

Massachusetts Institute of Technology

5.13: Organic Chemistry II

May 9, 2003

Test 4

Question 1 _____/06 points

Question 2 _____/06 points

Question 3 _____/06 points

Question 4 _____/20 points

Question 5 _____/12 points

Question 6 _____/12 points

Question 7 _____/12 points

Question 8 _____/12 points

Question 9 _____/14 points

Question 10 _____/[12 points]

TOTAL _____/100 points

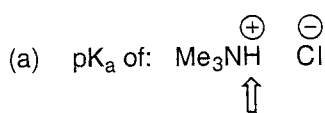
Name (printed) _____

Name (signed) _____

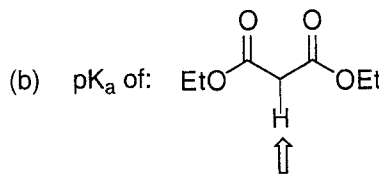
T.A. KEY

There are 9 pages (2-10) of questions in this exam.

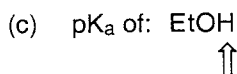
(1) (2 points each, 6 points total) In the boxes, please provide the requested information.



9-11



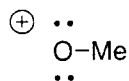
13



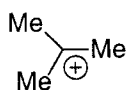
16-19

Out of range by 1 : 1 point

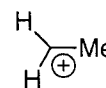
(2) (6 points total) (a) (4 points, all or nothing) In the boxes, please rank the stability of the three cations (1 = most stable, 3 = least stable).



3

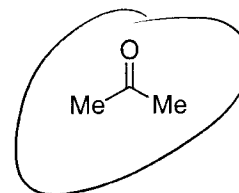
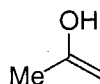


1

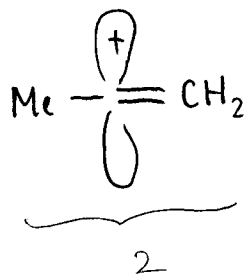
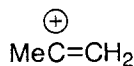


2

(b) (2 points) Circle the more stable tautomer:



(3) (6 points) Show the geometry of the propenyl cation illustrated below. What is the hybridization at the central carbon? Please clearly explain your reasoning.



2

linear geometry

sp hybridized

empty orbital: p orbital

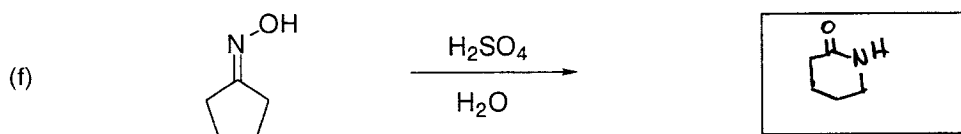
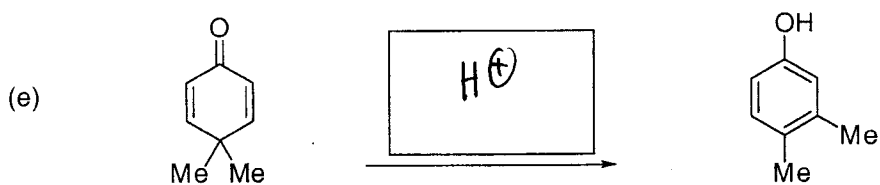
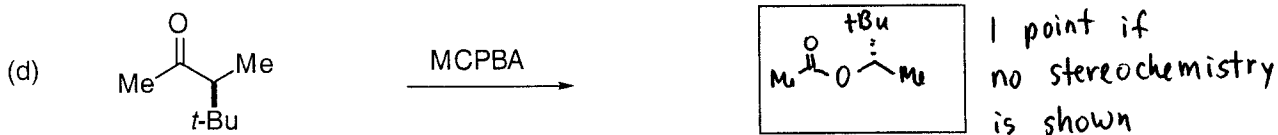
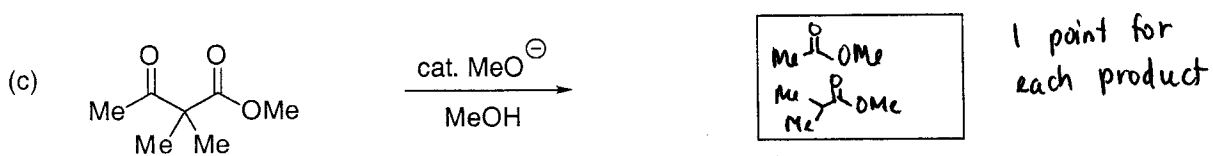
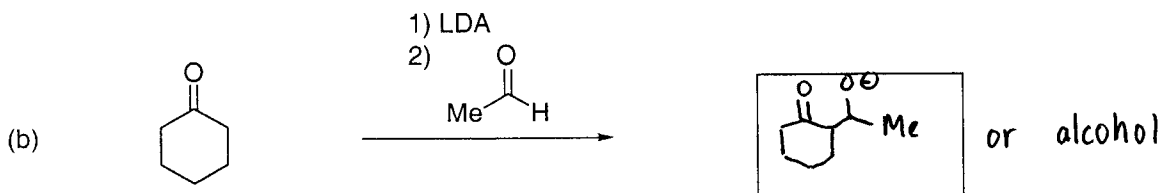
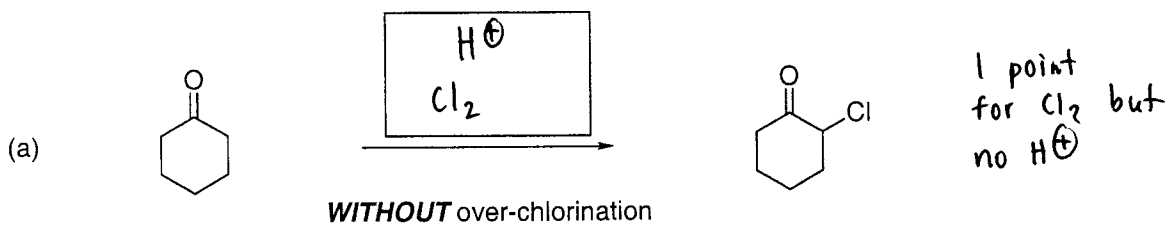
want empty orbital to have maximum p character

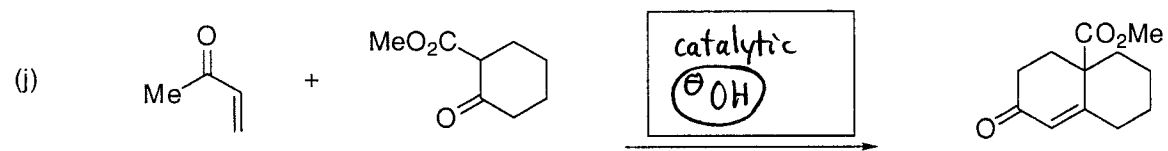
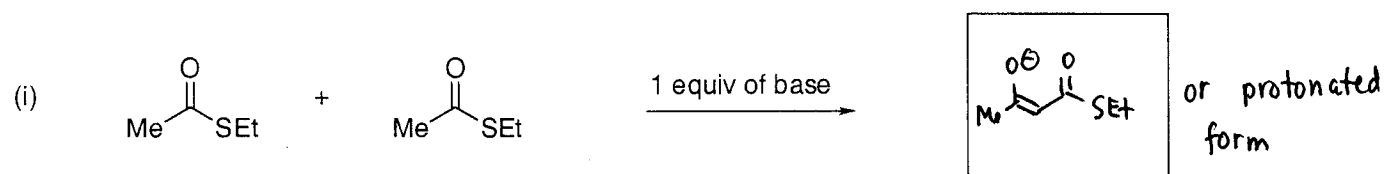
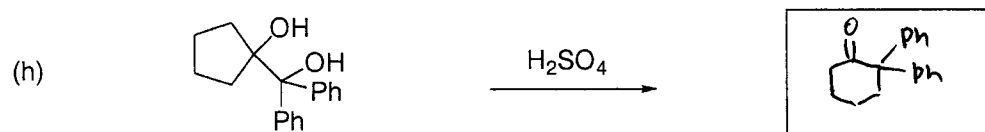
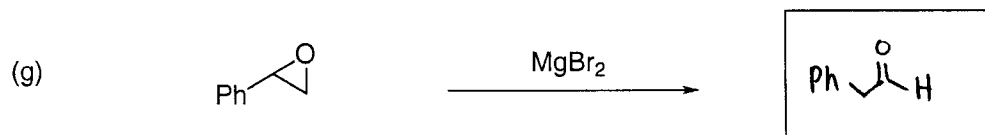
2 points for each part

2

2

(4) (2 points each, 20 points total) In the boxes, please provide the requested reagent(s) or product(s). If no reaction is expected, write "NR".



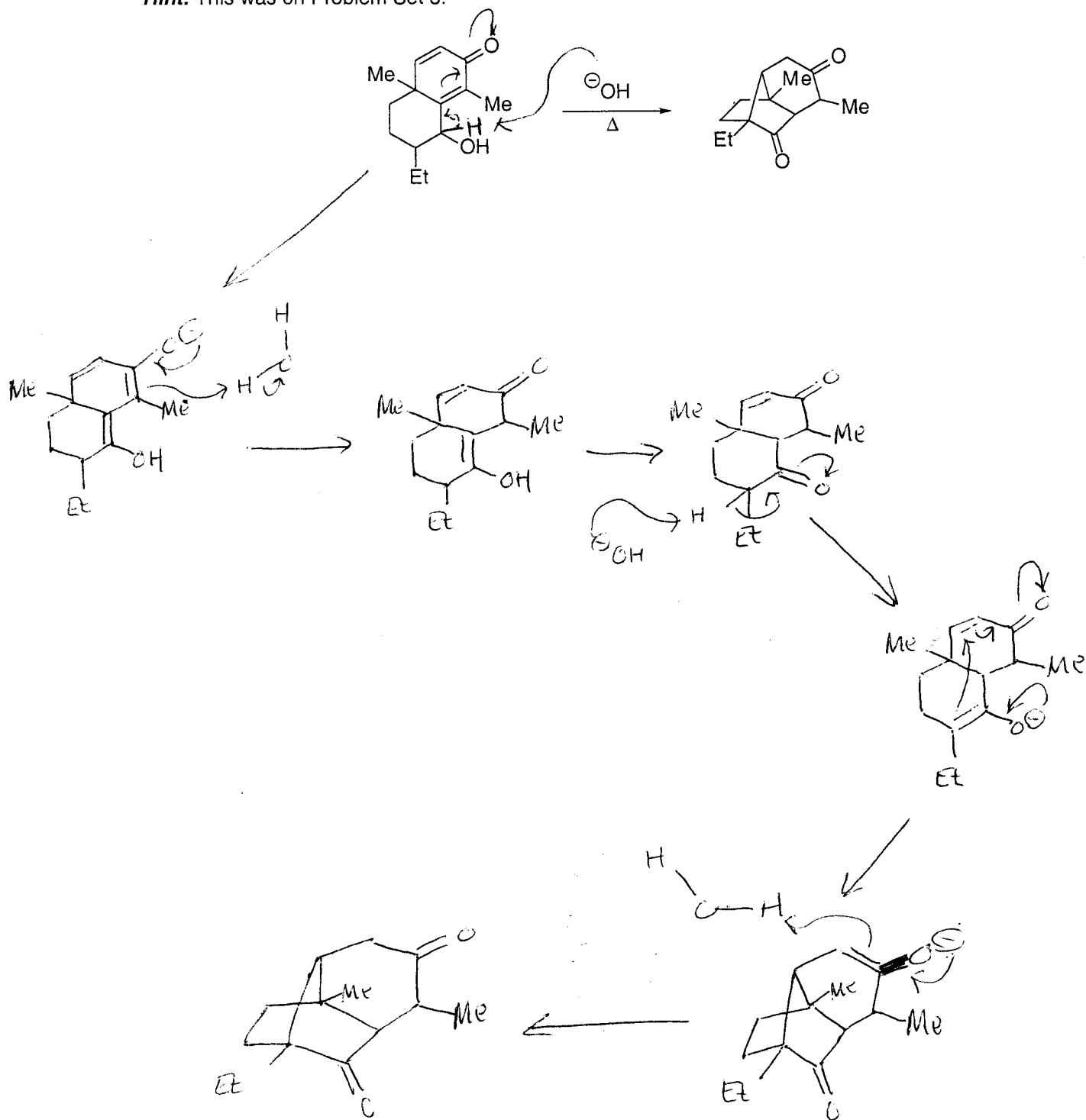


$\ominus\text{OMe}$ is better (in MeOH) to preserve the ester.

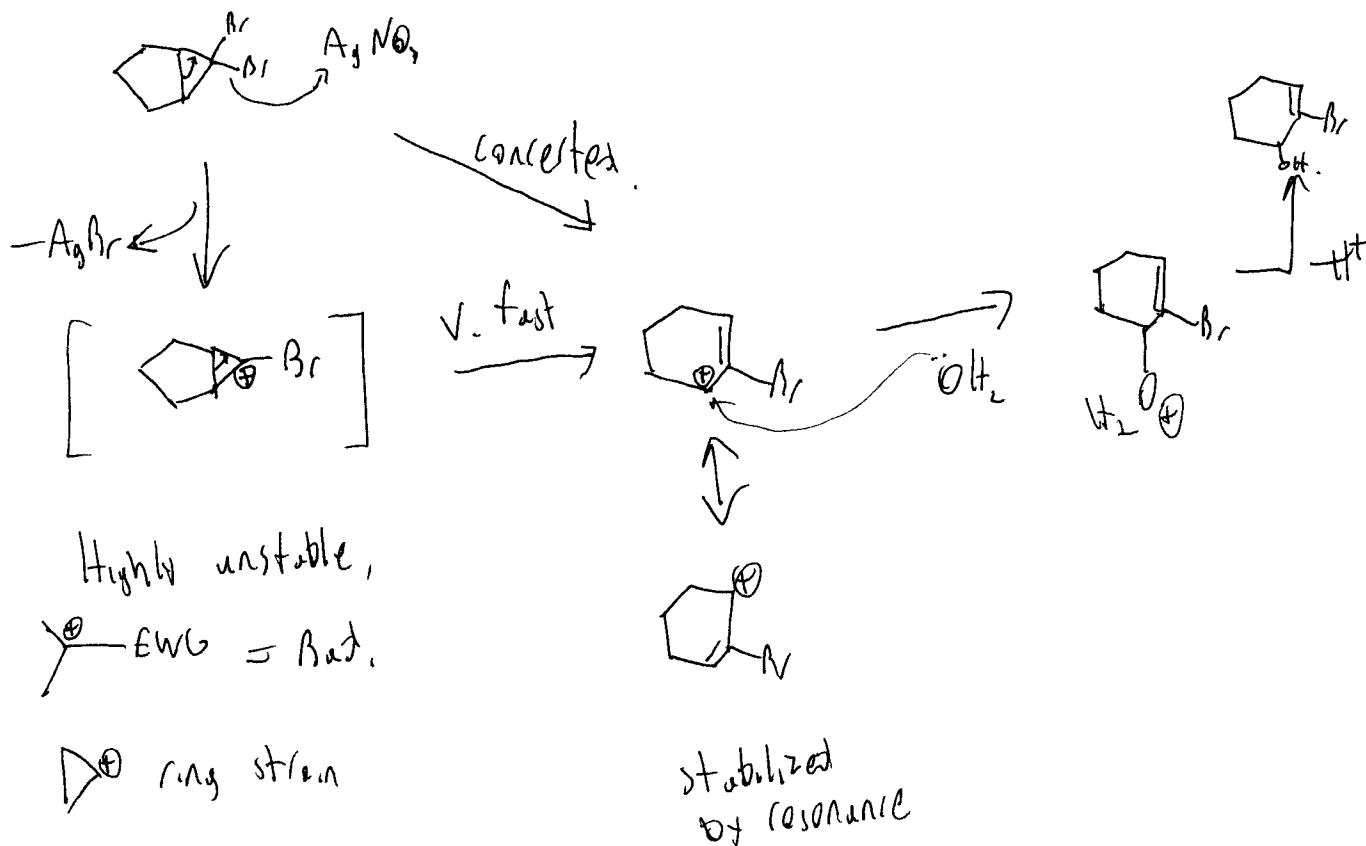
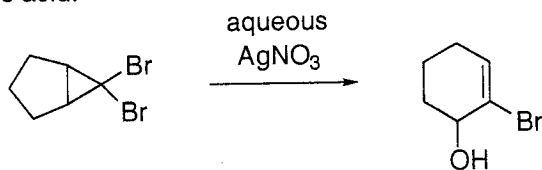
+1 for $\ominus\text{OH}$
+2 for $\ominus\text{OMe}$

(5) (12 points) Provide the best mechanism. Please show all arrow pushing.

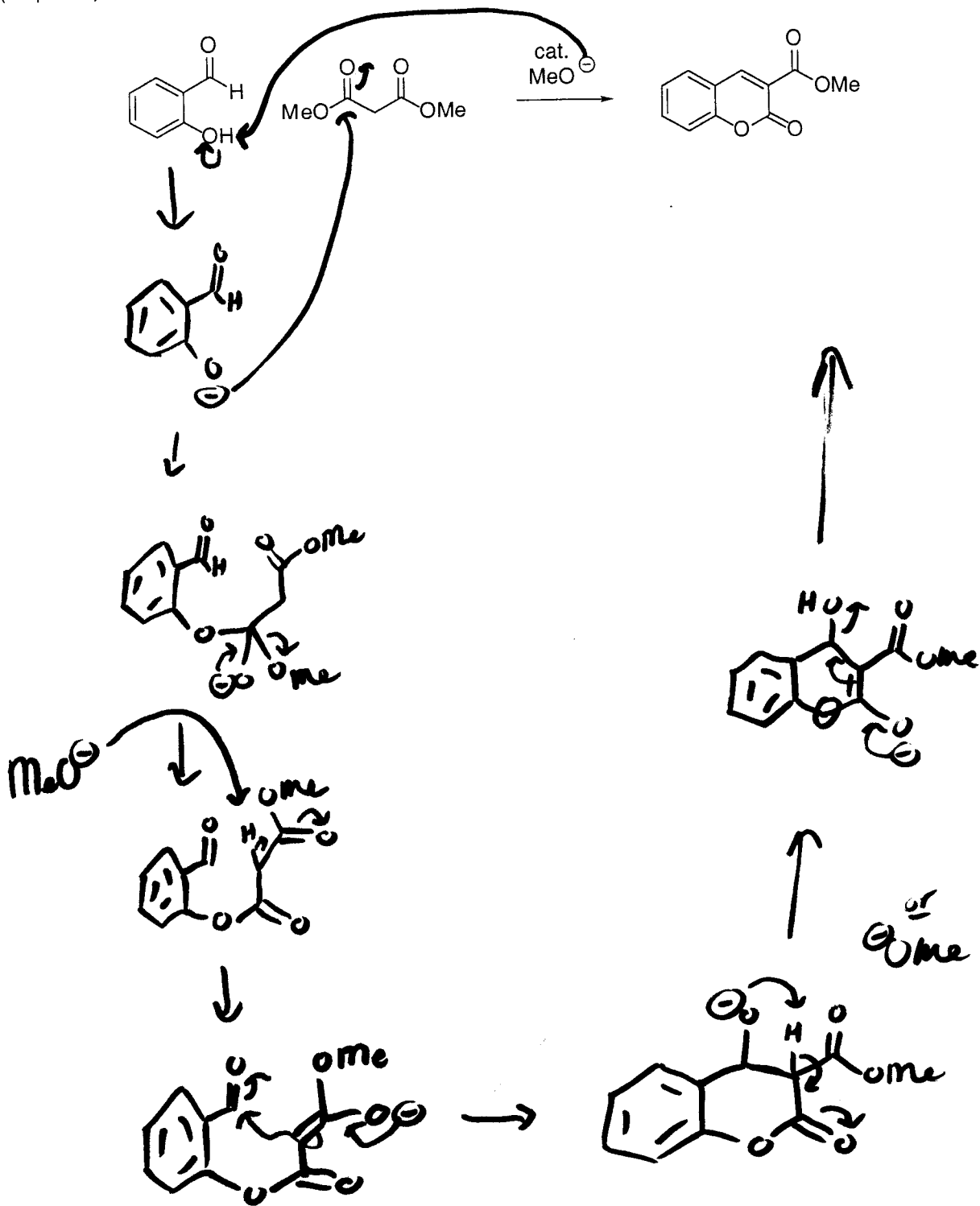
Hint: This was on Problem Set 8.



(6) (12 points) Provide the best mechanism for the illustrated transformation. Please show all arrow pushing. Very briefly discuss why each step occurs (e.g., discuss cation stability, ring strain, etc.). **Hint:** AgNO_3 is a Lewis acid.

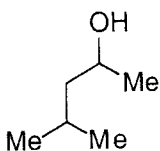


(7) (12 points) Provide a mechanism for the illustrated transformation. Please show all arrow pushing.



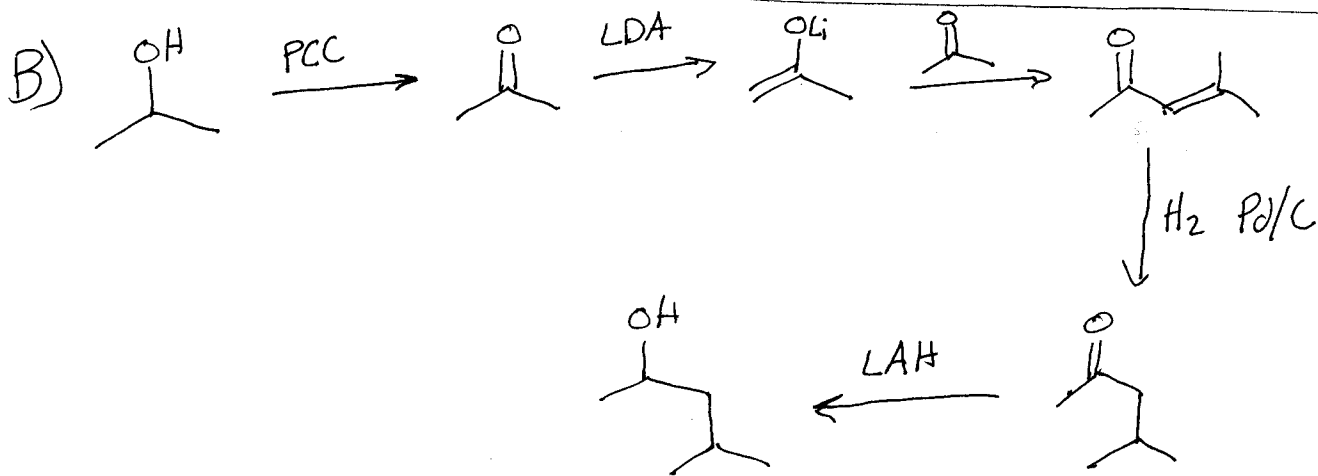
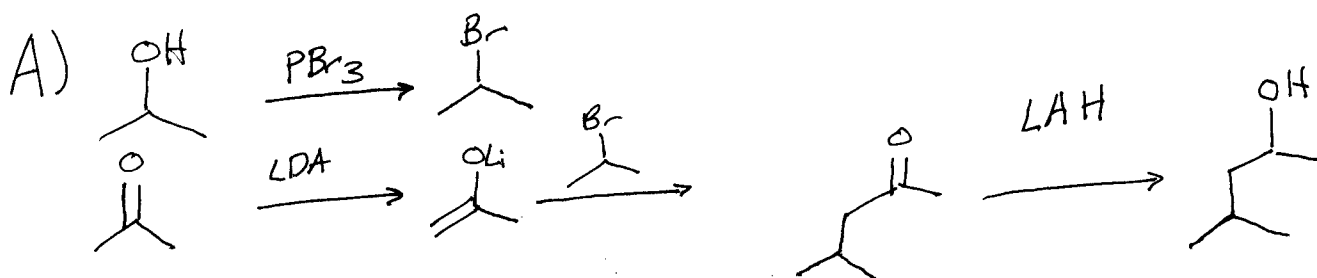
• Various orders of steps are acceptable

(8) (12 points) Please synthesize the compound illustrated below. All of the carbons of the products should come from isopropanol.



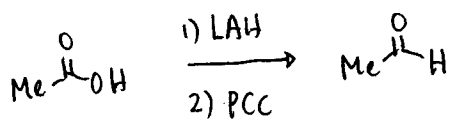
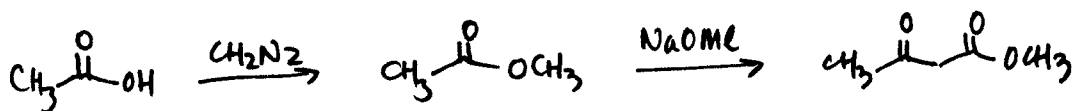
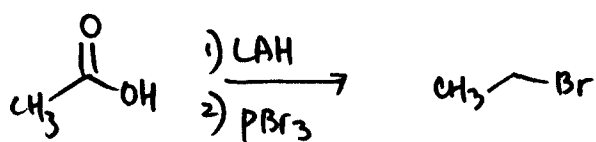
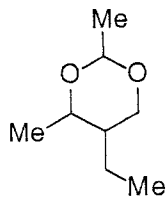
^{each}
 -2 for wrong reagents
 No worse than 6 for a conceptually correct synthesis

-4 each for major errors

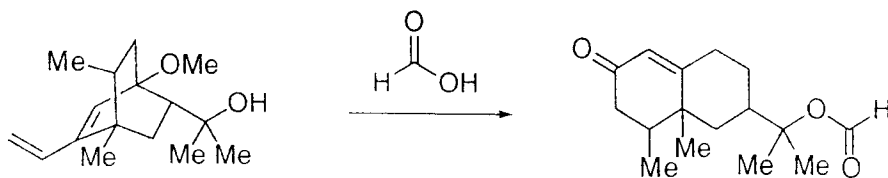


C) whatever works.

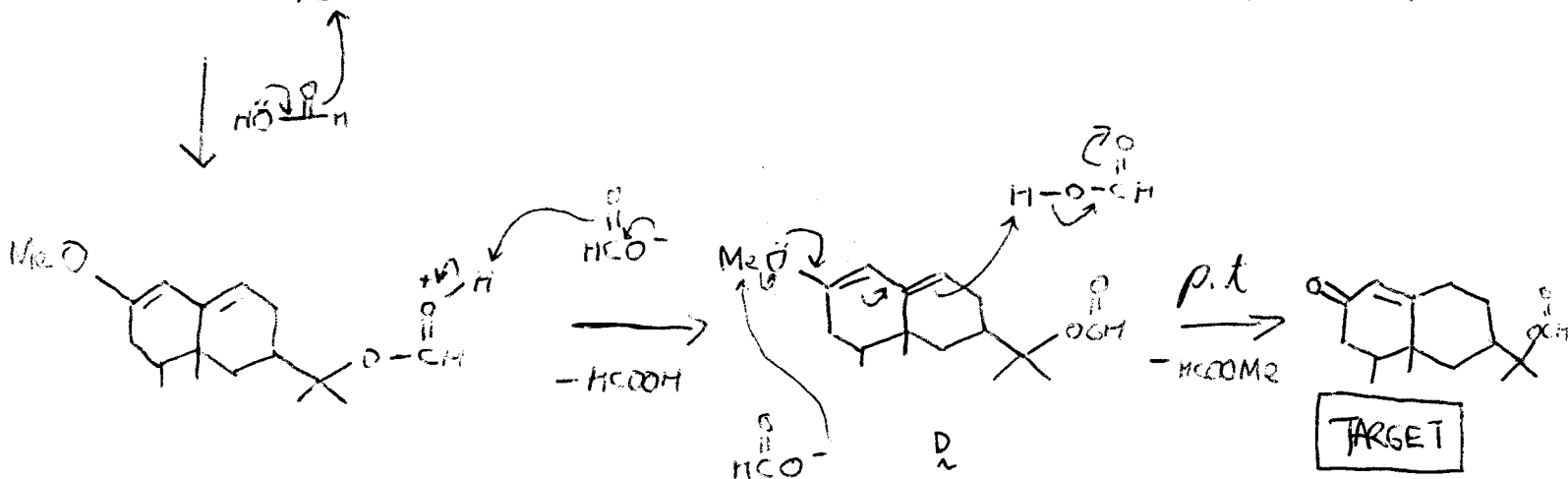
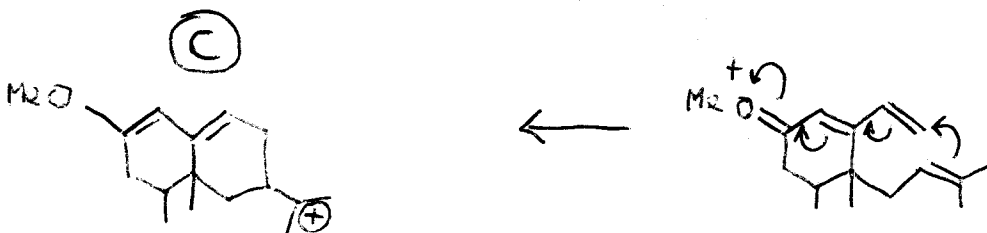
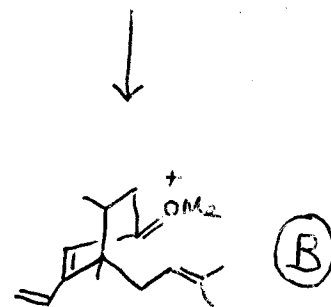
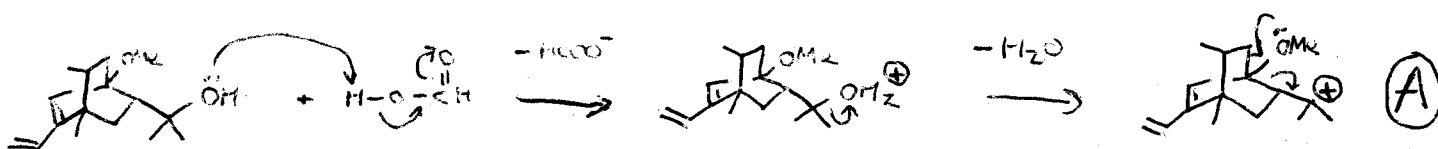
(9) (14 points) Please synthesize the compound illustrated below. All of the carbons of the products should come from acetic acid.



(10) (12 points) **Bonus question.** Provide the best mechanism for the illustrated acid-catalyzed transformation. Please show all arrow pushing. **Hint:** One of the first steps is the loss of a molecule of water.



NOTE THERE ARE OTHER ACCEPTABLE PATHWAYS TOO.



MARKS BREAKDOWN :

STARTING MATERIAL	→	(A)	/3
(A)	→	(B)	/3
(B)	→	(C)	/3
(C)	→	TARGET	/3
WRONG STEPS/ARROWS/ETC.			-1

