EXAMINATION 1

Chemistry 3B
Professor K. Peter C. Vollhardt
February 22, 1994

Name:_____
[Print first name before second! Use capital letters!]

Please check the name of your TA and corresponding section number. Complete the remaining information if applicable.

101	David Rea	_____	313	Krista Beaver	_____
102	Michael Lai	_____	411	Deepak Sonthalia	_____
111	Sara Cherry	_____	412	Alicia Albers Wright	_____
112	Barry Bunin	_____	413	Hyun Jin Kim	_____
113	Anita Huang	_____	414	Son Pham	_____
211	Jennifer Fujii	_____	511	Holly Wessling	_____
212	Kevin Cammack	_____	512	Mo Movassaghi	_____
213	Son Pham	_____	513	Abdolreza Siadati	_____
301	David Rea	_____	601	Lecture Only	_____
302	Demetra Panomitros	_____	703	Stephen Mills	_____
311	Matthew Plunkett	_____	704	Arvind Rajpal	_____
312	Josh Levine	_____			

Making up an I Grade _____

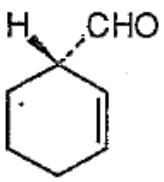
(If you are, please indicate the semester in which you took previous Chem 3B or 8B _____)

Please write the answer you wish to be graded in the spaces provided. Do scratch work on the back of the pages. This test should have 13 numbered pages. Check to make sure that you have received a complete exam. A good piece of advice: **read carefully over the questions (at least twice); make sure that you understand exactly what is being asked; avoid sloppy structures or phrases, it is better to be pedantic in accuracy! Good Luck!**

I.	_____	(30)
II.	_____	(50)
III.	_____	(60)
IV.	_____	(30)
V.	_____	(30)
TOTAL		(200)

I. [30 Points] Name (IUPAC) or draw, as appropriate, the following molecules, including their stereochemistry.

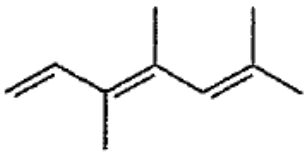
a.



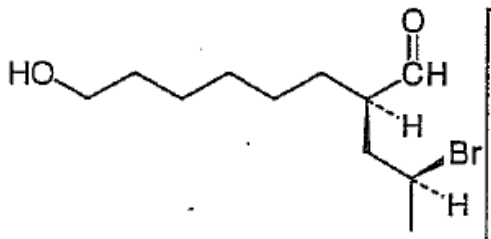
b.

Hex-1-yne-3-one

c.



d.

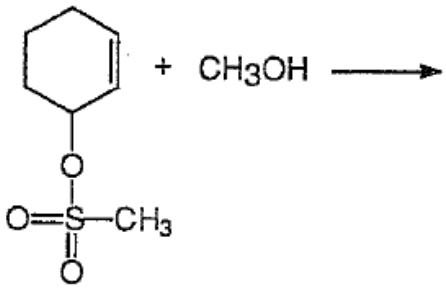


e.

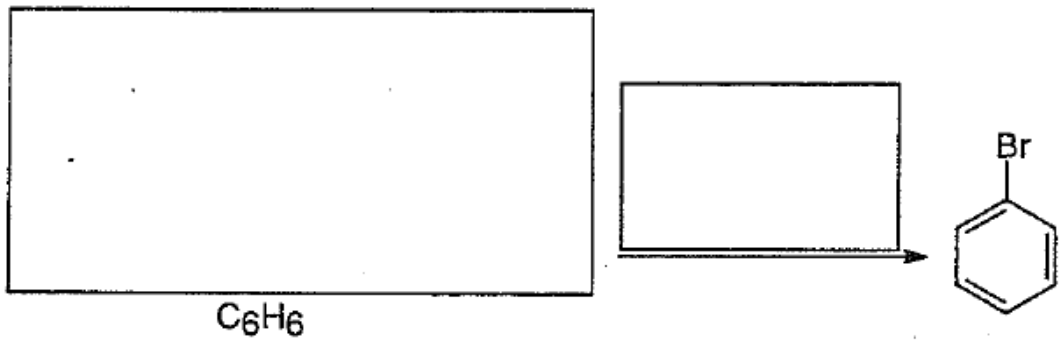
4-Oxo-2-hexynal

II. [50 Points] Add the missing components (starting materials, reagents, or products) of the following reactions in the boxes provided. Aqueous work-up (when required) is assumed to be part of a step. It is not part of any answer.

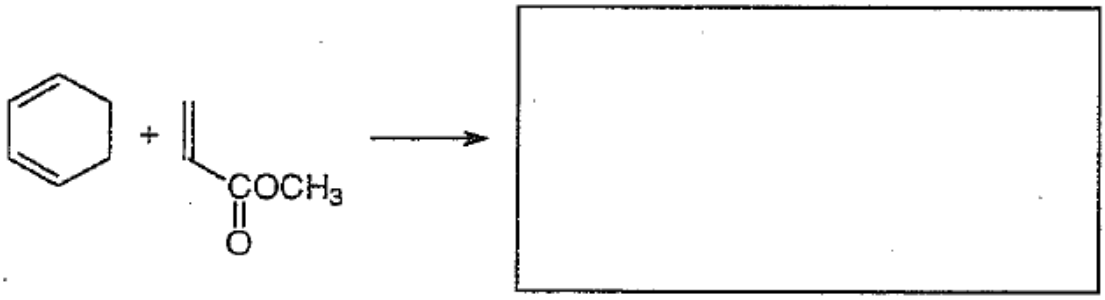
a.



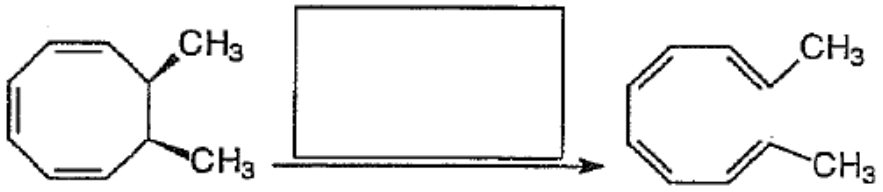
b.



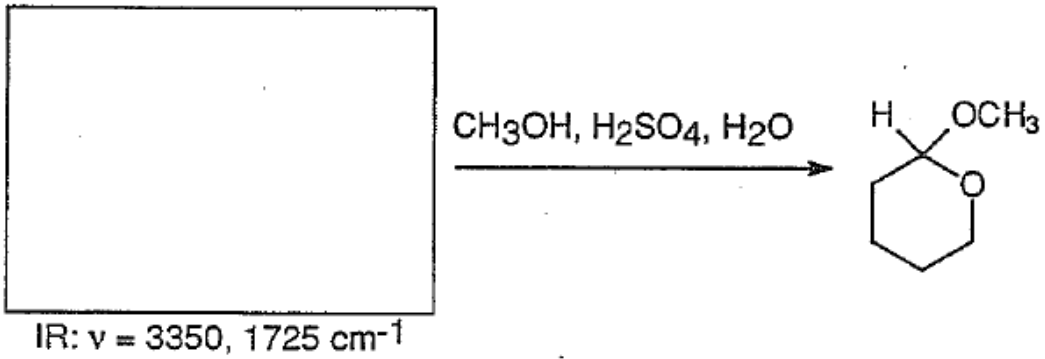
c.



d.

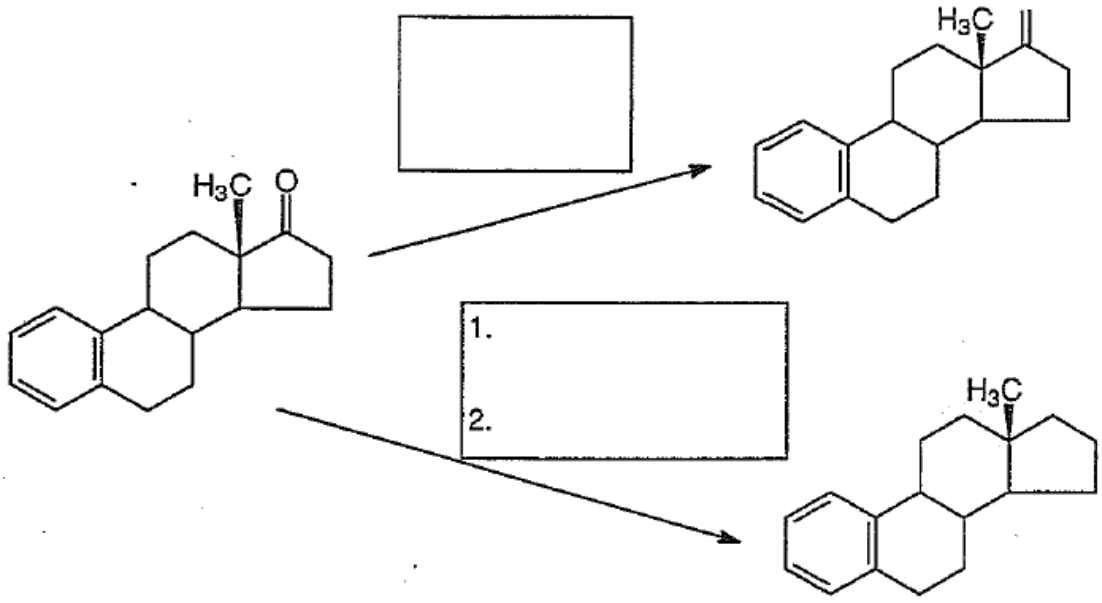


e.

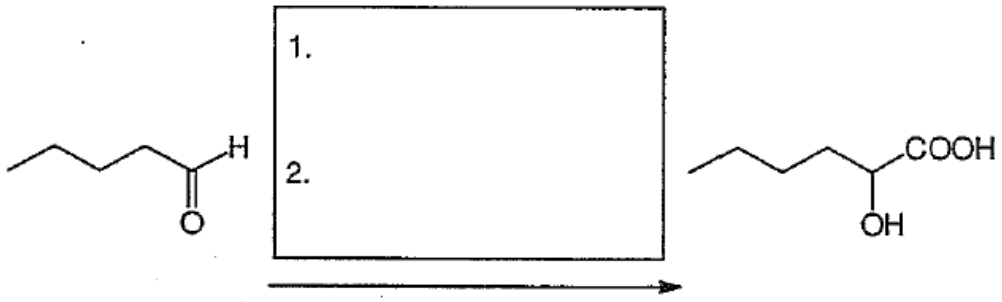


IR: ν = 3350, 1725 cm^{-1}

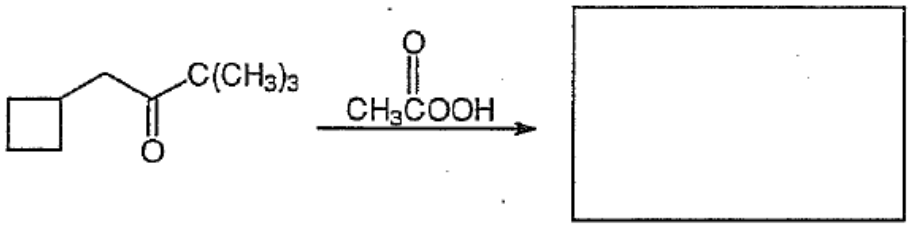
f.


H3C
O
H3C
1.
2.
H3C

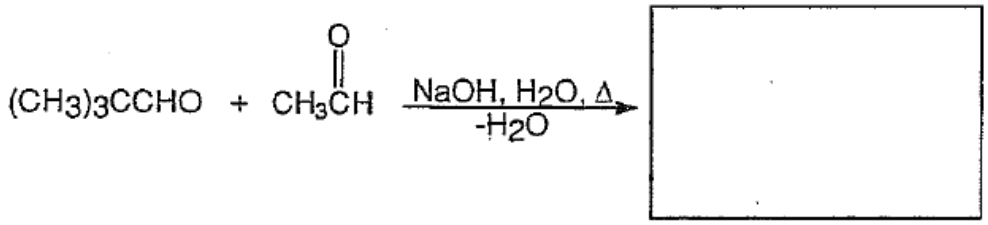
g.


1.
2.
H
O
COOH
OH

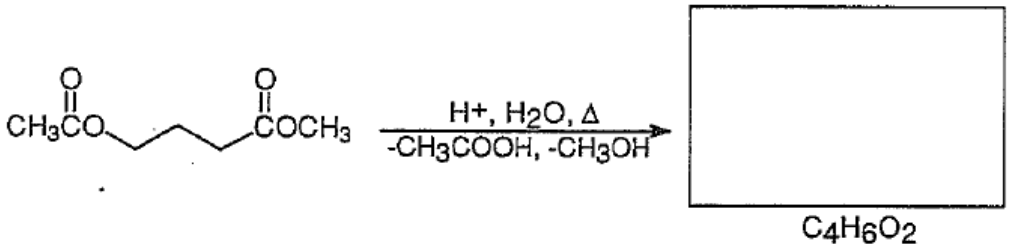
h.


C(CH3)3
O
O
CH3COOH

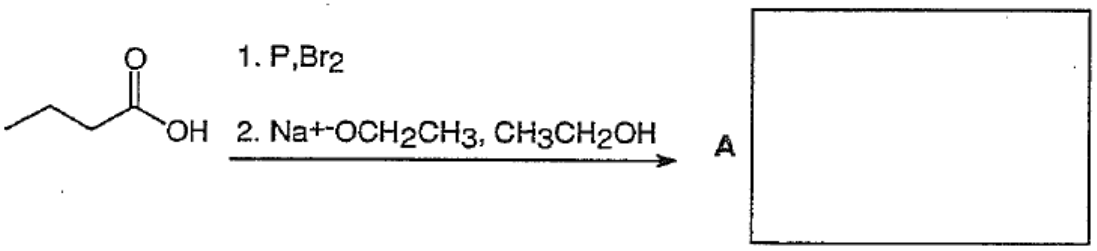
i.


(CH3)3CCHO
+
O
CH3CH
NaOH, H2O, Δ
-H2O

j.



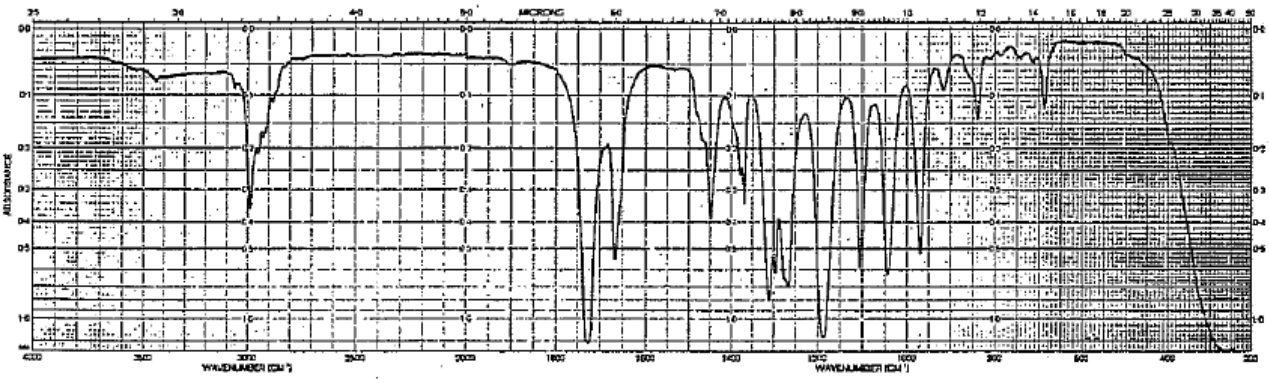
III. [60 Points] A researcher performed the Hell-Volhard-Zelinski bromination on butanoic acid and worked up the reaction mixture with sodium ethoxide in ethanol. The product A was a liquid, b.p. 145°C, which decolorized bromine solutions. Its IR and NMR spectra are shown below. The UV spectrum reveals an absorption at 314 nm (ε = 25).



a. What is A?

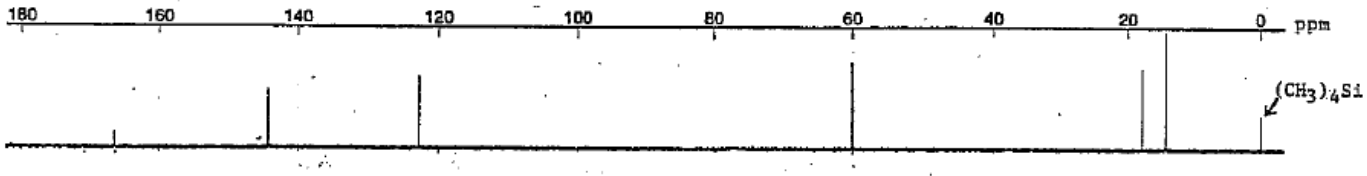
b. Interpret the spectral data as requested in the spaces provided.

1. IR Spectrum



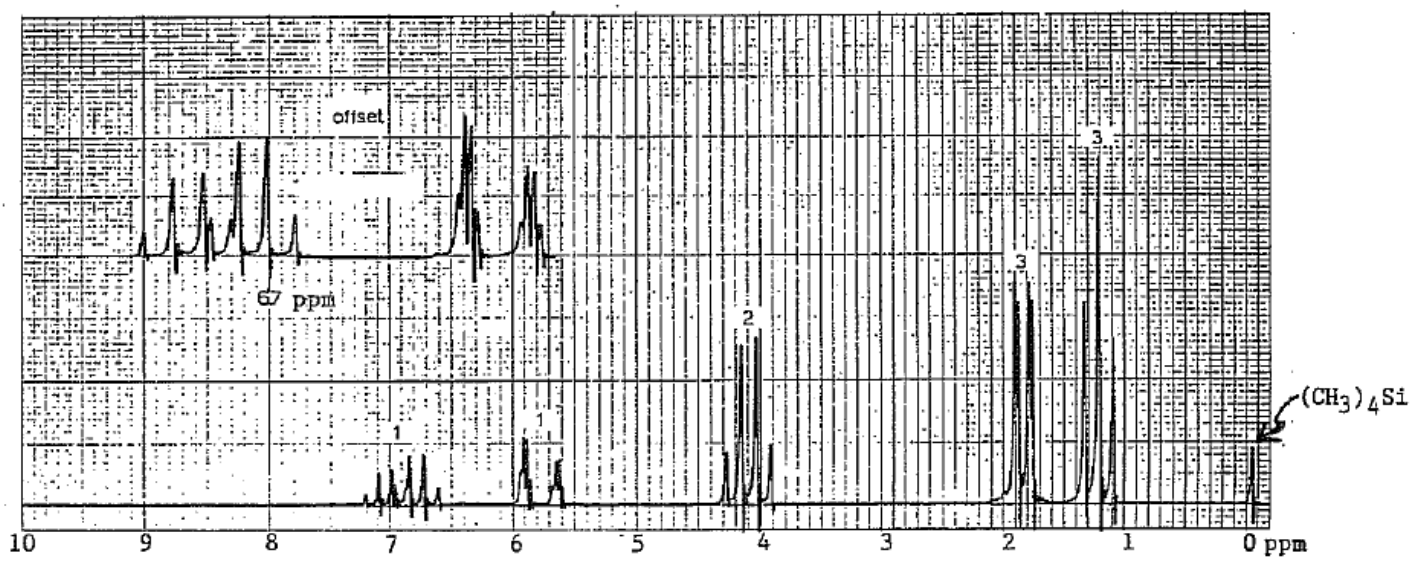
Comment on the peaks at 2990 and 1730 cm^{-1}.

2. ^{13}C NMR Spectrum



Number of lines, chemical shift assignments.

3. ^{1}H NMR Spectrum



Integration, chemical shifts, multiplicities, assignments of absorptions. The spectrum is reported as follows: δ = 1.24 (t, J = 6.8 Hz), 1.88 (dd, J = 6.8, 1.7 Hz), 4.13 (q, J = 6.8 Hz), 5.81 (dq, J = 16.0, 1.7 Hz), 6.95 (dq, J = 16.0, 6.8 Hz).

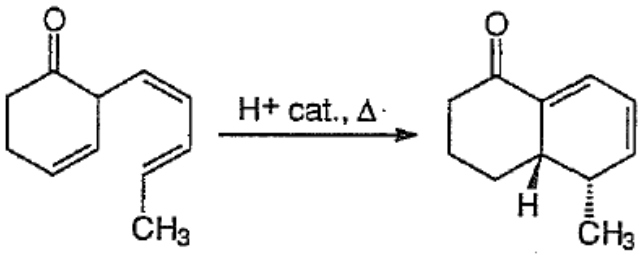
4. UV Spectrum

   Assign the absorption to a functional group.

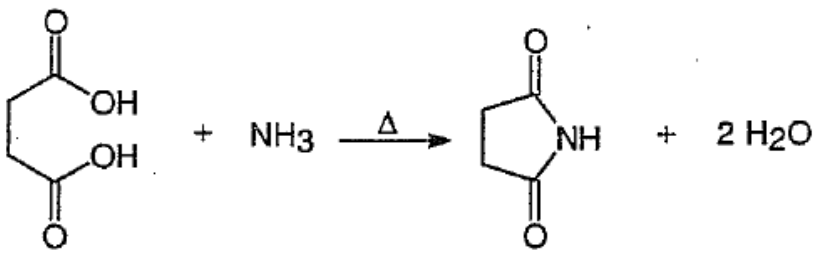
c. Formulate a detailed mechanism for the formation of **A.**

IV. [30 Points] Write detailed mechanisms to explain the following observations.

a.

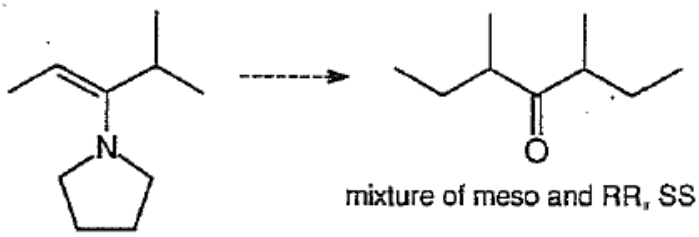


b.



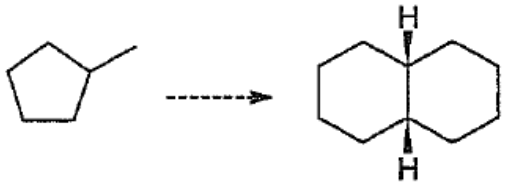
V. [30 Points] Provide a reasonable synthetic route from starting material to product. Note: several steps are required and there may be more than one solution to the problem. You may use any additional organic or organometallic reagents to effect your conversions.

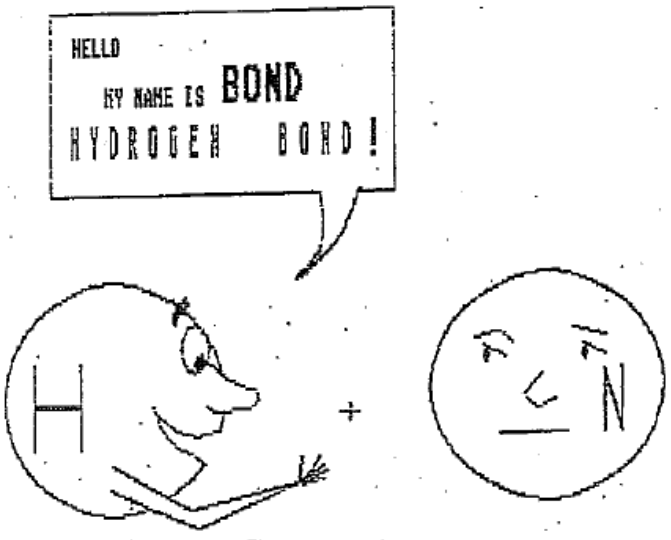
a.



mixture of meso and RR, SS isomers

b.





Good luck!
The End