EXAMINATION 2

Chemistry 3A
David MacMillan
Arlyn Myers
Peter Vollhardt
March 30, 1999

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.

111	Joe Ringgenberg	_____	361	Ryan Smith	_____
121	Polly Berseth	_____	371	Kristina Haman	_____
131	Jun Yin	_____	381	Jocelyn Grunwell	_____
141	David Nauman	_____	391	Kathy Winans	_____
151	Jeff Janes	_____	411	David Gray	_____
211	Jennifer Tripp	_____	421	Sara Paisner	_____
221	David Tully	_____	431	Scarlett Goon	_____
311	Jason Robinson	_____	511	Andy Martin	_____
321	Alex Adronov	_____	521	Fabian Fischer	_____
331	Matt Purdy	_____	531	Tony Tang	_____
341	Greg Watkins	_____	541	Marcus Strawn	_____
351	Lily Huang	_____	551	Lei Wang	_____
Making up an I Grade		_____			

(If you are, please indicate the semester during which you took previous Chem 3A previously _____).

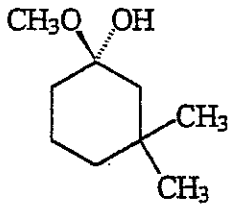
Please write the answer you wish to be graded in the spaces provided. Do scratch work on the back of the pages. This test should have 11 numbered pages. Check to make sure that you have received a complete exam. A good piece of advice: **read carefully over the questions (at least twice); make sure that you understand exactly what is being asked; avoid sloppy structures or phrases. It is better to be pedantic in accuracy!** **Good Luck!**

DO NOT WRITE IN THIS SPACE

I.	_____	(15)
II.	_____	(60)
III.	_____	(40)
IV.	_____	(30)
V.	_____	(30)
VI.	_____	(25)
Total:	_____	(200)

I. [15 Points]
Name or draw, as appropriate, the following molecules according to the IUPAC rules. Indicate stereochemistry where necessary (cis, trans, *R*, *S*, or meso).

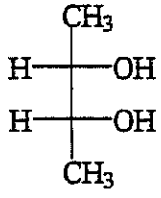
a.



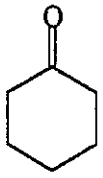
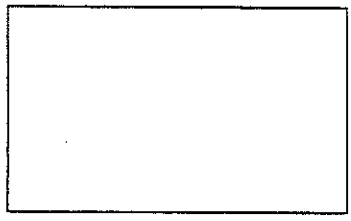
Hint: RO is alkoxy.

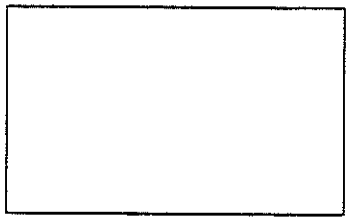
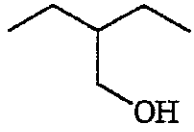
b. (*S*) -2-(Methylethyl)-1-pentanol

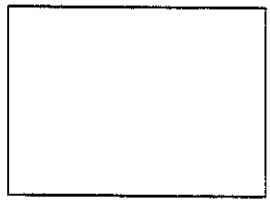
c.

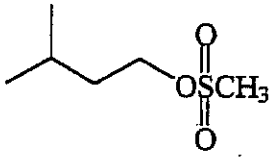
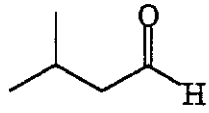


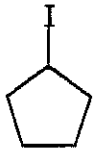
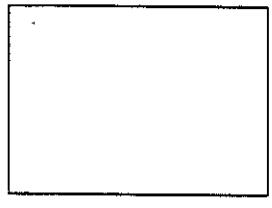
II. [60 Points]
Add the missing starting materials, reagents, or products (aqueous work up is assumed where necessary). Don't forget stereochemistry! Do not write a mechanism!

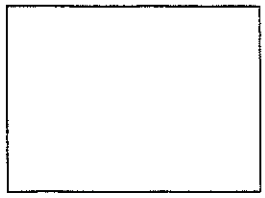
a.  $NaBH_4$ 

b.  $C_5H_{11}Br$ 1. Mg 2. $H_2C=O$ 

c.   

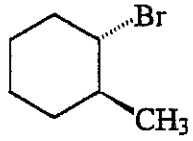
d.  1. 2. 

e.  1. $CH_3CO^-Na^+$ 2. $NaOH, H_2O$ 

f. CH_3Li +  → 

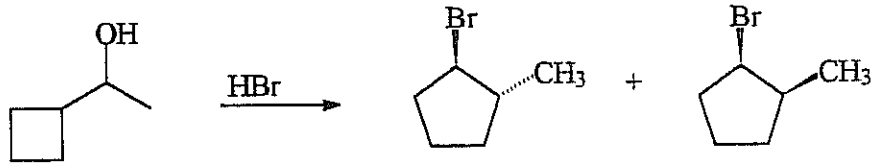
C_3H_4O

III. [40 Points]
Explain the following observations by a detailed **mechanism** (i.e. write a scheme with structures, use arrow-pushing to illustrate the flow of electrons, do **not** add any reagents!).

a.  $\xrightarrow{CH_3OH}$ achiral product

Mechanism:

b.



racemic

4 : 1

both racemic

Mechanism:

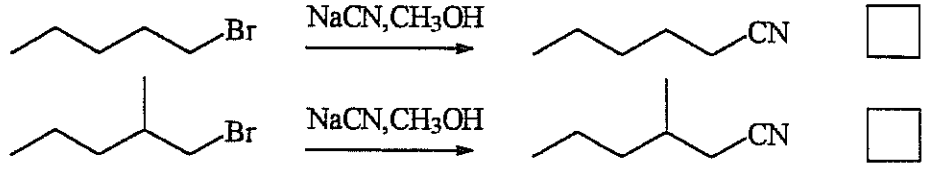
Suggest an explanation for the excess trans product.

Explanation:

IV. [30 Points]

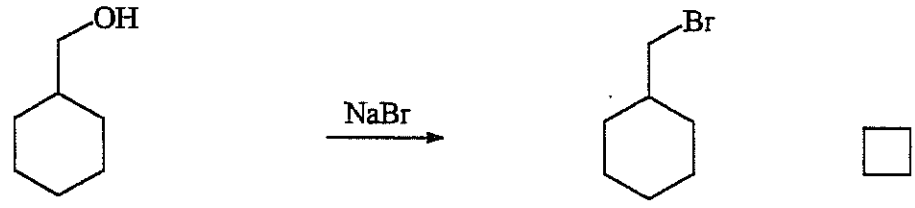
For each pair of reactions shown below, mark the box on the right with an "X" indicating which will go faster and circle the mechanism by which it proceeds (e.g. S_N2, S_N1, E_2, E_1). In one complete, grammatically correct sentence, provide a brief explanation in each case in the bottom box provided (i.e., explain why so-and-so is a better nucleophile, leaving group, solvent, etc.). *No credit will be given for the right answer with an incorrect reason.*

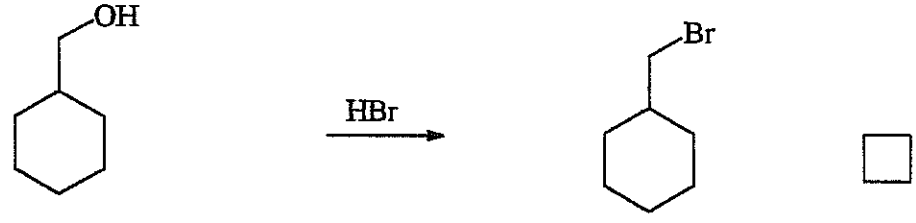
a.



S_N2 S_N1 E_2 E_1

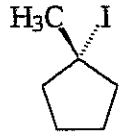
b.

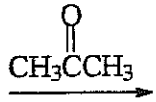


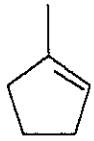


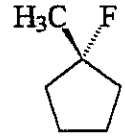
S_N2 S_N1 E_2 E_1

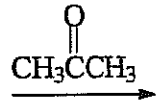
c.

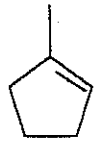






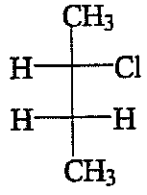


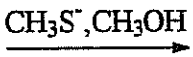


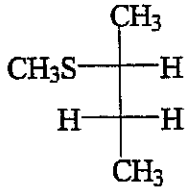


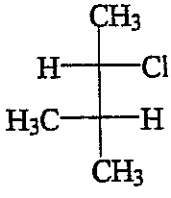
S_N2 S_N1 E_2 E_1

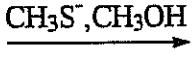
d.

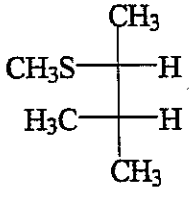










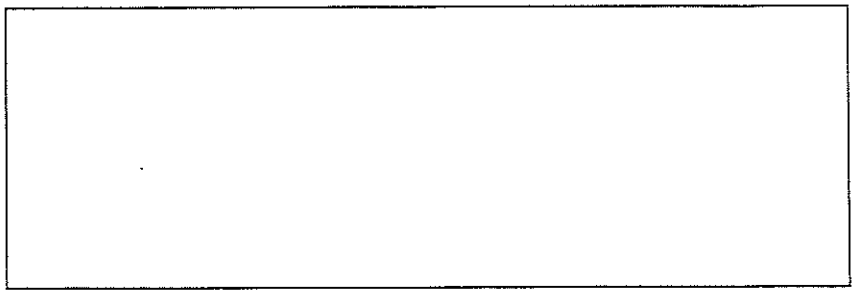


S_N2 S_N1 E_2 E_1

e. $CH_3CH_2I \xrightarrow{NaNH_2} CH_3CH_2NH_2$ ☐

$CH_3CH_2I \xrightarrow{NaOH} CH_3CH_2OH$ ☐

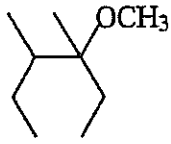
S_N2 S_N1 E_2 E_1



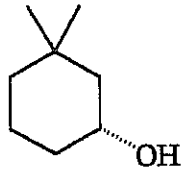
V. [30 Points]
Provide a viable synthetic route from starting material to product. Use the back of the page(s) for retrosynthetic analyses. Write the answer in the forward direction indicating all necessary reagents. Do **not** show mechanisms (arrows).

a. 

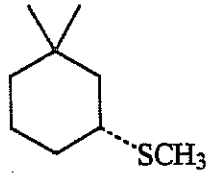
(as the only organic starting material)



(mixture of diastereomers)

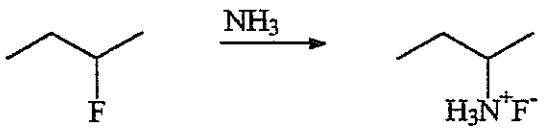
b. 

optically pure



optically pure

VI. [25 Points]
Consider the following transformation:



a. Provide two ways with which you could distinguish between an S_N2 and an S_N1 mechanism.

1st Method : (specify)

Expected result for S_N2 :

Expected result for S_N1 :

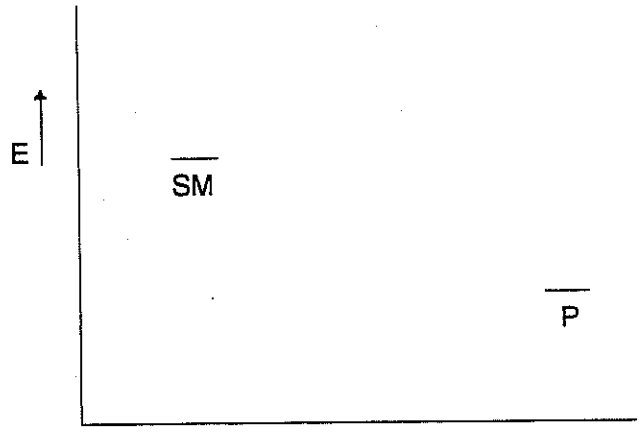
2nd Method : (specify)

Expected result for S_N2 :

Expected result for S_N1 :

b. Draw rough potential energy diagrams for both processes.

S_N2



SM = starting materials, P = product

S_N1