Chemistry 3A –
Midter

chemistry 3A – MIDTERM 2 – SPRING 2001 – FRECHET

Professor Jean Fréchet

April 10, 2002

Your full si _____

Print your _____

Middle)

Your SID_

Please check the section number and name of y

_____ 161 Margot Paulick
_____ 171 Danielle Dube
_____ 181 Matt Pratt
_____ 191 Laurie Schenkel
_____ 111 Cathleen Yung
_____ 121 Priya Sonik
_____ 131 Paul Furuta
_____ 141 Zach Fresco
_____ 261 Aaron Stutz
_____ 271 Vanessa Sun
_____ 211 Jamey Kain
_____ 221 Laura Anderson
_____ 361 Reema Thalji
_____ 371 Warren Wood

_____ 471 Alex Kollias
_____ 411 Andrew Chi
_____ 421 Shahed Ghoghawala
_____ 431 Mike Slater
_____ 561 Jean Han
__✓__ 571 Ognjen Miljanic
_____ 511 Joe Kwon
_____ 521 Catherine Chan
_____ 531 Olga Fedin
_____ 541 Jason Serin

Do not write in this box.

If you are making up an I-grade, indicate the semester you took 3A _____ and the Professor _____

This exam has **10** pages; **make sure that you have them all.**

We will only grade answers that are in the designated spaces. Plea do your scratch work on the backs of the exam pages. Write only o answer to each problem; multiple answers will receive **no** credit, ev one of them is correct.

Note: This examination runs for a total of 90 minutes. No questions be answered by proctors after the exam begins. Please write legibl ambiguous or messy answers will receive **no credit**.

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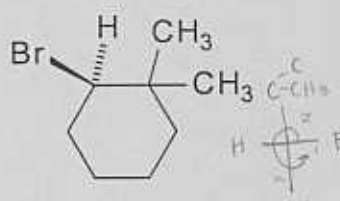
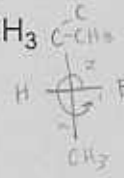
(10 points) **Name** (using IUPAC nomenclature) or **draw**, as appropriate, the following molecules. Do not forget stereochemistry (e.g.: *cis*, *trans*, *R*, *S*, *meso*) where appropriate.

(a)





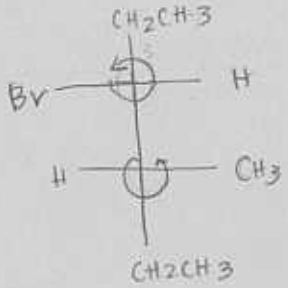
looks like S, but is R

(R)-1-bromo-2,2-dimethyl cyclohexane

WRONG # 3 1

(b) (3R,4R)-3-bromo-4-methylhexane

(Show as a Fischer Projection)



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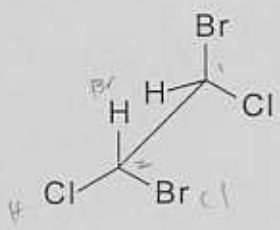
(c)

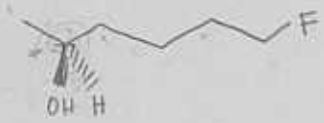


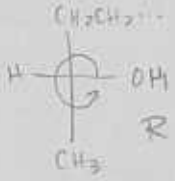
(Shown here as a sawhorse projection)

meso-1,2-dibromo-1,2-dichloro ethane

2

(d) (R)-6-fluoro-2-hexanol





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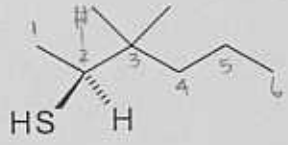
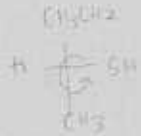
(e)

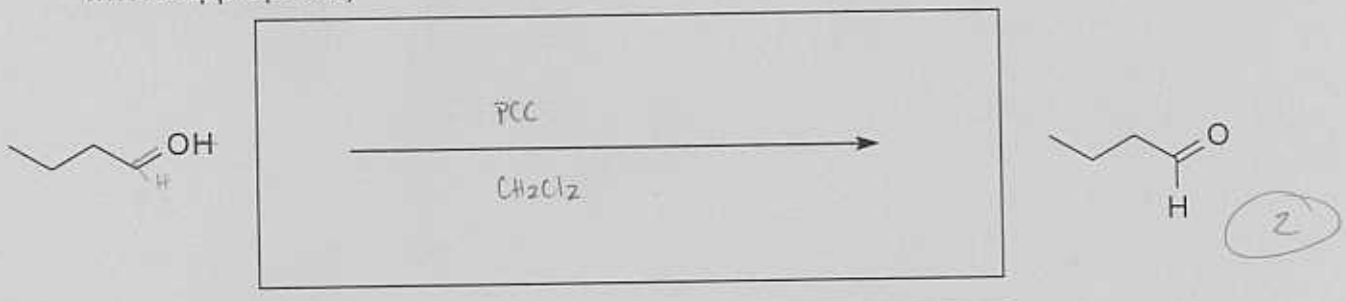




(R)-3,3-dimethyl-2-hexanethiol

2 / 7

(11 Points). Add the missing reagents (and solvents, if relevant), or products (show stereochemistry where appropriate)



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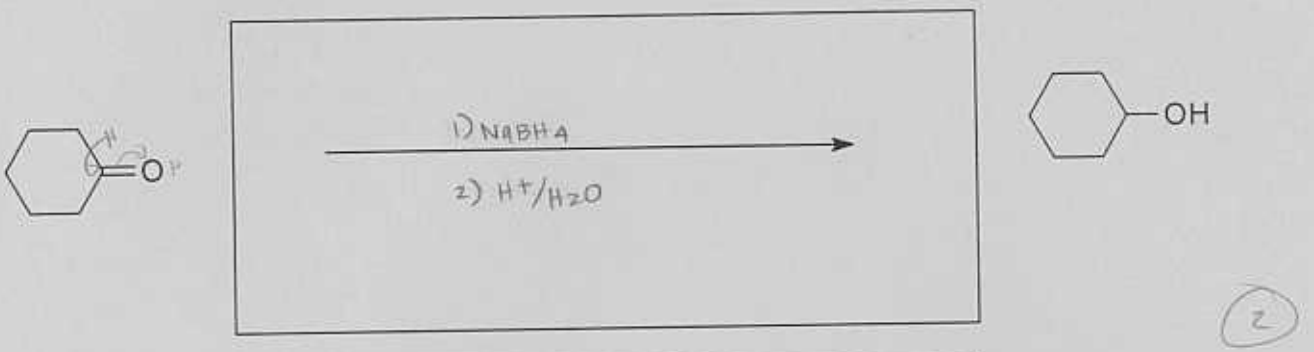

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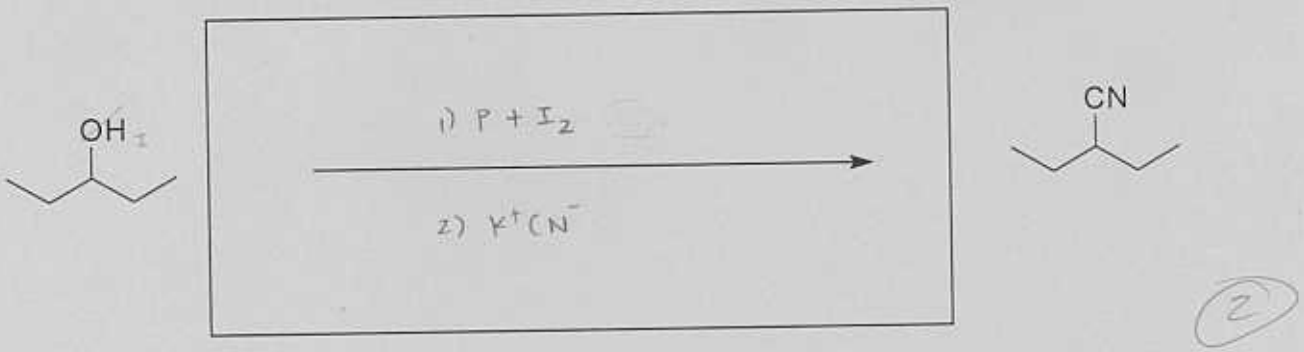

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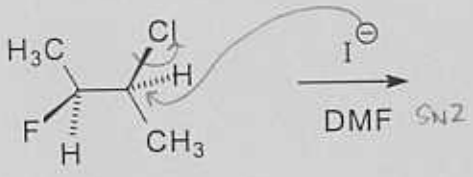

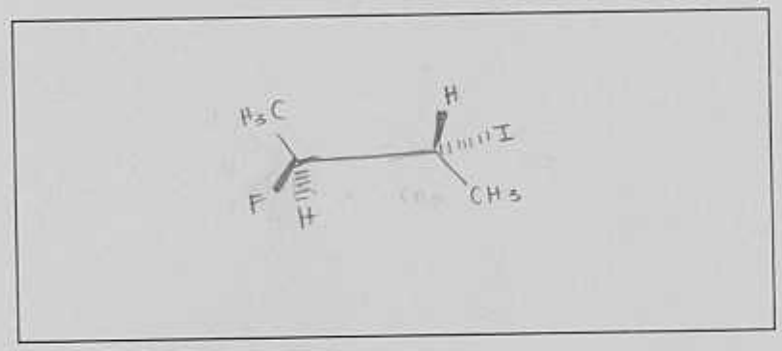

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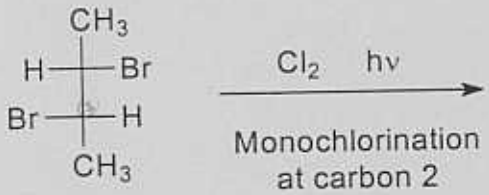
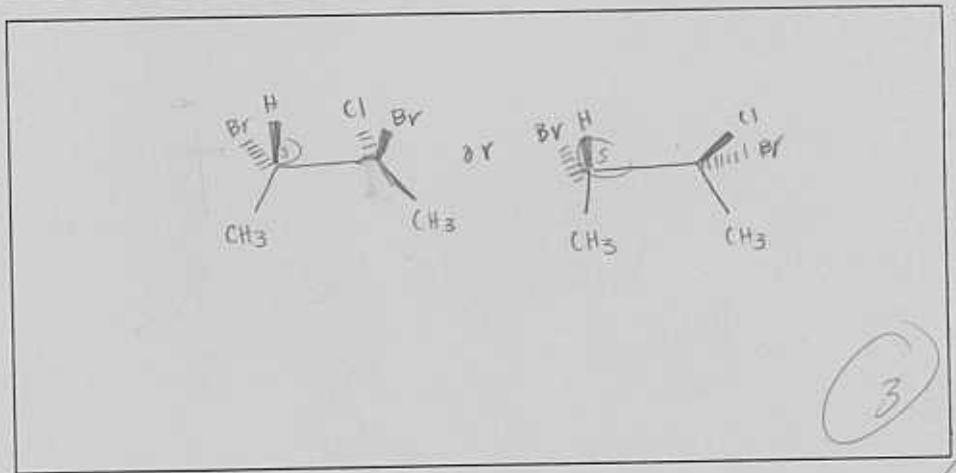


Hint: *are there one or two products?*



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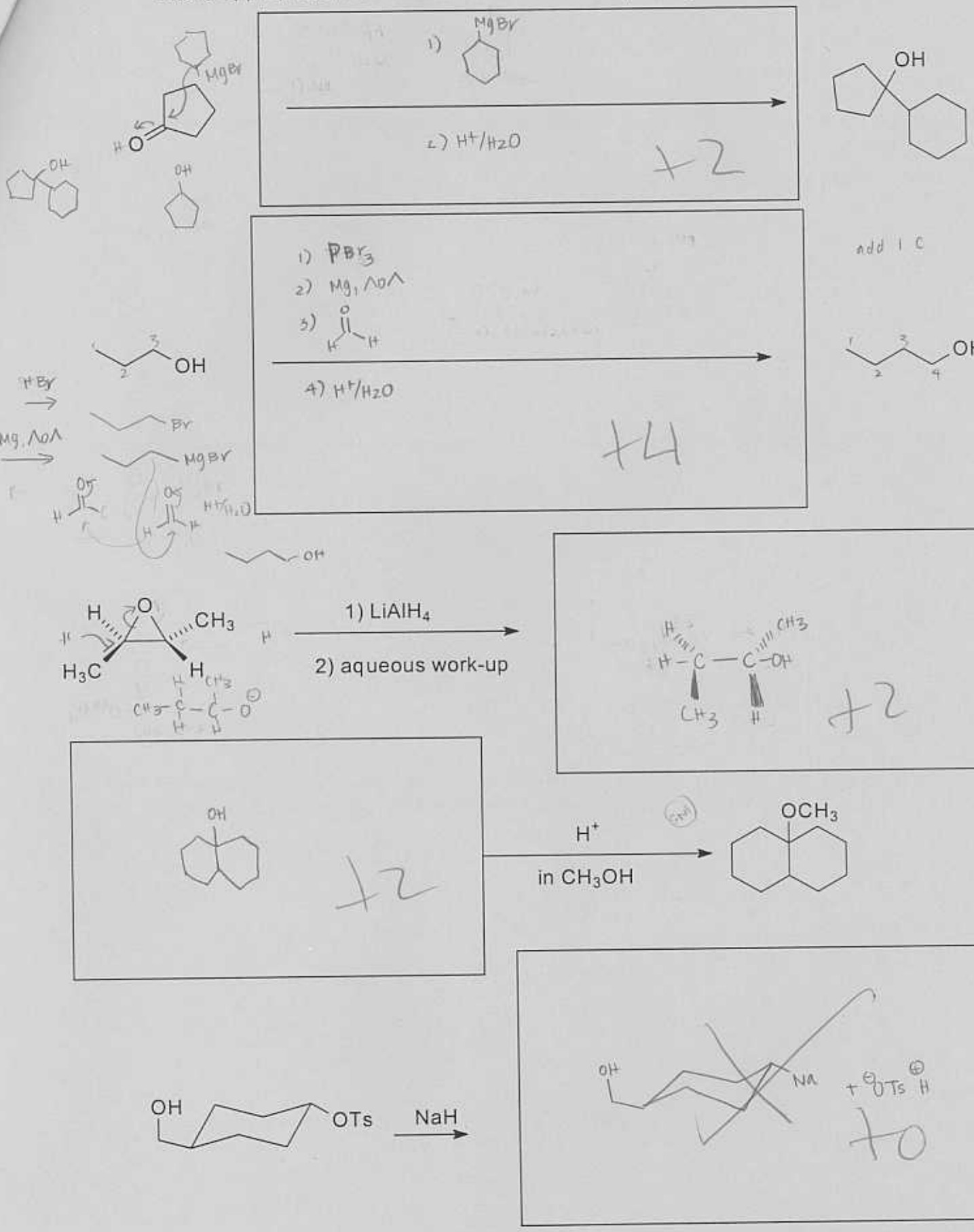
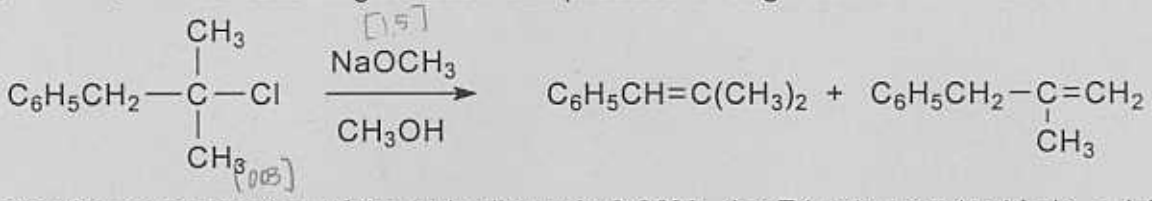
. (12Points). Add the missing starting material, reagents, or products (show stereochemistry where appropriate, note that several reaction steps may be required!)



4. (9 Points). The following reaction can proceed through both E1 and E2 mechanisms.



Data: the concentration of the haloalkane is 0.03M; the E1 rate constant is $k_1 = 1.5 \times 10^{-4}\ s^{-1}$; the E2 rate constant is $k_2 = 1.8 \times 10^{-4}\ L\ mol^{-1}\ s^{-1}$.

(i) Calculate the rate of each reaction and state which elimination mechanism is predominant with 1.5M $NaOCH_3$. *Show detailed work and do not forget the units!*

Rate of E1 reaction

Rate = k [haloalkane] = $(1.5\times10^{-4})(0.03) = 4.5\times10^{-6}\ M\ s^{-1}$ (L / s·mol; mol/L) 1

Rate of E2 reaction

Rate = k [haloalkane][Nu] = $(1.8\times10^{-4})(0.03)(1.5) = 8.1\times10^{-6}\ M\ s^{-1}$ (L/mol·s; mol/L) 1

Predominant mechanism is: E2 1

(ii) At what concentration of base does exactly 50% of the starting material react by an E1 route and 50% by an E2 pathway? *Show detailed work and do not forget units!*

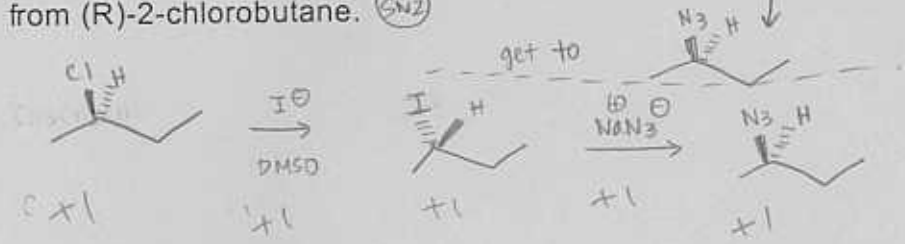
E1 = E2

$(1.5\times10^{-4})(0.03) = (1.8\times10^{-4})(0.03)(\text{base})$ 2

$\text{base} = \dfrac{(1.5\times10^{-4})(0.03)}{(1.8\times10^{-4})(0.03)} = 0.83\ M$

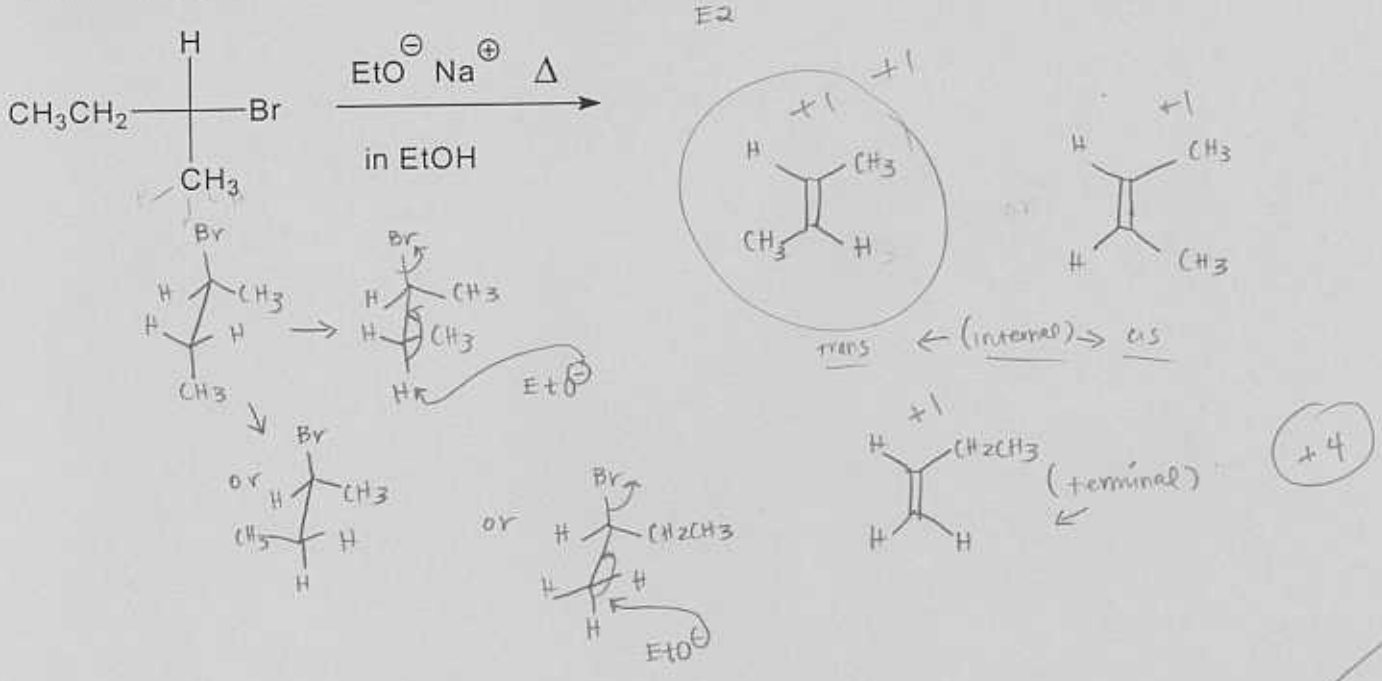
Answer: 0.83M 2 7

5. (11 Points). (a) Propose a synthesis of the (R) isomer of $CH_3CHN_3CH_2CH_3$ starting from (R)-2-chlorobutane. (SN2)



+5

(b) Show clear structures for **all** the products obtained in the following reaction and circle the major elimination product. *(Note that there is no need to consider any "rearranged" product)*



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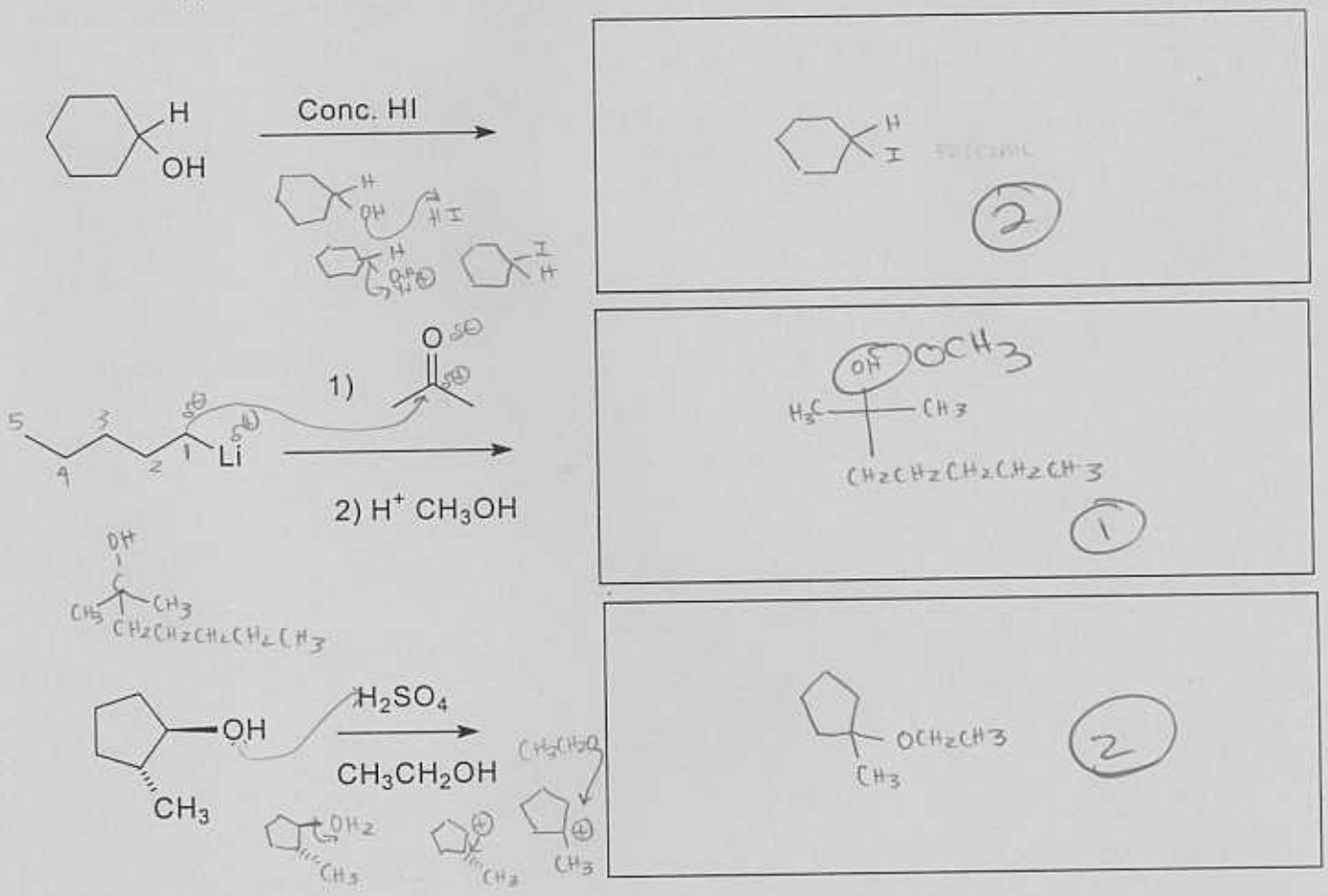
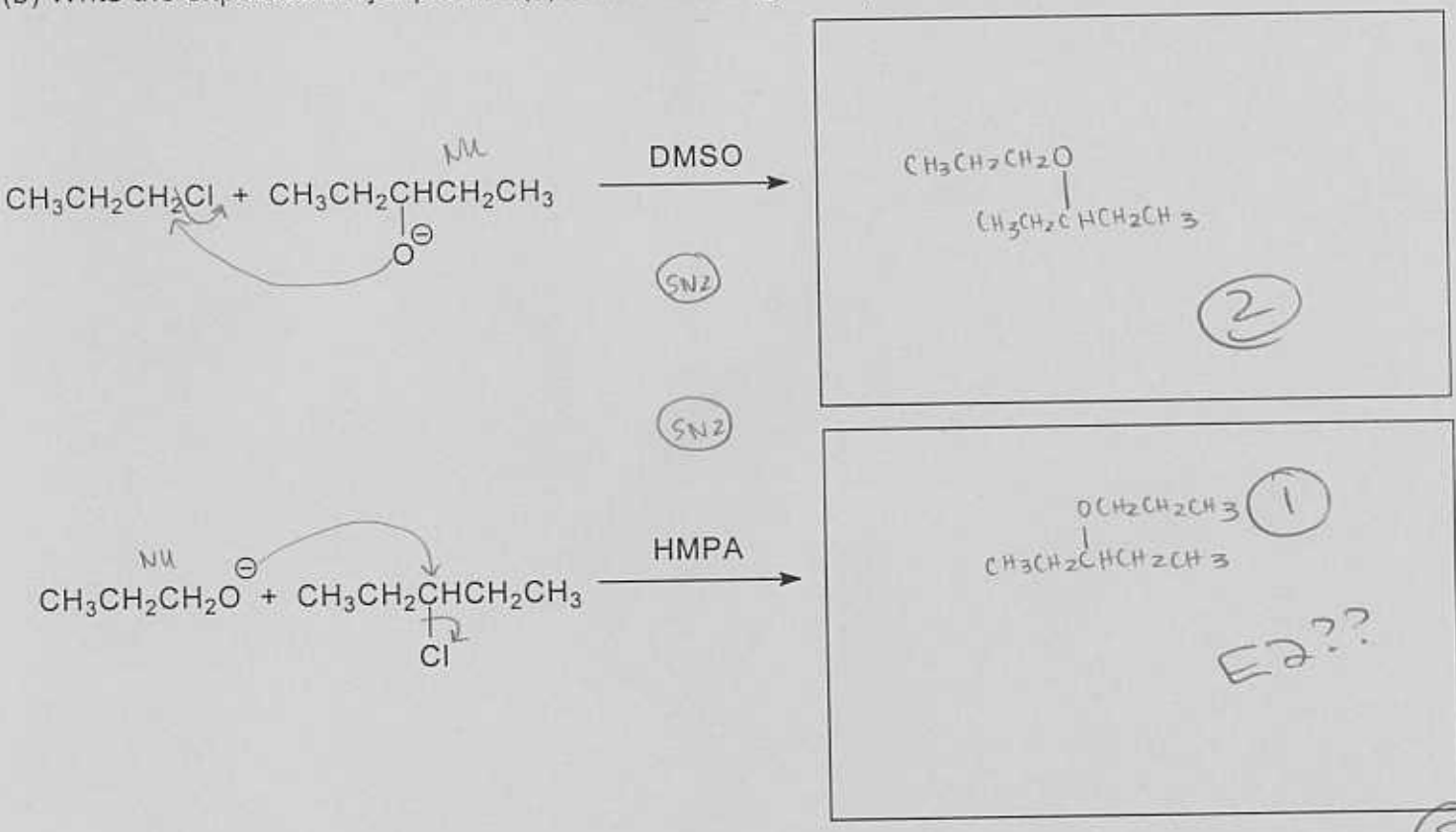
6. (11 Points). (a) Give the expected major product of each of the following reactions.

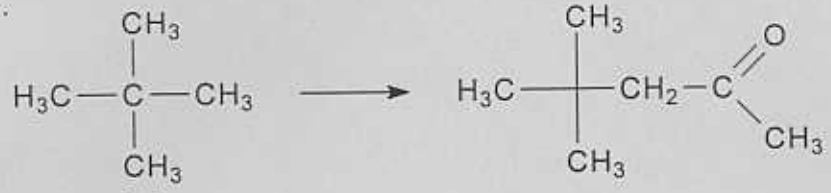


(b) Write the expected major product(s) of the following attempted ether syntheses



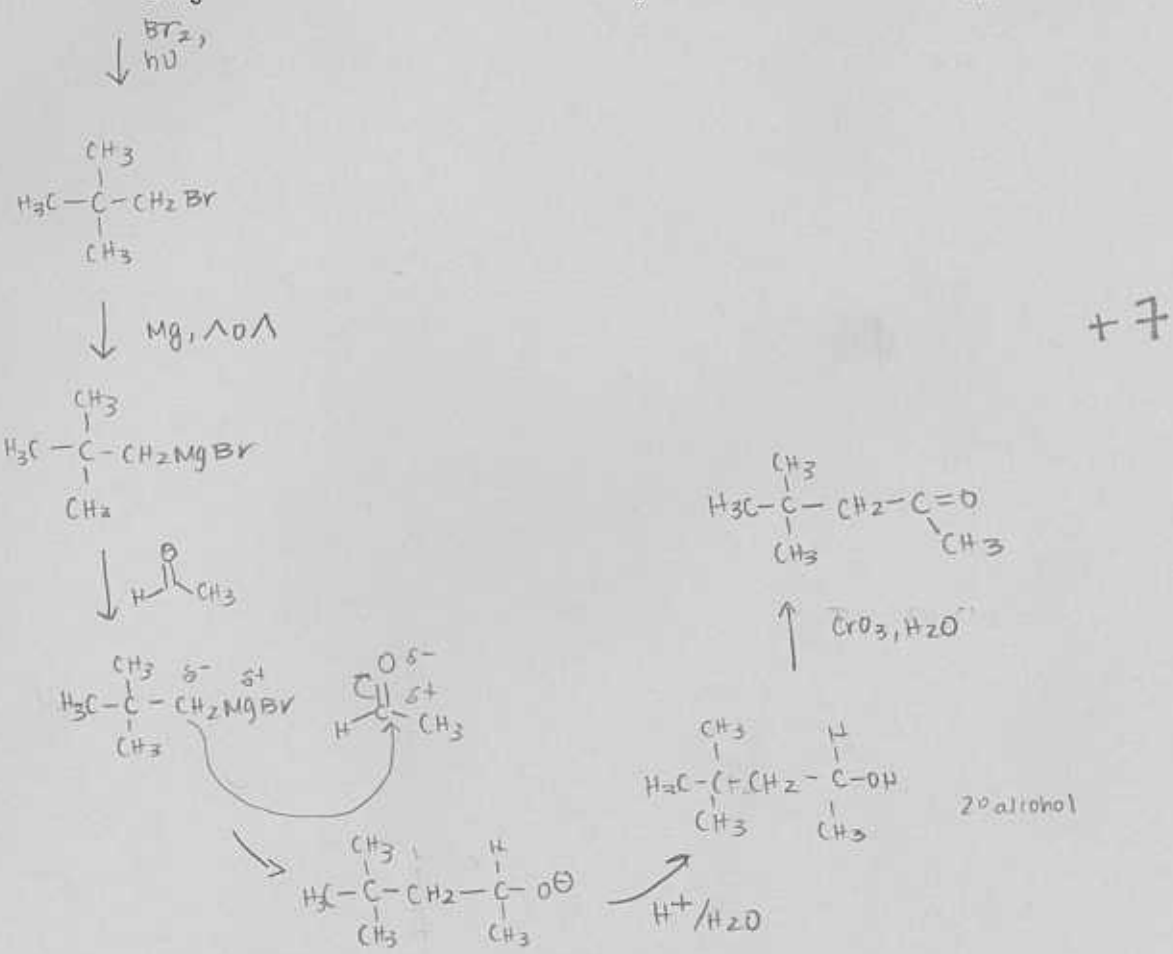
7. (14 points). Provide a viable synthetic route for the product below. You must start from the starting material indicated but you may use any other organic or inorganic compound in your synthetic scheme.

Starting material



Product

add 2 Cs and an O



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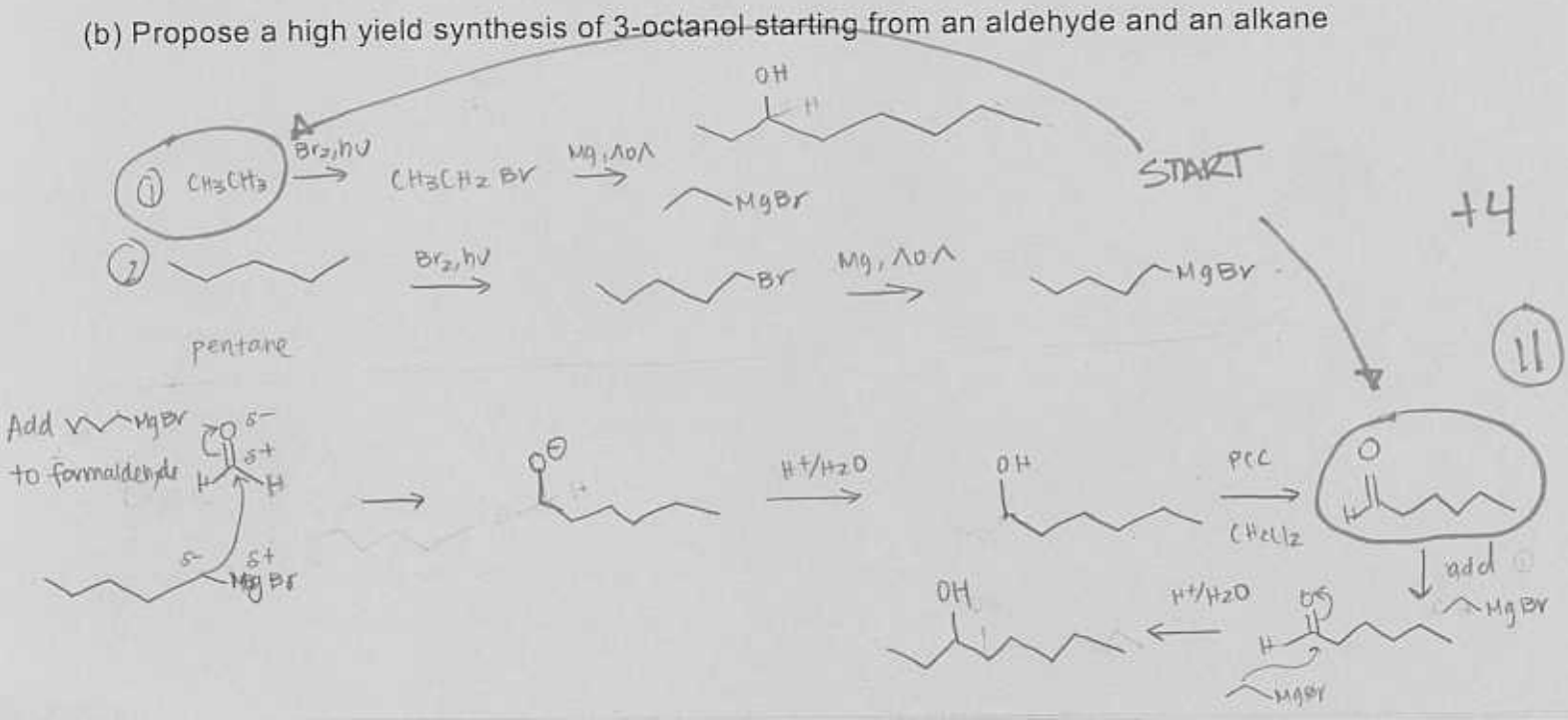
(b) Propose a high yield synthesis of 3-octanol starting from an aldehyde and an alkane



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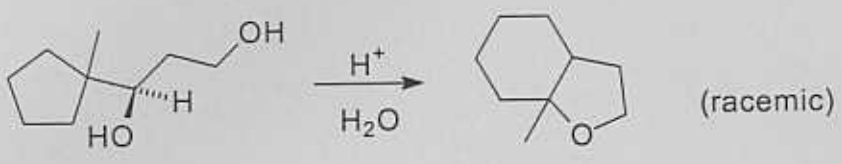
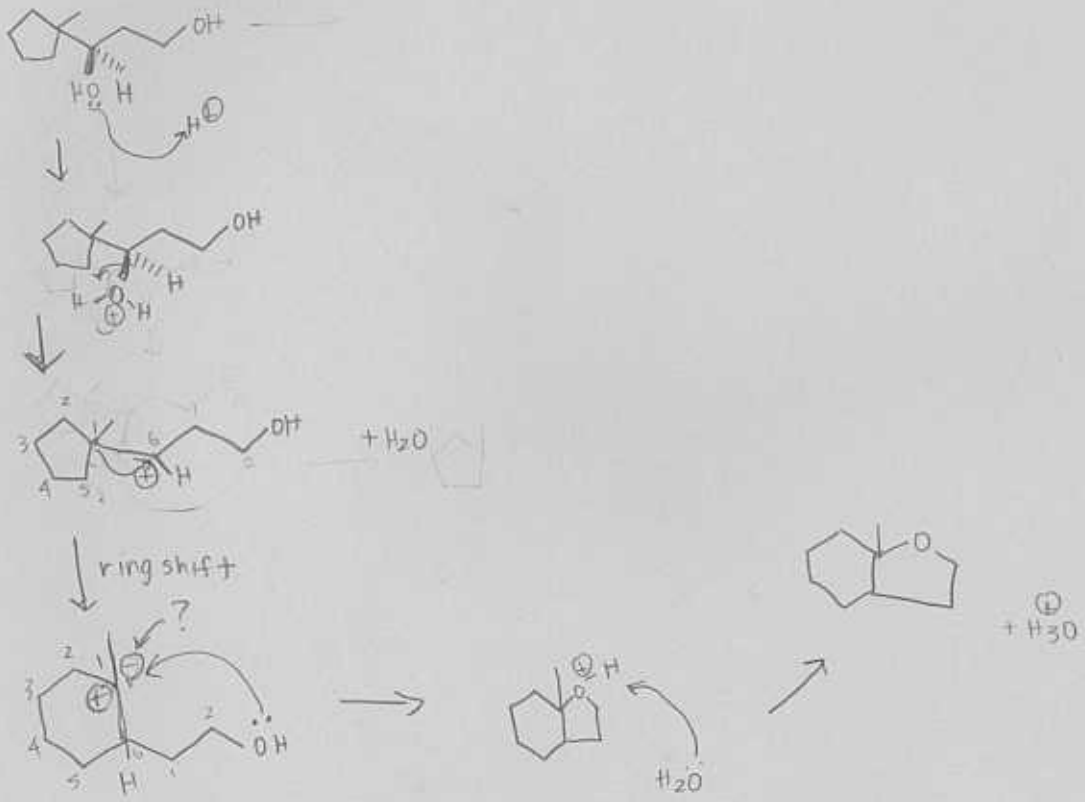
11

8. (10 points). Write a step-by step mechanism (include arrows) for the reaction below. Show all intermediates, and explain (in the box) why the product is racemic.





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Explanation: the product is racemic because... the 1st H_2O that leaves goes through SN1 and produces a carboration in trig planar form which allows attack from either side.

2

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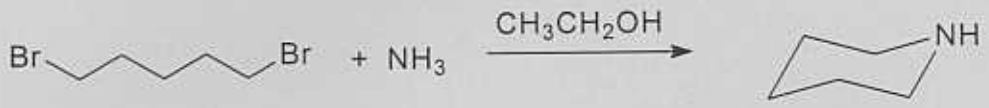
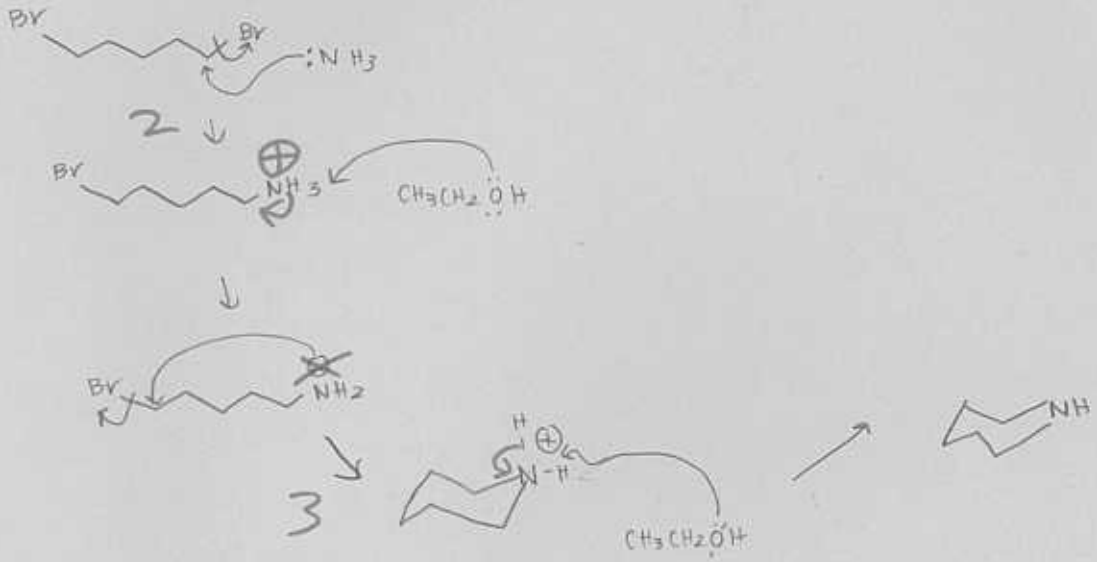
9. (12 Points). (a) Show a detailed step by step mechanism (with curved arrows) explaining the the outcome of the following reaction:





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(b) Show clear structures for products A and B in the reaction sequence below: