.922

As

ARSENIC

34

78.96

Se

SELENIUM

35

79.904

Br

BROMINE

36

83.80

Kr

KRYPTON

37

85.468

Rb

RUBIDIUM

38

87.62

Sr

STRONTIUM

39

*The End*