

Name: _____

SID: _____

Signature: _____

**PRINT YOUR
NAME CLEARLY!!**

**Chem 3BL Su09
Neil O.L. Viernes**

Final Exam

10AUG09

This exam has 10 pages; **make sure you have them all.** Page 6 is blank. Use as scratch paper, anything written on it will NOT be graded.

Please place answers in designated spaces. **Please write clearly.** Messy or ambiguous answers will not be graded.

This exam is 60 minutes long. No clarifying questions will be answered by the GSI's after the exam begins.

Mark one of the following.

___ 101 – Greg Dallinger

___ 102 – Winnie Liang

___ 103 – Jonathan Pai

___ 107 – Philip Chung

___ 108 – Katherine He

___ 109 – David Nagle

___ 201 – Jocelyn Scheintaub

___ 202 – Raj Dedhia

___ 203 – Christine Yin

___ 204 – Susan Kim

___ 207 – Massimo Pacilli

___ 208 – Lily Zhong

Do not write in this box

1) _____ (8)

2) _____ (10)

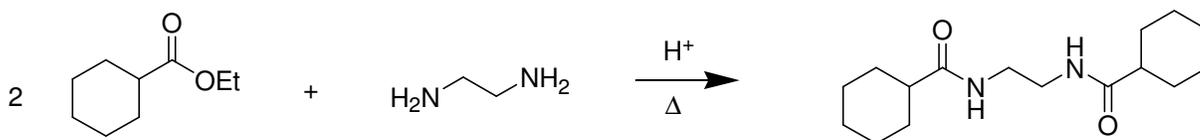
3) _____ (10)

4) _____ (10)

Total: _____ (38)

1) (8 pts)

The following reaction was conducted in lab



Calculate the molecular weight of the product

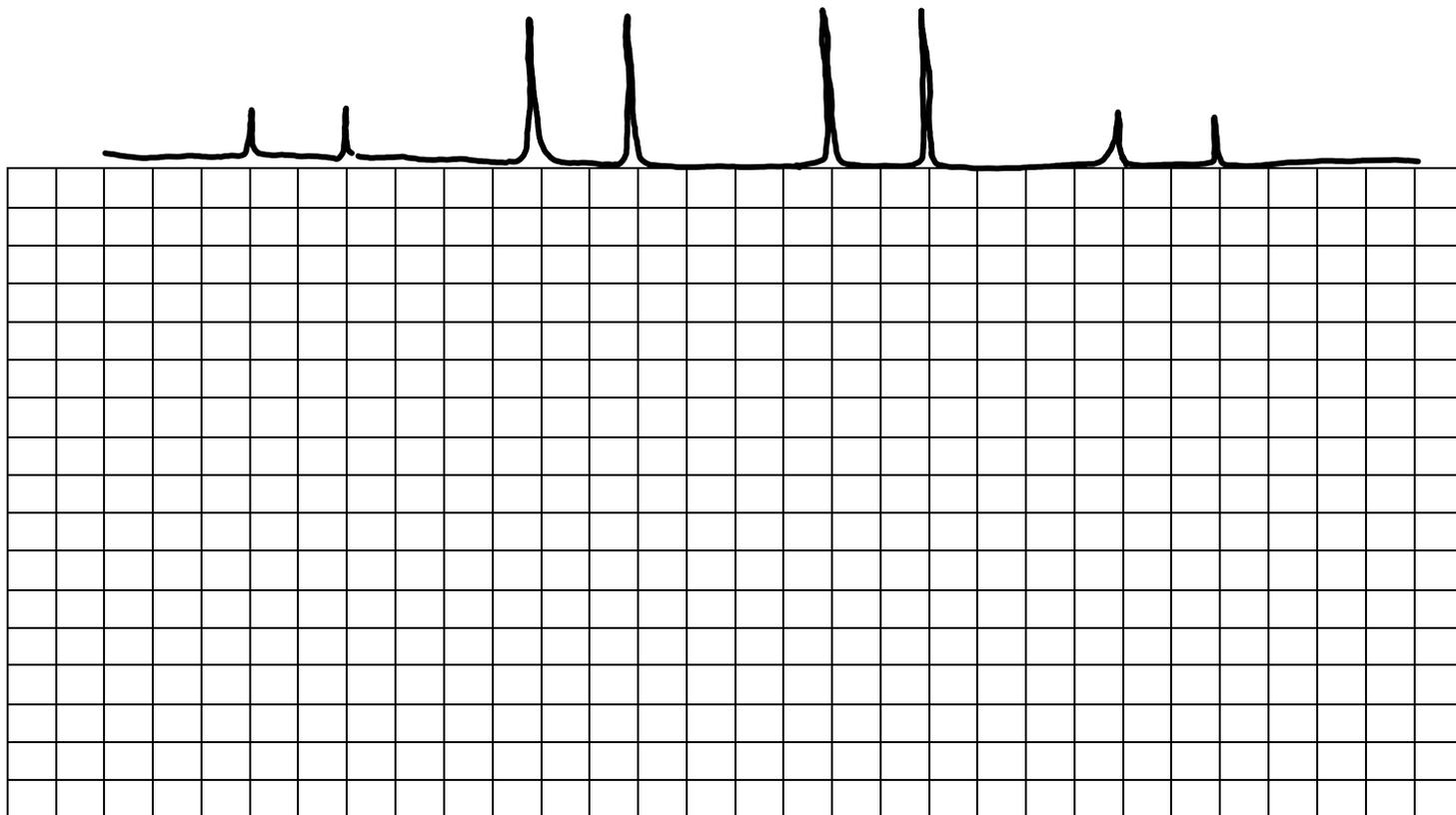
If 1 mmol of (1) and 1 mmol of (2) was used, what is the theoretical yield of the product?

If 0.5 g of the product was isolated and the %yield of the reaction was 87%. How many grams of (1) was added to the reaction?

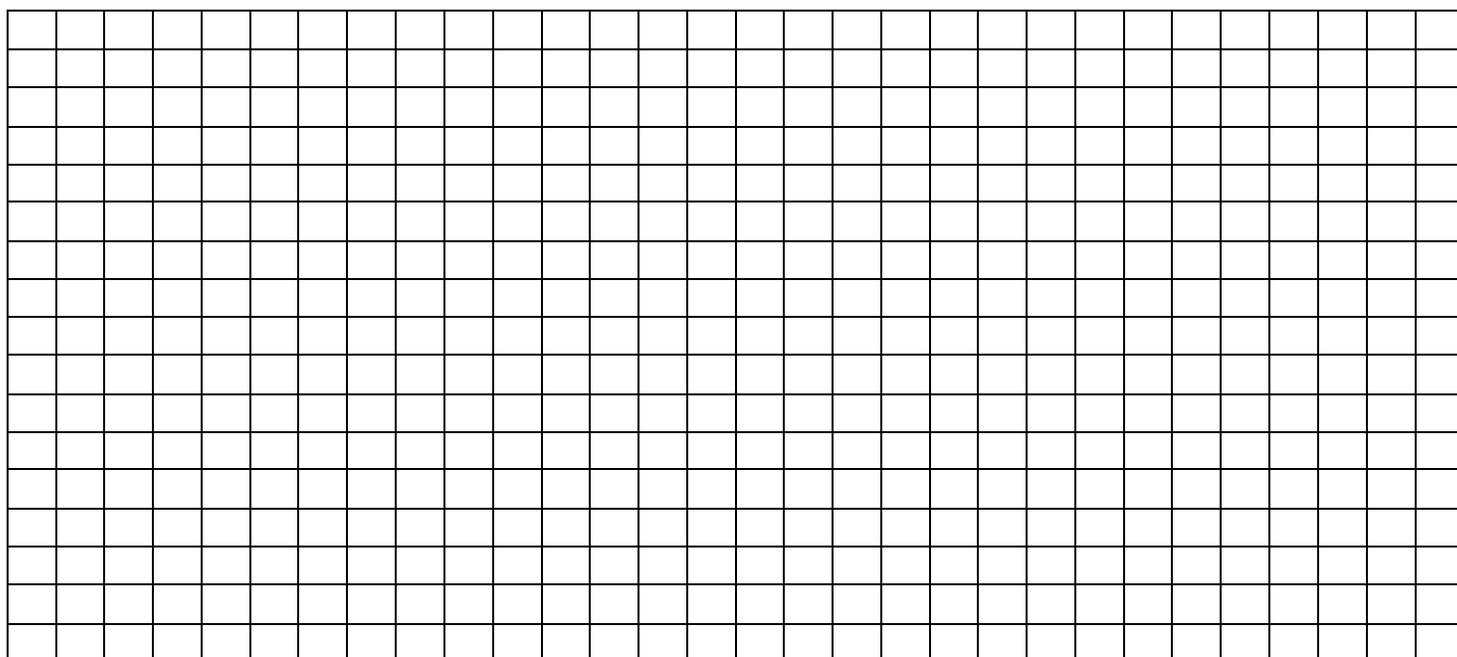
If an excess amount of (2) was used in the reaction, predict the product of the reaction with the new stoichiometry.

2) (10 pts)

Describe the splitting observed below. Include the coupling constants in your answer.

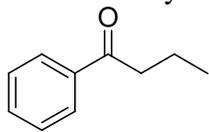


Draw the splitting tree for a quartet-triplet with a coupling constant of 6 and 2 respectively. Also provide the expected ratios for each peak.

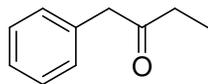


3) (10 pts)

How would you differentiate between the two ketones



(1)

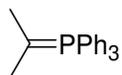


(2)

With ^1H NMR:

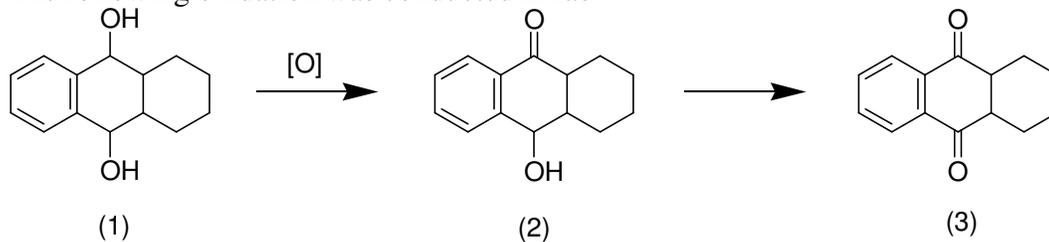
With mass spectrometry

Predict the product of the reaction between compound 1 and



4) (10 pts)

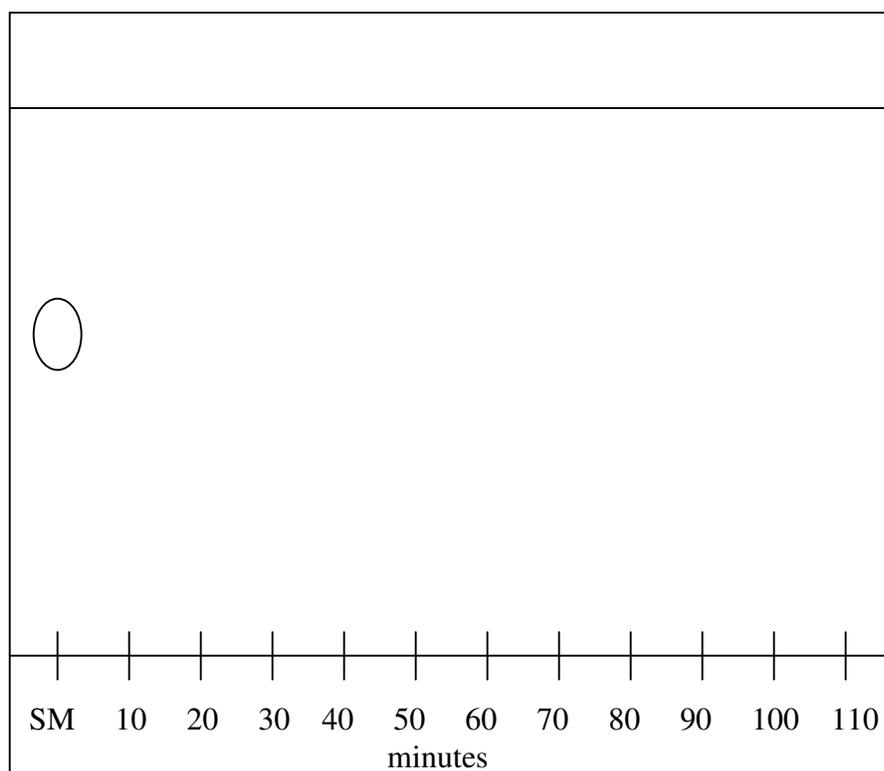
The following oxidation was conducted in lab



Complete the following Reversed Phase TLC plate for the reaction with the following additional information:

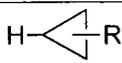
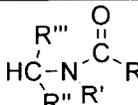
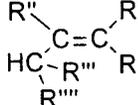
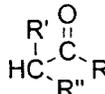
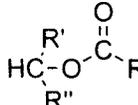
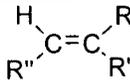
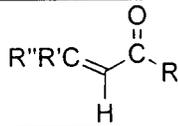
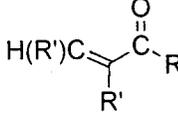
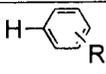
- 1) The starting material alcohol is not observed after 45 minutes
- 2) The intermediate is observed after 15 minutes
- 3) The product is observed after 25 minutes
- 4) The reaction is complete after 65 minutes

The starting material alcohol is identified in the column marked SM. Samples of the reaction were spotted every 10 minutes. Identify the spots corresponding to compounds 1 and 2.

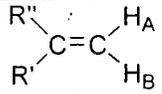
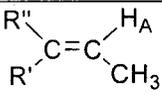
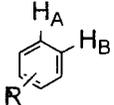
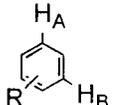
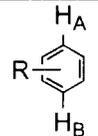
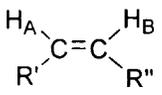
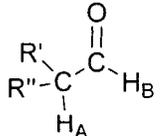
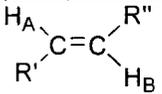


A sample obtained at 30 minutes was analyzed by gas chromatography. Rank the compounds by order of detection (1=detected first).

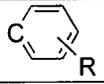
¹H NMR Chemical Shifts

Chemical Shift Range (ppm)	Type of Hydrogen	Chemical Shift Range (ppm)	Type of Hydrogen
0.2-0.8		2.7-4.0	
0.8-1.2	H ₃ C-R	2.8-3.8	
1.2-1.8	H ₂ C- 	3.1-4.0	
1.4-1.8		3.2-3.6	
1.6-2.2		3.2-3.6	
1.8-2.6		3.6-4.8	
1.9-3.0	HC≡CR	4.2-4.8	
2.0-2.8		4.6-5.7	
2.1-3.1		5.5-6.0	
2.2-2.9		6.0-7.5	
2.2-2.8		6.0-8.5	
2.2-4.2		9.0-10.0	

H-H Coupling Constants

Type of Coupling	Coupling Constant (Hz)	Type of Coupling	Coupling Constant (Hz)
H_A-C-H_A	0		0-3
H_A-C-H_B	2-30 (geminal)		4-10
$H_A-C-C-H_B$	0-10 (vicinal)		6-10 (ortho)
$H_A-C-C-C-H_B$	0-1 (rare)		1-3 (meta)
$H_A-C-C=C-H_B$	2-3 (allylic)		0-1 (para)
	6-12 (cis)		1-3
	12-18 (trans)		

¹³C NMR Chemical Shifts

Chemical Shift Range (ppm)	Type of Carbon	Chemical Shift Range (ppm)	Type of Carbon
0-5	$R'RC \triangle$	27-60	$C-NR_2$
5-30	H_3C-R	50-80	$C-OR$ alcohols and ethers
25-45	$H_2C \begin{matrix} /R \\ \backslash R' \end{matrix}$	75-95	$R'C \equiv CR$
35-60	$HC \begin{matrix} /R \\ \backslash R' \\ R'' \end{matrix}$	115-130	$N \equiv CR$
30-50	$\begin{matrix} R'' & & R \\ & \diagdown & / \\ & C & \\ & / & \diagdown \\ R''' & & R' \end{matrix}$	105-145	$\begin{matrix} R'' & & R' \\ & \diagdown & / \\ & C=C & \\ & / & \diagdown \\ R''' & & R \end{matrix}$
70-80	$C-F$	115-160	
25-50	$C-Cl$	150-185	$\begin{matrix} O \\ \\ R_2N-C-R \end{matrix}$
10-40	$C-Br$	150-185	$\begin{matrix} O \\ \\ RO-C-R \end{matrix}$ carboxylic acids and esters
0-30	$C-I$	185-220	$\begin{matrix} O \\ \\ R'-C-R \end{matrix}$ aldehydes and ketones

