EXAMINATION 2
Chemistry 3B

Name: Key _____ **SID #:** _____
Print first name before second!
Use capital letters!

GSI (if you are taking Chem 3BL): _____

Peter Vollhardt
October 28, 2010

Please provide the following information if applicable.

Making up an I Grade _____
If you are, please indicate the semester during which you took previous Chem 3B:

_____ _____
Semester Instructor

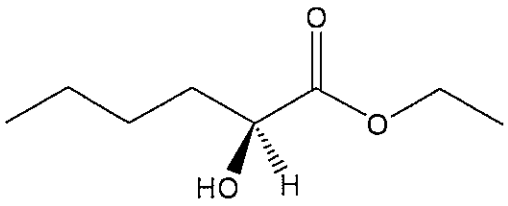
Please write the answer you wish to be graded in the spaces provided. ***Do scratch work on the back of the pages***. This test should have **13** numbered pages. Check to make sure that you have received a complete exam. A good piece of advice: **Read carefully over the questions (at least twice); make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

DO NOT WRITE IN THIS SPACE

I.	_____	**(30)**
II.	_____	**(30)**
III.	_____	**(50)**
IV.	_____	**(60)**
V.	_____	**(60)**
VI.	_____	**(20)**
Total:	_____	**(250)**

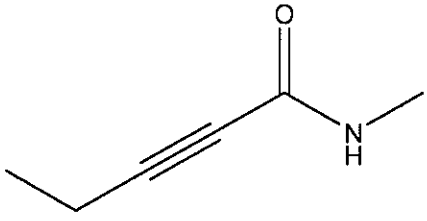
I. [30 Points] Name or draw, as appropriate, the following molecules according to the IUPAC rules. Indicate stereochemistry where necessary (*cis*, *trans*, *E*, *Z*, *R*, or *S*).

a.

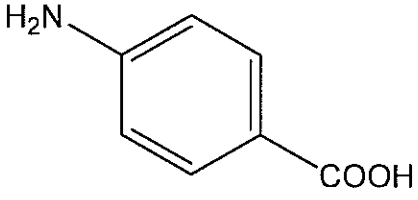


(*S*)-Ethyl 2-hydroxyhexanoate

b. *N*-Methylpent-2-ynamide

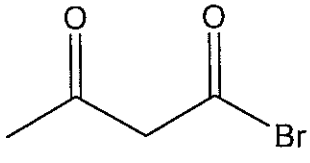


c.



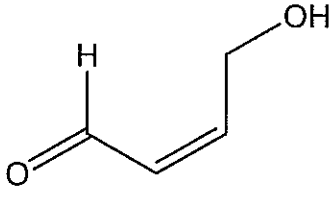
4-Aminobenzoic acid

d.

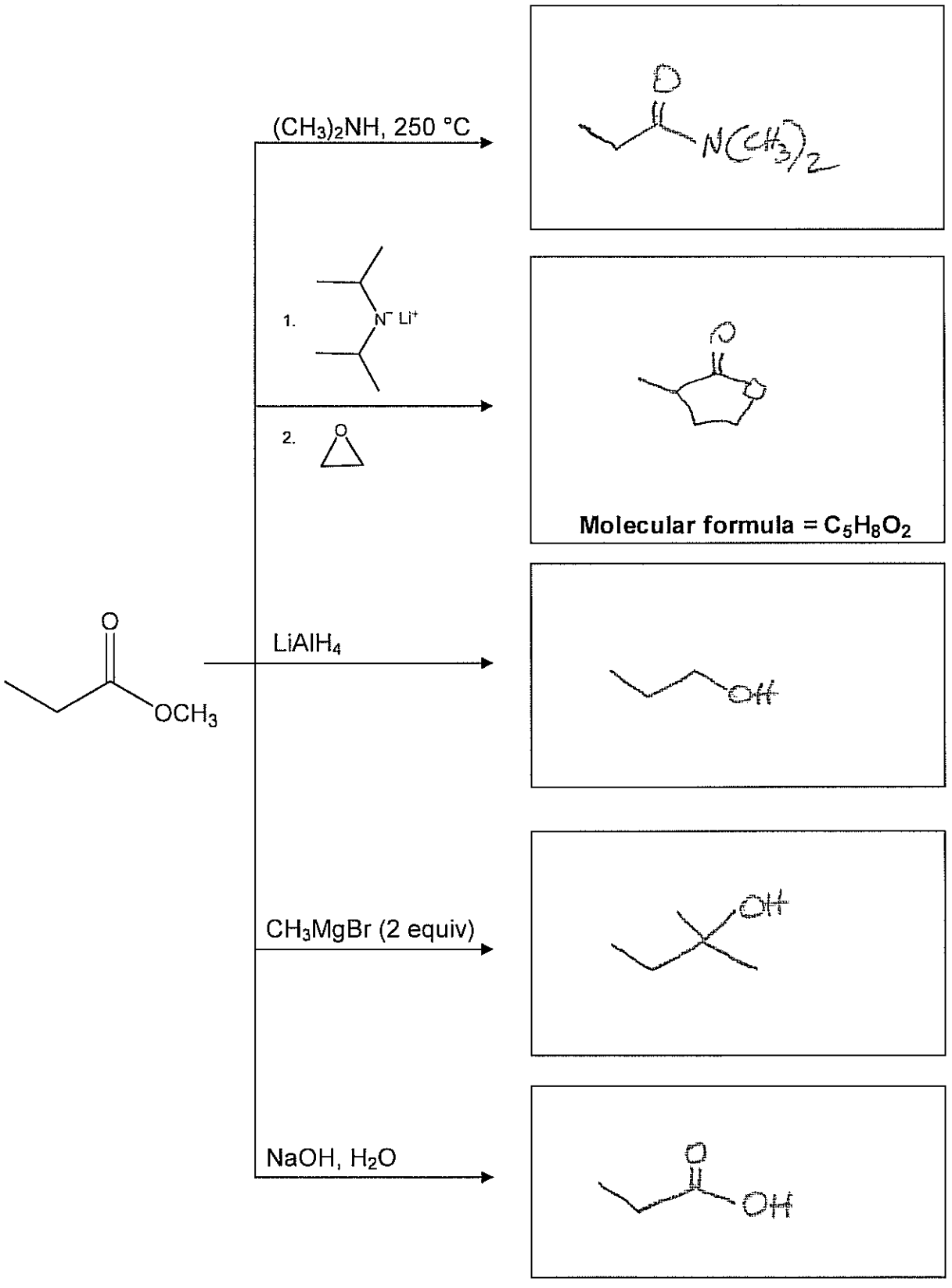


3-Oxobutanoyl bromide

e. (*Z*)-4-Hydroxybut-2-enal



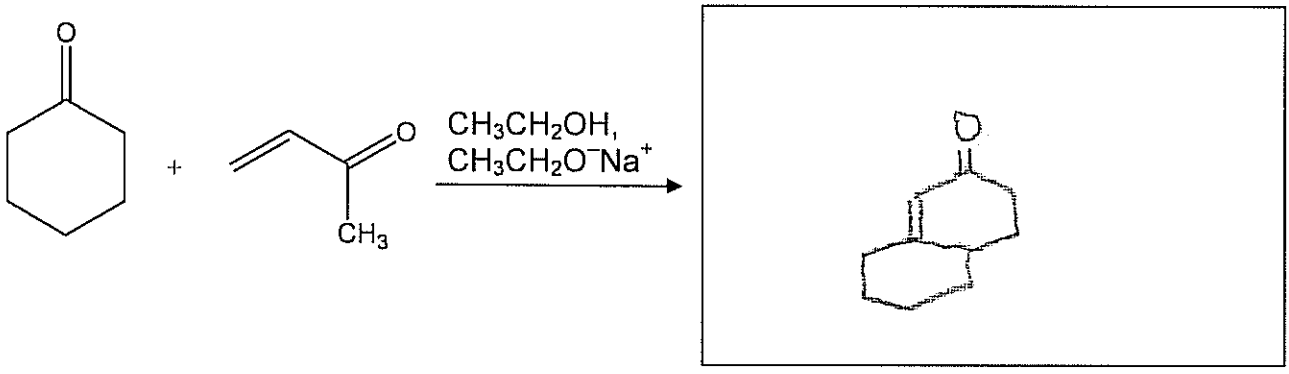
II. [30 Points] Write the organic products of the following reactions of the starting ester. Neutralizing aqueous work up is assumed.



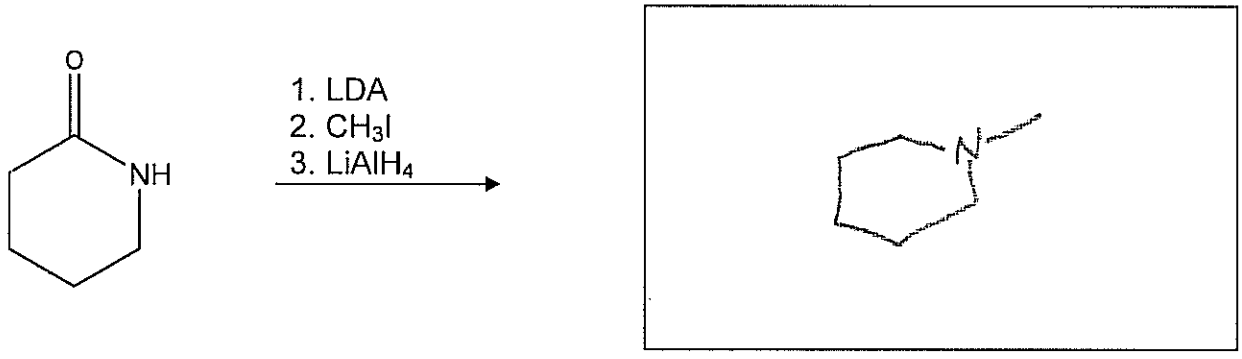
Molecular formula = $C_5H_8O_2$

III. [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 follow each step. It is not part of any answer.

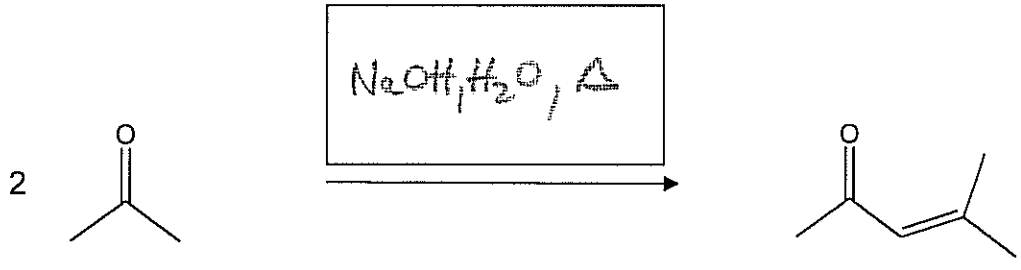
a.



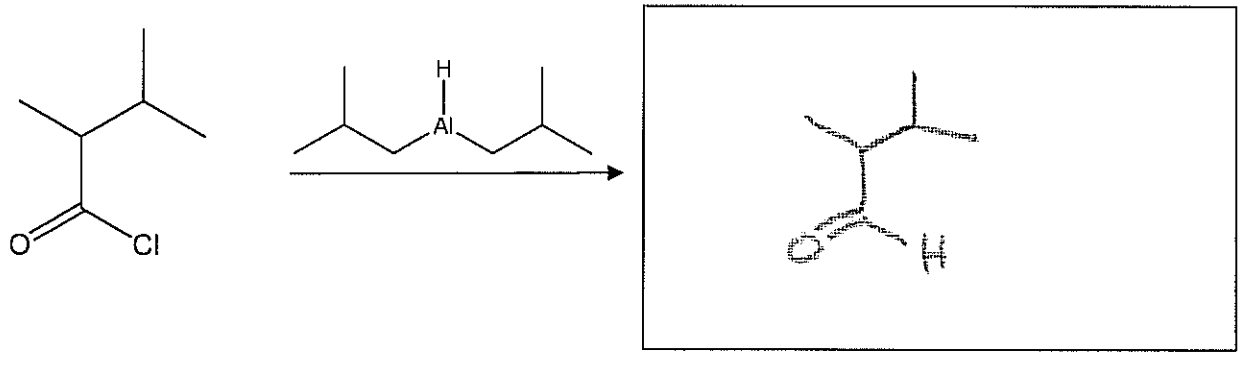
b.



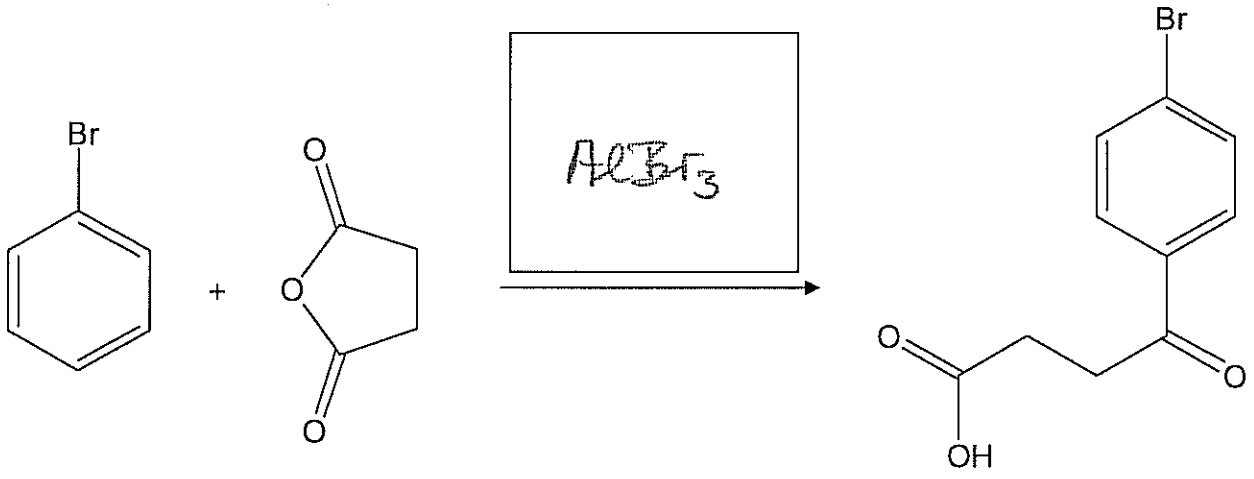
c.



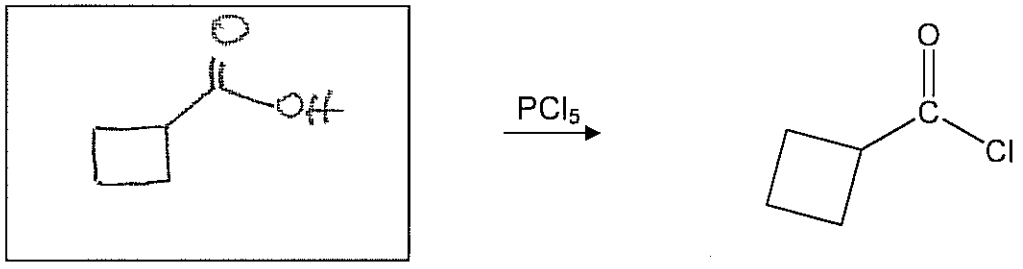
d.



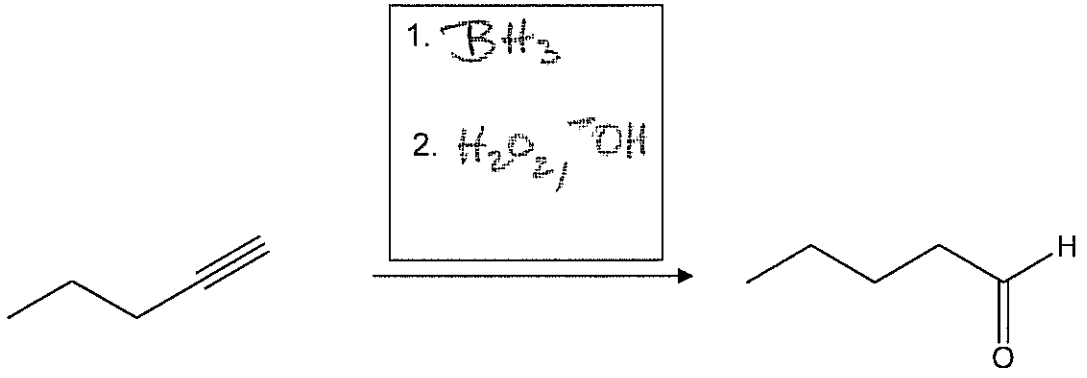
e.


Br
O
O
O
+
$AlBr_3$
Br
O
O
OH

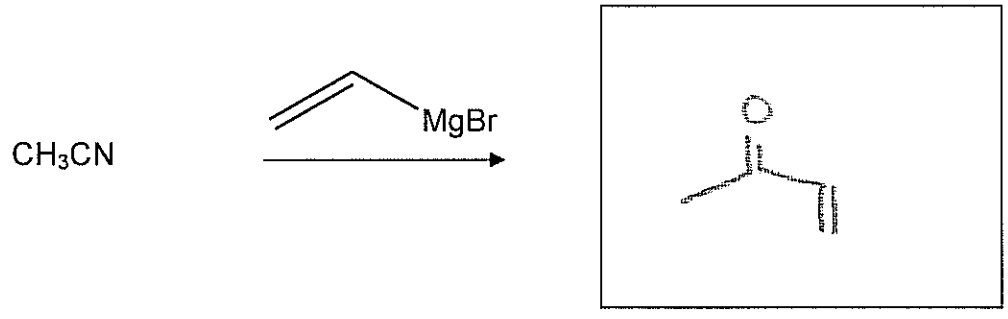
f.


O
OH
PCl_5
O
C
Cl

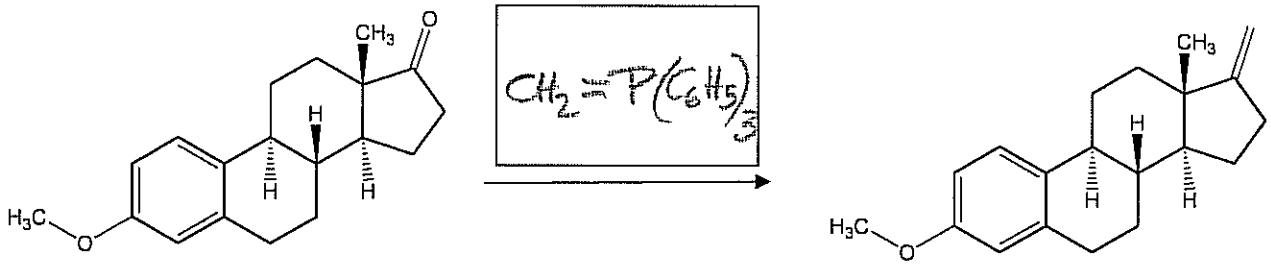
g.


1. BH_3
2. H_2O_2, ^-OH
H
O

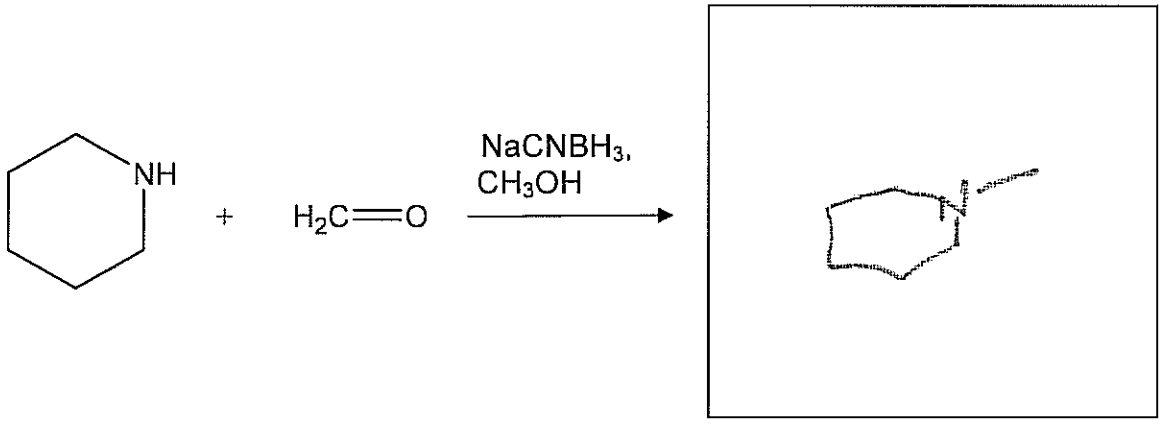
h.


CH_3CN
MgBr
O

i.

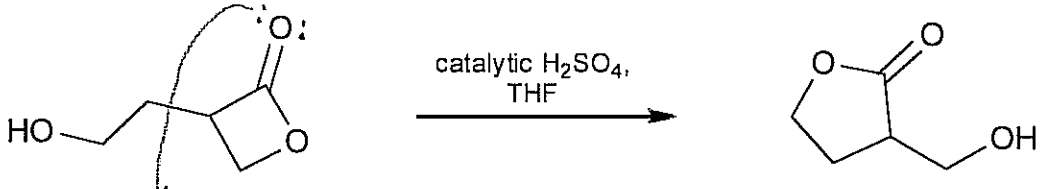


j.

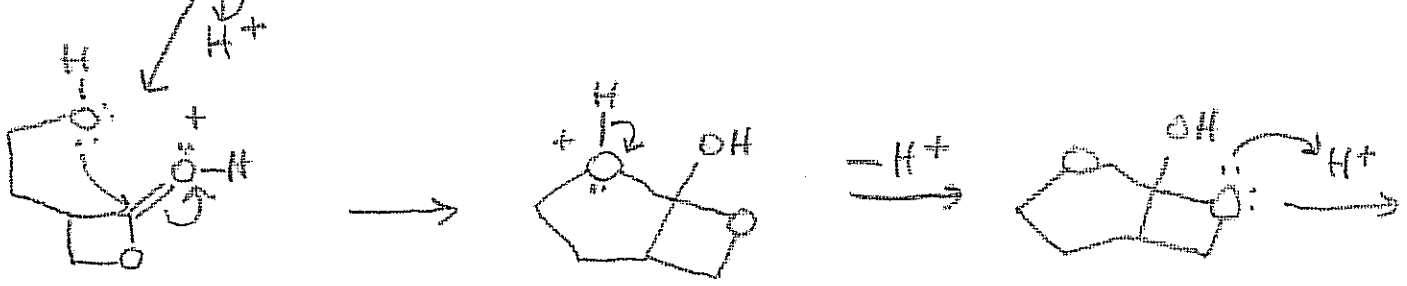


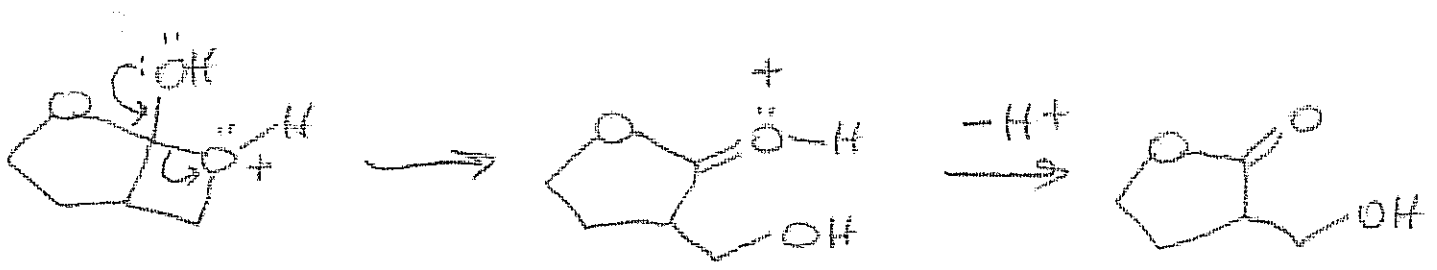
IV. [60 Points] Write detailed step-wise mechanisms for the following transformations. Use only structures and "arrow-pushing" techniques. Note: These are not synthetic problems. Do not add any reagents! What you see is what you have!

a.

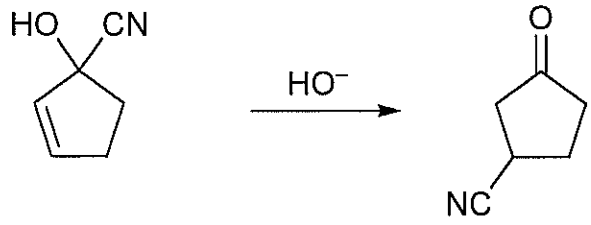


Work from left to right in the following spaces. There is more space than you will need.





b.



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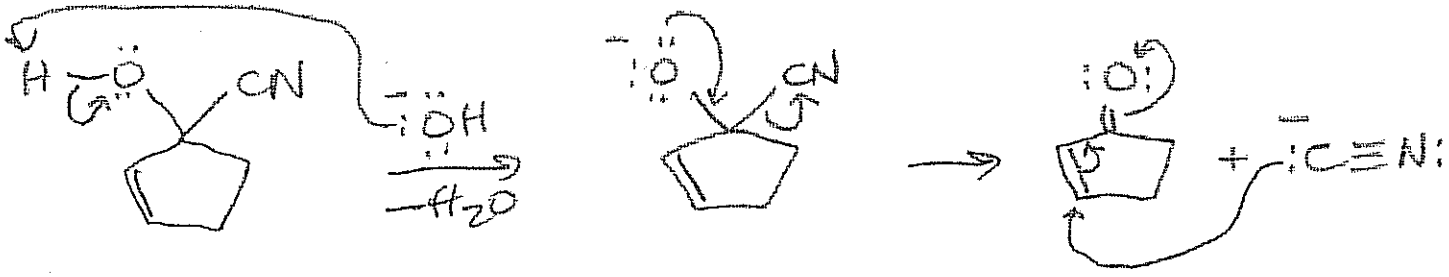
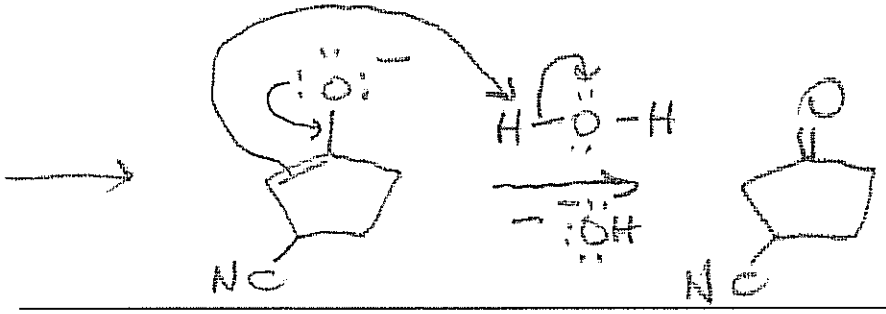
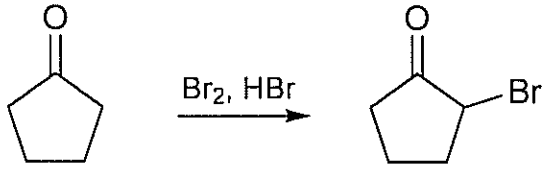




c.



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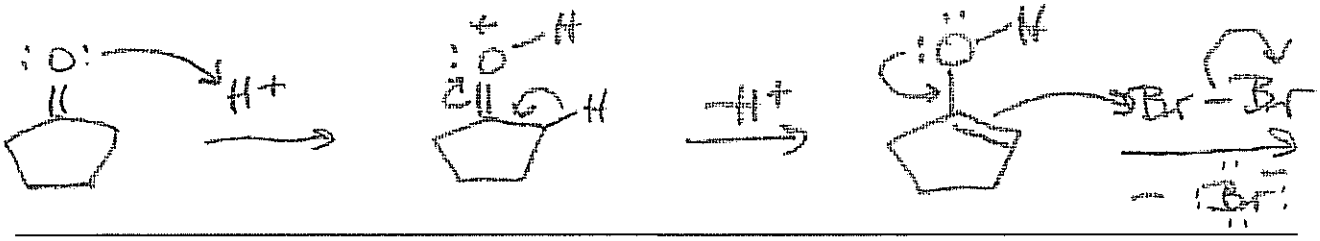
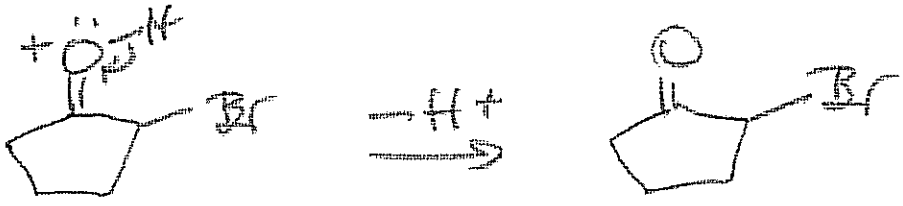
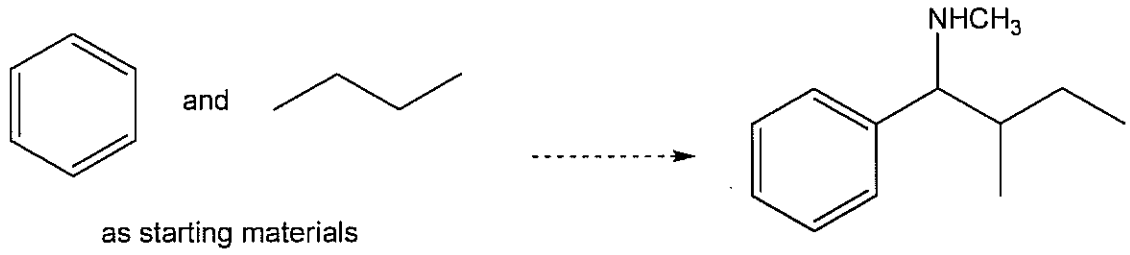




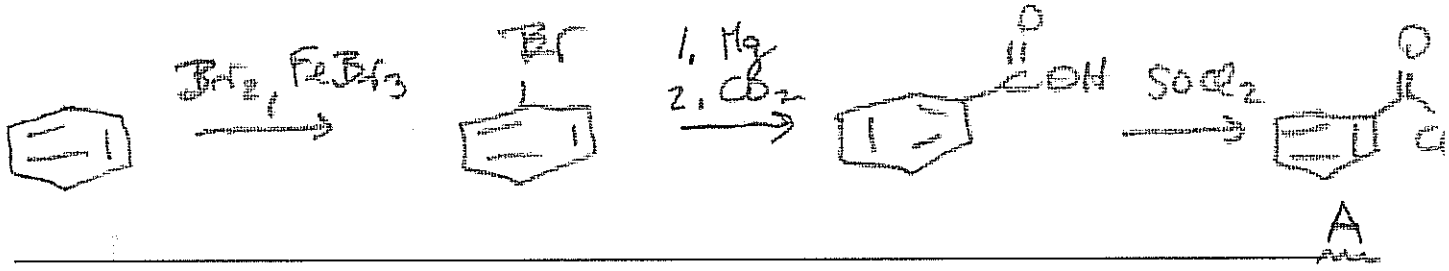
V. [60 Points] Provide a reasonable synthetic route from starting material to product.
Note: Several steps are required, and there may be more than one solution to the problem.
Do not write mechanisms! Write out each step separately, including reagents and products.
Apply retrosynthesis! It will help you obtain at least partial credit.

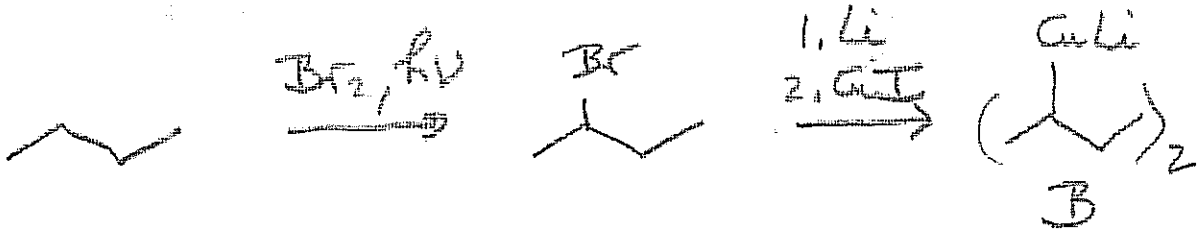
a. You may use any additional simple reagents.

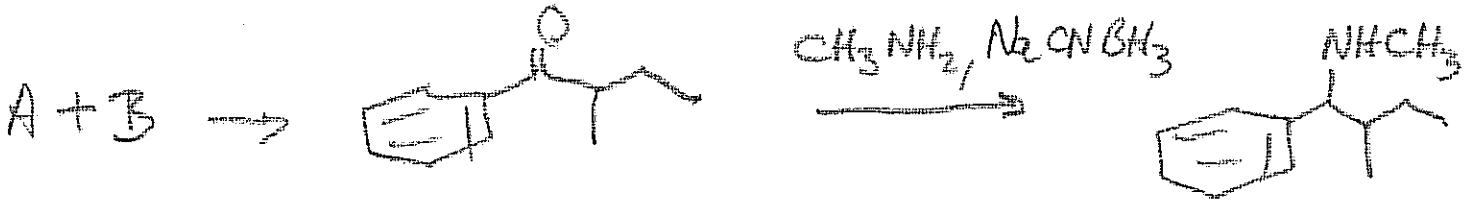


as starting materials

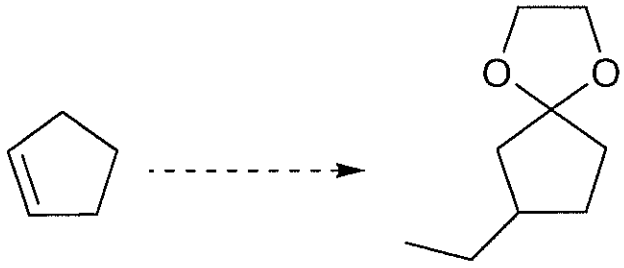
Work from left to right in the following spaces. There is more space than you will need.







b.



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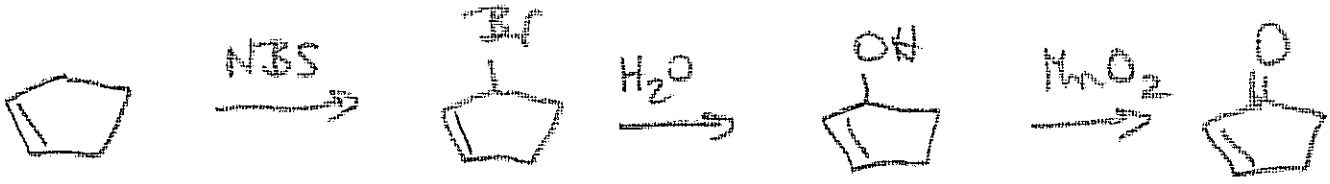
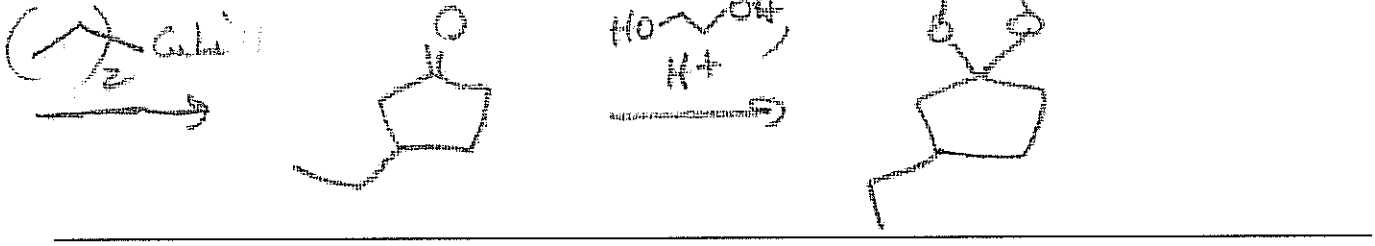
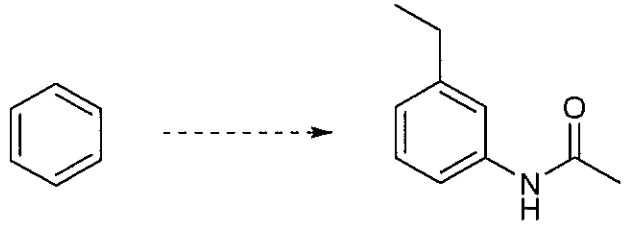


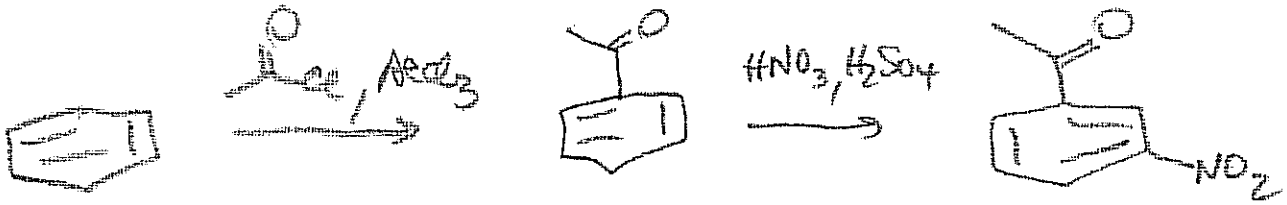


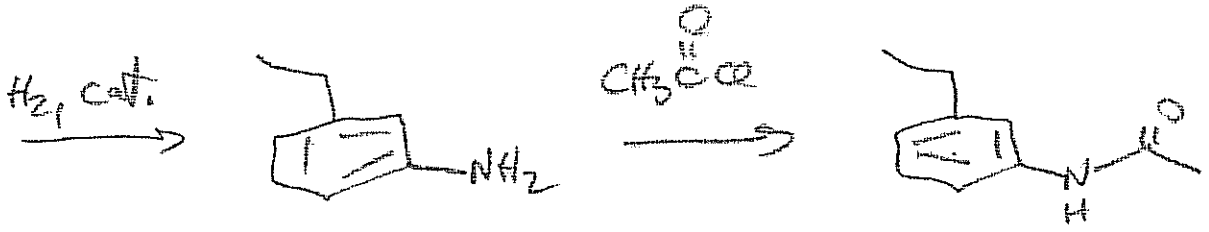
c. Synthesize compound **A** from benzene.



A

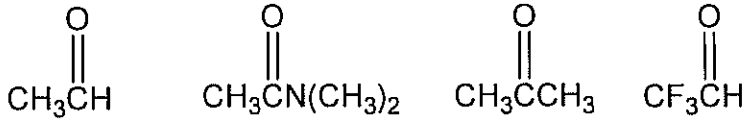
Work from left to right in the following spaces. There is more space than you will need.





VI. [20 Points] Place an X mark in the box next to the most accurate statement.

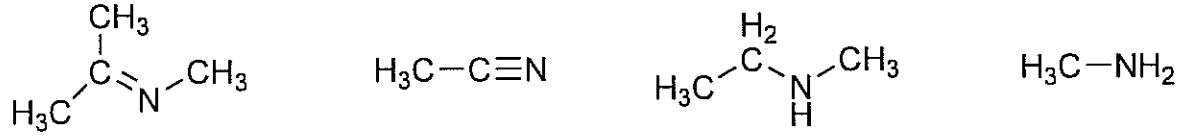
a. The equilibrium constant K for the hydration of **1**–**4** increases in the order



1 **2** **3** **4**

- [ ] **1, 2, 3, 4**
- [ ] **4, 3, 2, 1**
- [ ] **2, 3, 4, 1**
- [X] **2, 3, 1, 4**

b. The basicity of **1**–**4** increases in the order



1 **2** **3** **4**

- [ ] **1, 2, 3, 4**
- [ ] **4, 3, 2, 1**
- [X] **2, 1, 4, 3**
- [ ] **3, 2, 1, 4**

They failed Chem 3B....

"Whoa! *That* was a good one! Try it, Hobbs—just poke his brain right where my finger is!"

"The End"