Name:	SID:	
Signature:	PRINT NAME CI	' YOUR LEARLY!!
Chem 3BL Su09	Final Exam	10AUG09

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

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 <u>will not be</u> <u>graded</u>.

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



### 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



With <sup>1</sup>H 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).

# <sup>1</sup>H NMR Chemical Shifts

Chemical Shift Range (ppm)	Type of Hydrogen	Chemical Shift Range (ppm)	Type of Hydrogen
0.2-0.8	H-	2.7-4.0	R HC – Br R'
0.8-1.2	H₃C-R	2.8-3.8	R''' " HĆ,−N´C`R R" <sup>R'</sup>
1.2-1.8	H₂C< <sup>R</sup> R'	3.1-4.0	R HC–CI R'
1.4-1.8	HC< <sup>R</sup> ' R' R"	3.2-3.6	R' HC(-OR R"
1.6-2.2	R",R' C=C, HC,R""R R"""	3.2-3.6	R HĆ–OH R'
1.8-2.6	R' <sup>O</sup> HC <sup>C</sup> R R"	3.6-4.8	0 R' <sup>"</sup> HC-O <sup>C</sup> R R"
1.9-3.0	HC≡CR	4.2-4.8	R HC(-F R'
2.0-2.8	R HC CN R'	4.6-5.7	H_C=C_R R"R'
2.1-3.1	R' HC´–SR R"	5.5-6.0	R"R'C H
2.2-2.9	R HC(Ph R'	6.0-7.5	H(R')C R'
2.2-2.8	R' HC(−NR₂ R"	. 6.0-8.5	H-
2.2-4.2	HC HC R'	9.0-10.0	O H <sup>Ź</sup> R

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# **H-H Coupling Constants**

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Type of Coupling	Coupling Constant (Hz)	Type of Coupling	Coupling Constant (Hz)
H <sub>A</sub> _C <sup>H</sup> A	. 0	$ \begin{array}{c}     R'' \\     C = C \\     H_B \end{array} $	0-3
H <sub>A</sub> ~C~H <sub>B</sub>	2-30 (geminal)	R'C=CCH <sub>3</sub>	4-10
H <sub>A</sub> _C <sup>C</sup> H <sub>B</sub>	0-10 (vicinal)	H <sub>A</sub> H <sub>B</sub>	6-10 (ortho)
H <sub>A</sub> _C <sup>C</sup> C <sup>H</sup> B	0-1 (rare)	R <sup>H</sup> A H <sub>B</sub>	1-3 ( <i>meta</i> )
H <sub>A</sub> C C C M H <sub>B</sub>	2-3 (allylic)		0-1 (para)
H <sub>A</sub> C=C <sup>H<sub>B</sub></sup> R"	6-12 ( <i>cis</i> )	0    R'_C R''-C H <sub>B</sub> H <sub>A</sub>	1-3
H <sub>A</sub> C=C <sup>R</sup> R'C=CH <sub>B</sub>	12-18 (trans)		

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# <sup>13</sup>C NMR Chemical Shifts

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Chemical Shift Range (ppm)	Type of Carbon	Chemical Shift Range (ppm)	Type of Carbon
0-5	R'RC	27-60	C-NR <sub>2</sub>
5-30	H₃C—R	50-80	C-OR alcohols and ethers
25-45	H₂C< <sup>R</sup> R'	75-95	R'C≡CR
35-60	HC   R' R'	i15-130	N≡CR
30-50	R" R	105-145	
70-80	C—F	115-160	C R
25-50	C-CI	150-185	$R_2 N \sim R$
10-40	C—Br	150-185	
			carboxylic acids and esters
0-30	CI	185-220	O II R' <sup>C</sup> R aldehvdes
	·		and ketones

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