

Chem 41c Midterm Exam

Stoltz, Spring 2006, May 5, 2006

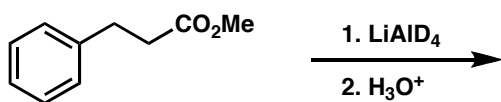
The exam begins when you turn to page 2. You have 55 minutes to complete the exam. This is a closed note and closed book exam with no collaboration. You may use the periodic table at the front of the room or the one on the last page of this packet. You may not use any other materials. The exam has a total of 130 points. Your grade will be calculated based on 120 points (i.e., you have 10 bonus points built-in). (Also, remember that your midterm counts 60 points toward your final grade, e.g., 5 quiz points = 10 points here). Good luck.

There are 9 pages in this exam packet.

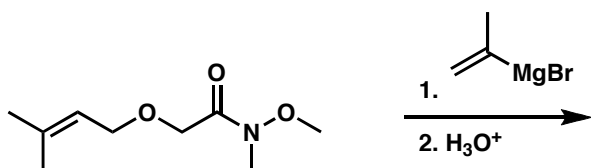
Name: _____

1. Predict the major non-volatile products (if any) of the following reactions or sequences. (5 points each)

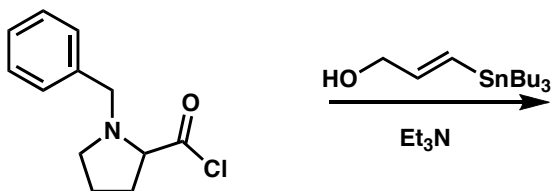
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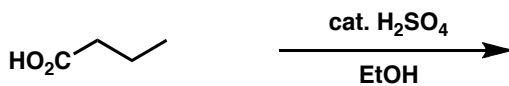
b.



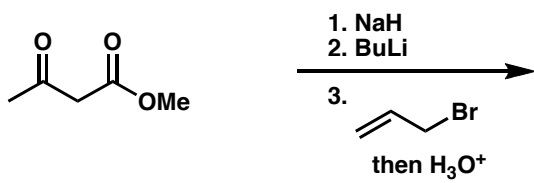
c.



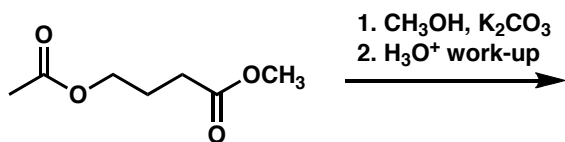
d.



e.

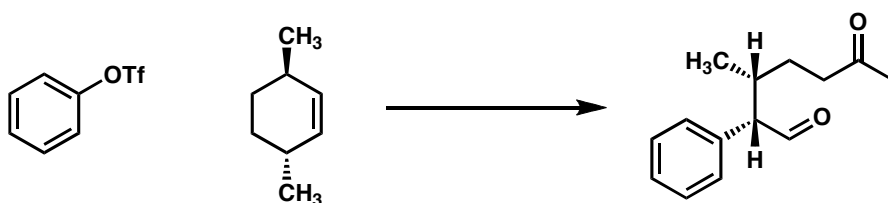


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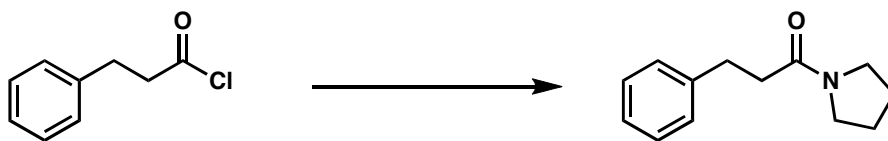


2. Provide reagents for the following transformations. They may be multistep processes (none are longer than 3 steps). (5 points each)

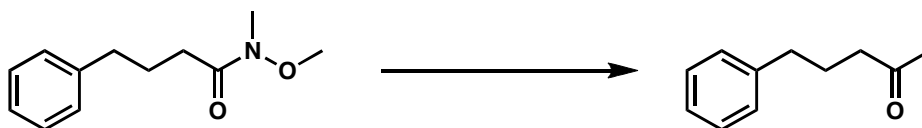
a.



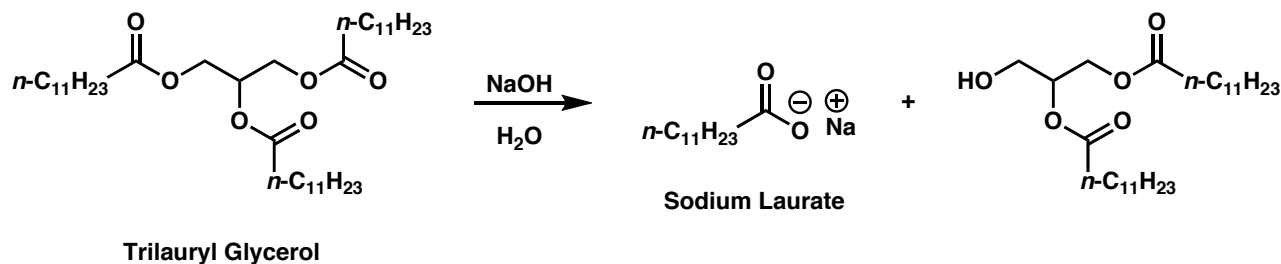
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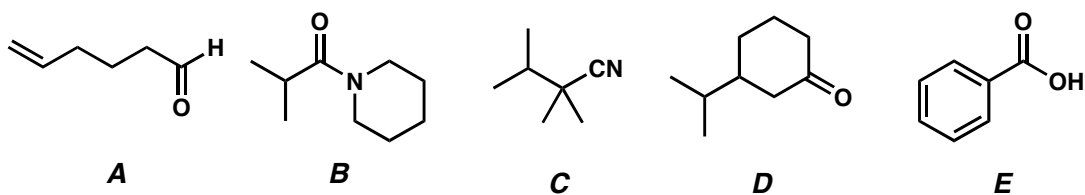
3. Trilauryl glycerol, a large component of coconut oil, is commonly used to make soap through a process known as saponification. The process involves cooking the oil in a lye (sodium hydroxide) solution, which saponifies the trilauryl glycerol component in the oil to sodium laurate.



Draw a mechanism for the above reaction (15 points).

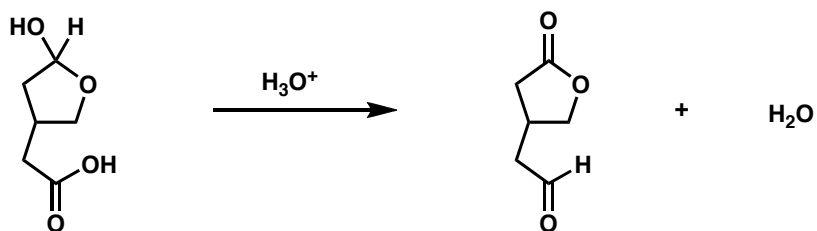
BONUS: Why does the reaction go to completion? (5 bonus points)

4. Rank the following compounds in order of reactivity with MeMgBr. (10 points)

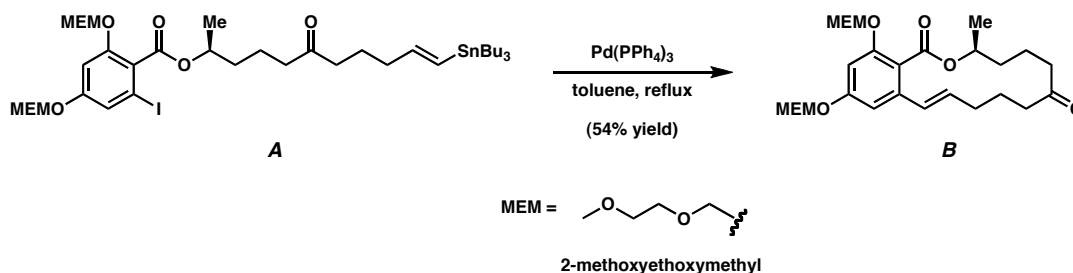


most reactive > > > > least reactive

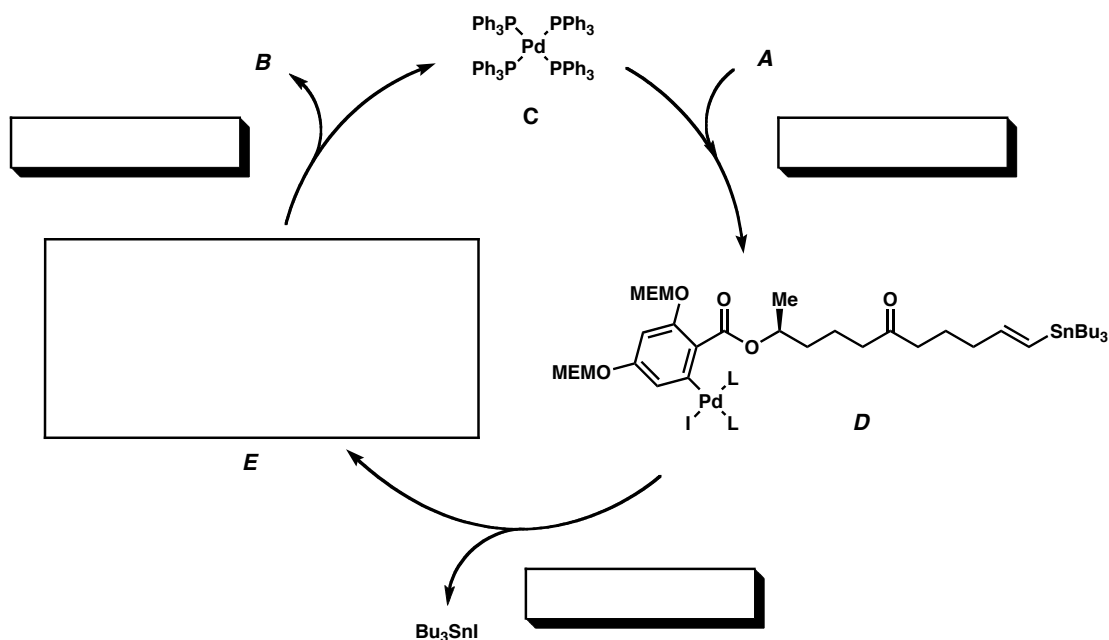
5. Provide a detailed mechanism for the following reaction. (10 points)



6. In 1991, the palladium catalyzed reaction shown below was used in the asymmetric total synthesis of the natural product (*S*)-Zearalenone.



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 **E**. 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? (20 points-5 points bonus)



Compound C

Compound D (assume L = PPh₃)

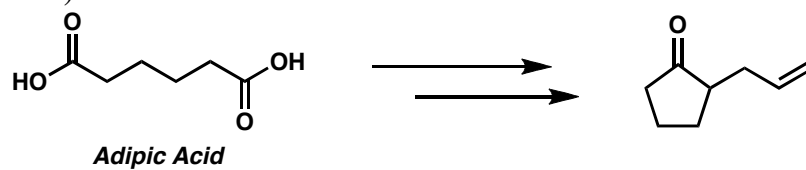
Metal oxidation state: _____

Metal *d* count: _____

Total electron count: _____

(bonus-5 points) Name of reaction: _____

7. Devise a synthesis of 2-allyl-cyclopentanone starting from adipic acid and any other reagents containing 3 carbons or less. (20 points)



PERIODIC TABLE OF THE ELEMENTS

<http://www.ktf-split.hr/periodni/en/>

GROUP

1

IA

1

1.0079

PERIOD

1

1

H

HYDROGEN

2

IIA

3

6.941

4

9.0122

2

Li

Be

BERYLLIUM

11

22.990

12

24.305

3

Na

Mg

SODIUM

MAGNESIUM

19

39.098

20

40.078

21

44.956

22

47.867

23

50.942

24

51.996

25

54.938

26

55.845

27

58.933

28

58.693

29

63.546

30

65.39

31

69.723

32

72.64

33

74.922

34

78.96

35

79.904

36

83.80

4

K

Ca

Sc

Ti

V

Cr

Mn

Fe

Co

Ni

Cu

Zn

Ga

Ge

As

Se

Br

Kr

POTASSIUM

CALCIUM

SCANDIUM

TITANIUM

Vanadium

CHROMIUM

MANGANESE

IRON

COBALT

NICKEL

COPPER

ZINC

GALLIUM

GERMANIUM

ARSENIC

SELENIUM

BROMINE

KRYPTON

37

85.468

38

87.62

39

88.906

40

91.224

41

92.906

42

95.94

43

(98)

44

101.07

45

102.91

46

106.42

47

107.87

48

112.41

49

114.82

50

118.71

51

121.76

52

127.60

53

126.90

54

131.29

5

Rb

Sr

Y

Zr

Nb

Mo

Tc

Ru

Rh

Pd

Ag

Cd

In

Sn

Sb

Te

I

Xe

RUBIDIUM

STRONTIUM

YTRITIUM

ZIRCONIUM

NIOBIUM

MOLYBDENUM

TECHNETIUM

RUTHENIUM

RHODIUM

PALLADIUM

SILVER

CADMIUM

INDIUM

TIN

ANTIMONY

TELLURIUM

IODINE

XENON

55

132.91

56

137.33

57-71

La-Lu

Lanthanide

72

178.49

73

180.96

74

183.84

75

186.21

76

190.23

77

192.22

78

195.08

79

196.97

80

200.59

81

204.38

82

207.2

83

208.98

84

(209)

85

(210)

86

(222)

6

Cs

Ba

La-Lu

Hf

Ta

W

Re

Os

Ir

Pt

Au

Hg

Tl

Pb

Bi

Po

At

Rn

CAESIUM

BARIUM

Lanthanide

HAFNIUM

TANTALUM

TUNGSTEN

RHENIUM

OSMIUM

IRIDIUM

PLATINUM

GOLD

MERCURY

THALLIUM

LEAD

BISMUTH

POLONIUM

ASTATINE

RADON

87

(223)

88

(226)

89-103

Ac-Lr

Actinide

104

(261)

105

(262)

106

(266)

107

(264)

108

(277)

109

(268)

110

(281)

111

(272)

112

(285)

114

(289)

7

Fr

Ra

Ac-Lr

Rf

Db

Sg

Bh

Hs

Mt

Uun

Uuu

Uub

Uuq

FRANCIUM

RADIUM

Actinide

RUTHERFORDIUM

DUBNIUM

SEABORGIUM

BOHRIUM

HASSIUM

MEITNERIUM

UNUNNIUM

UNBIDIUM

UNTRIUM

UNQUADIUM

GROUP NUMBERS
IUPAC RECOMMENDATION
(1985)

GROUP NUMBERS
CHEMICAL ABSTRACT SERVICE
(1986)

ATOMIC NUMBER

SYMBOL

ELEMENT NAME

RELATIVE ATOMIC MASS (1)

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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 (adivar@netlinx.com)

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LANTHANIDE															
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
LANTHANUM	CERIUM	PRASEODYMIUM	NEODYMIUM	PROMETHIUM	SAMARIUM	EUROPIUM	GADOLINIUM	TERBIUM	DYSPROSIUM	HOLMIUM	ERBIDIUM	THULIUM	YTTERBIUM	LUTETIUM	
ACTINIDE															
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	
ACTINIUM	THORIUM	PROTACTINIUM	URANIUM	NEPTUNIUM	PLUTONIUM	AMERICIUM	CURIUM	BERKELIUM	CALIFORNIUM	EINSTEINIUM	FERMILIUM	MENDELEVIUM	NOBELIUM	LAWRENCECIUM	

The End