

CHEM 3331, Professor Zhang, Fall 2014
Second hour exam, Oct 21, 2014

Printed Name: Key Student ID: _____

Recitation TA Name: _____ Recitation day and time: _____

Scores:

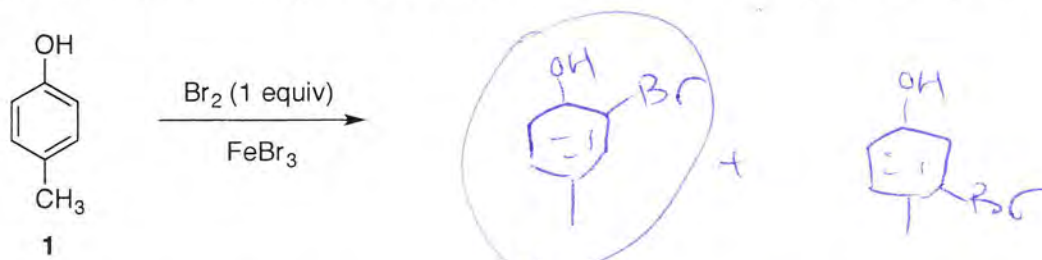
- 1)
 - 2)
 - 3)
 - 4)
 - 5)
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CU Honor Code Pledge: On my honor, as a University of Colorado at Boulder Student, I have neither given nor received unauthorized assistance.

This is a closed-book exam. The use of notes, models, calculators, scratch paper will not be allowed during the exam. Please put all your answers on the test. Use the backs of the pages for scratch.

1A								8A	
1 H							2 He		
	2A								
3 Li	4 Be	3A	4A	5A	6A	7A	10 Ne		
		5 B	6 C	7 N	8 O	9 F			
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar		
						35 Br			
						53 I			

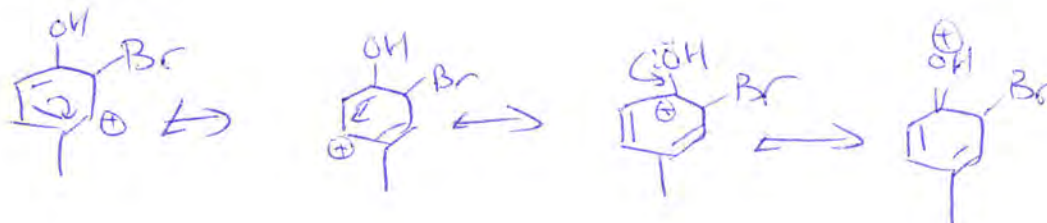
1) (23pts) a) *p*-Methylphenol (**1**) reacts with bromine (1 equiv) and iron tribromide to give two mono-brominated products. Give the structures of the two products (4pts)



b) Which of these two products is more favored? Give **brief** explanation. (4 pts)

Oxygen is stronger activator due to e^- donating by resonance.

c) The reactions above involve formation of reactive intermediate cations. For the more favored product, draw all the important resonance contributors to the structure of the cation intermediate. (4pts)

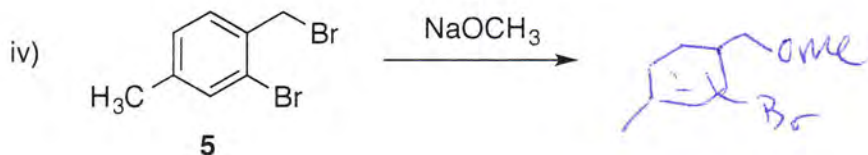
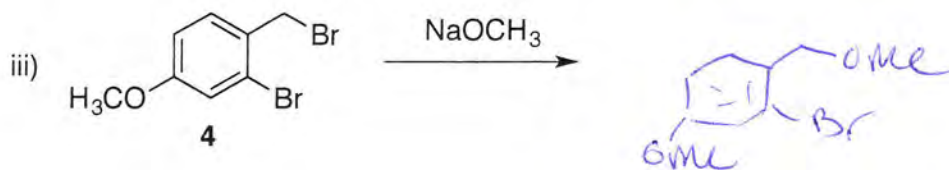
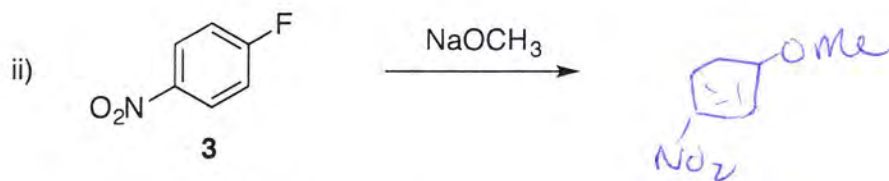
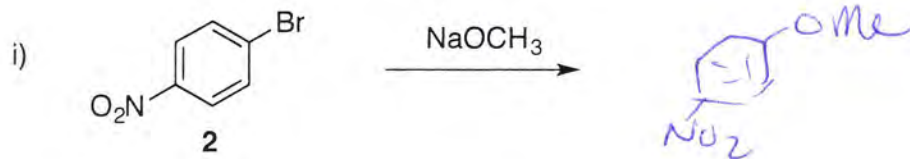


d) Is the reaction in part 1a FASTER or SLOWER than the bromination of methylbenzene? (3pts).

Faster.



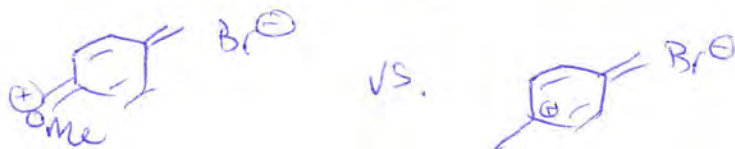
e) Give the structures of the products obtained when halide **2-5** are reacted with sodium methoxide (1 equiv), respectively. (4pts)



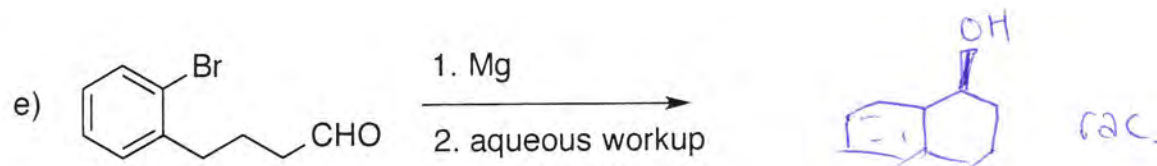
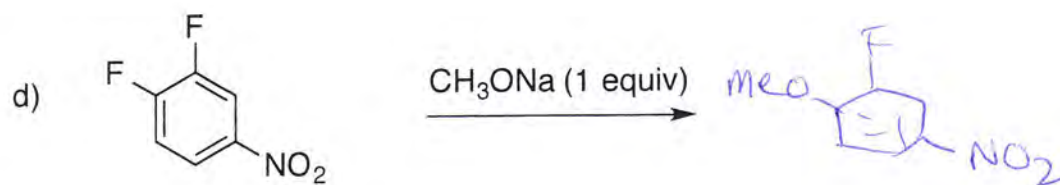
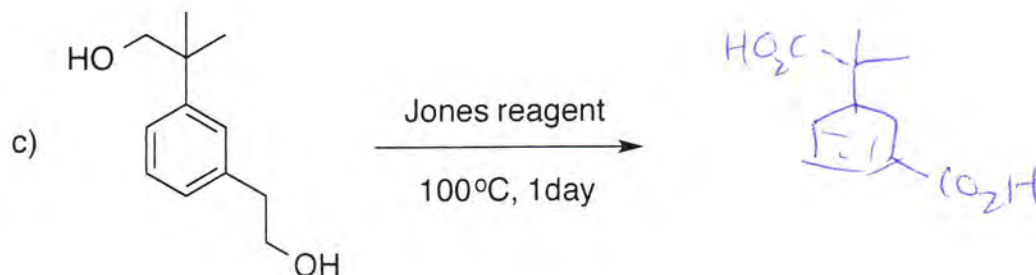
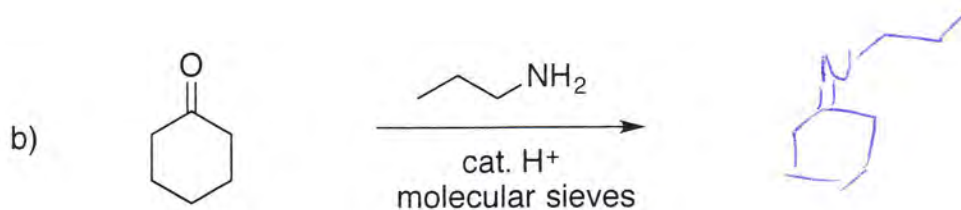
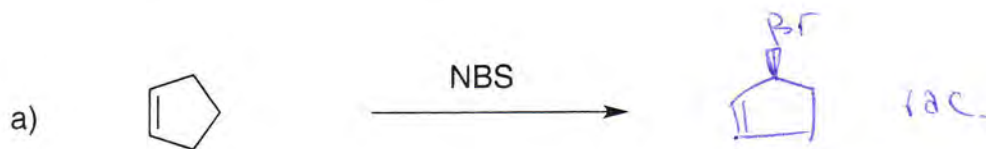
f) Under the same conditions, between reaction (i) and (ii) in part 1e, which one proceeds faster? Between reaction (iii) and (iv), which one proceeds faster? **Briefly** explain the reasoning. (4pts)

ii proceeds faster than i. The carbon attached to the F is a better ~~nucleo~~ electrophile. (F is more electro-negative than Br).

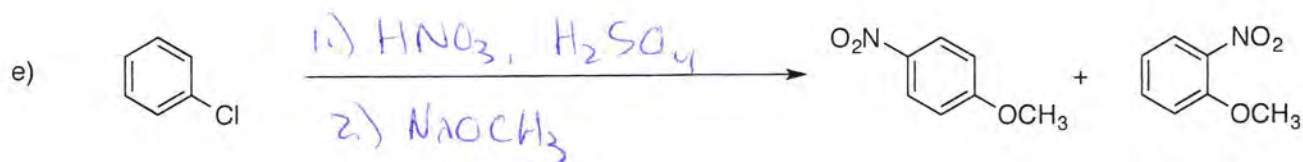
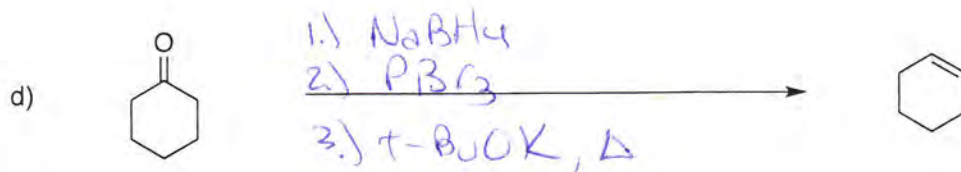
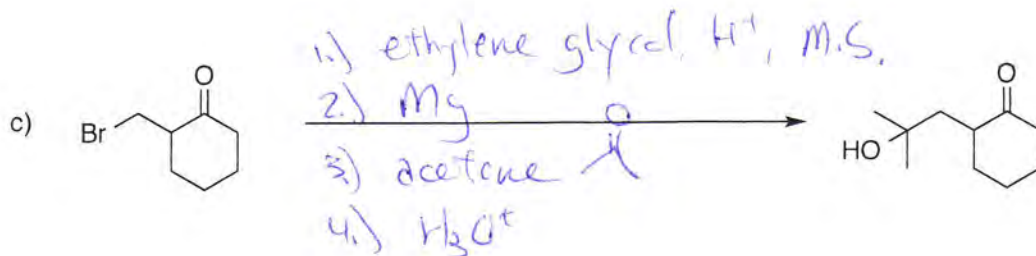
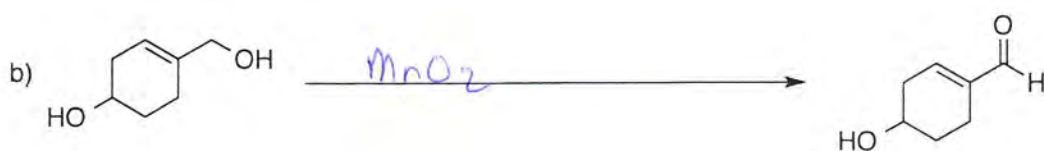
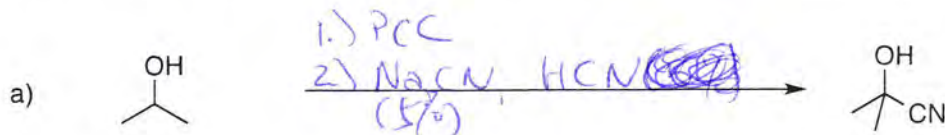
iii proceeds faster than iv due to \bar{e} donating effects of methoxy.



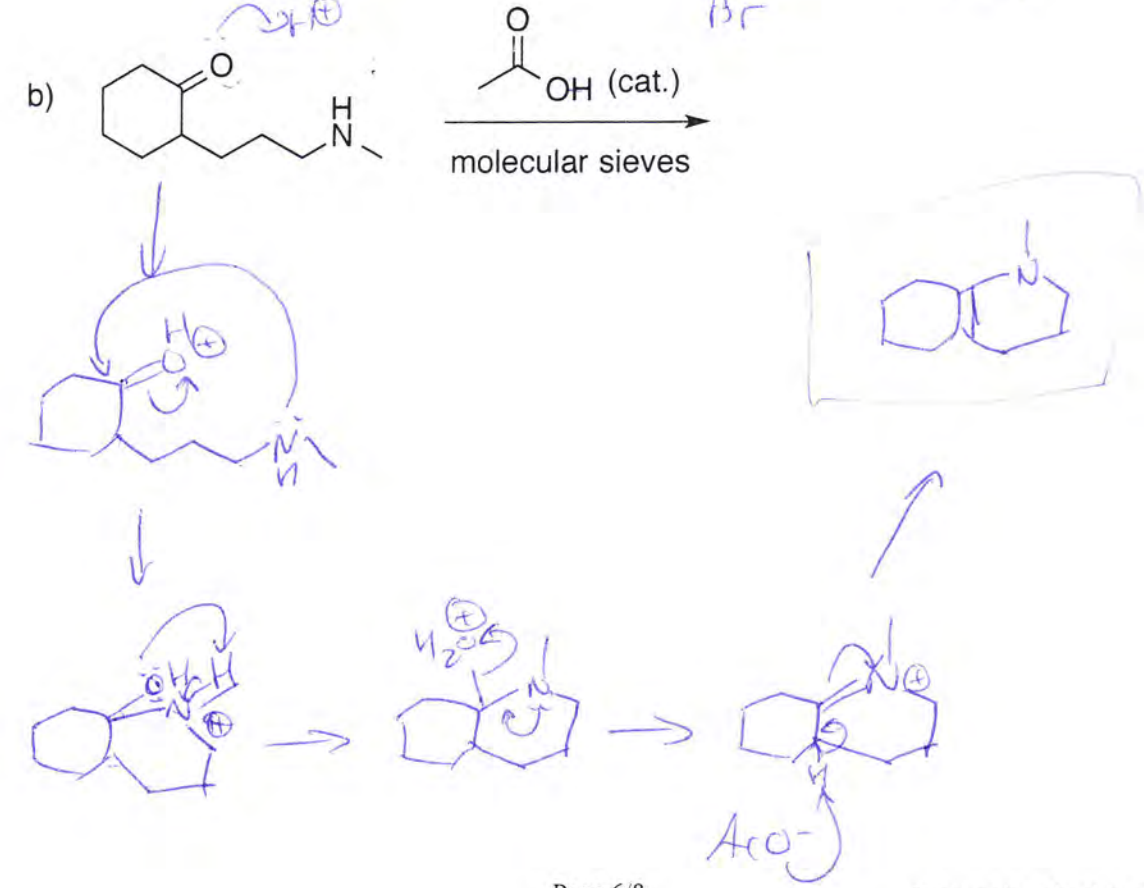
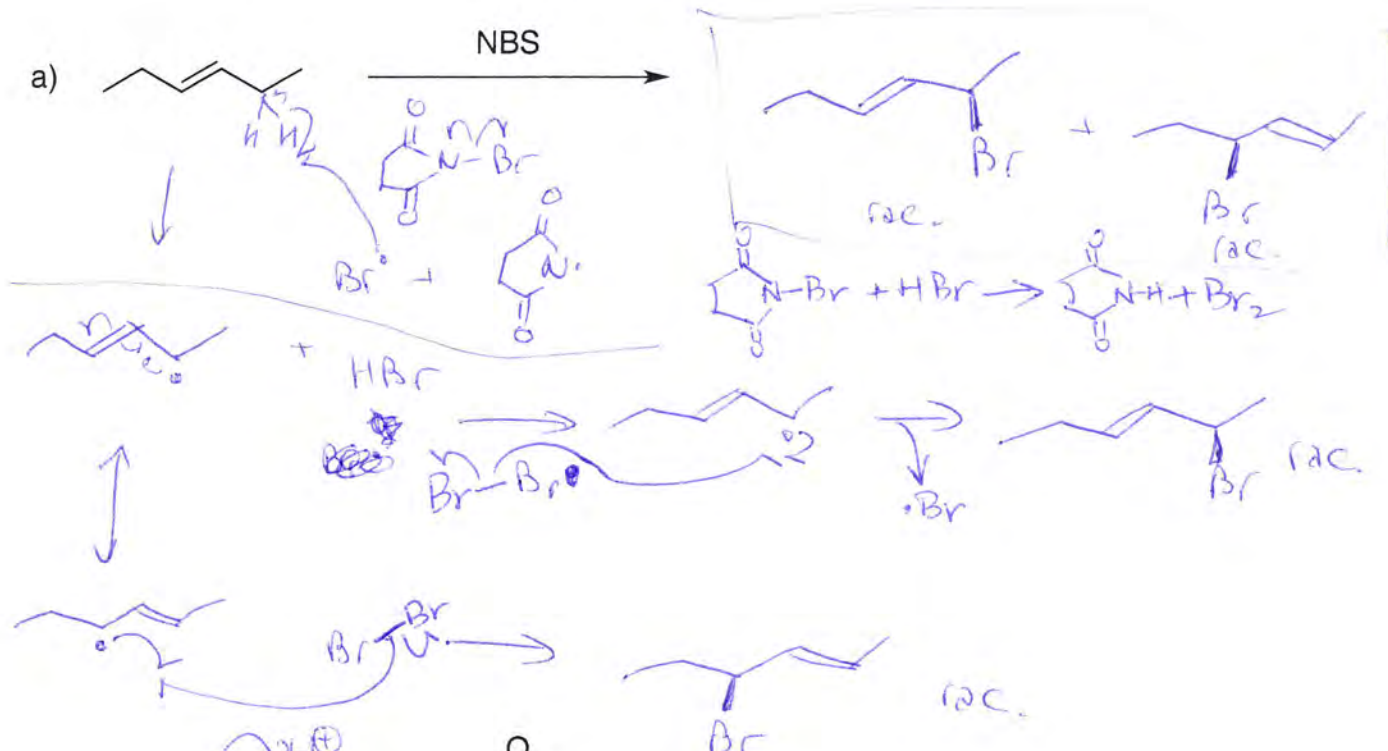
2) (20 pts) Give the single major product of each of the following reactions, carefully showing stereochemistry if appropriate. If a racemate is formed, show only one enantiomer, and label it "rac". All reactions have an appropriate aqueous work up. (4 pts each)



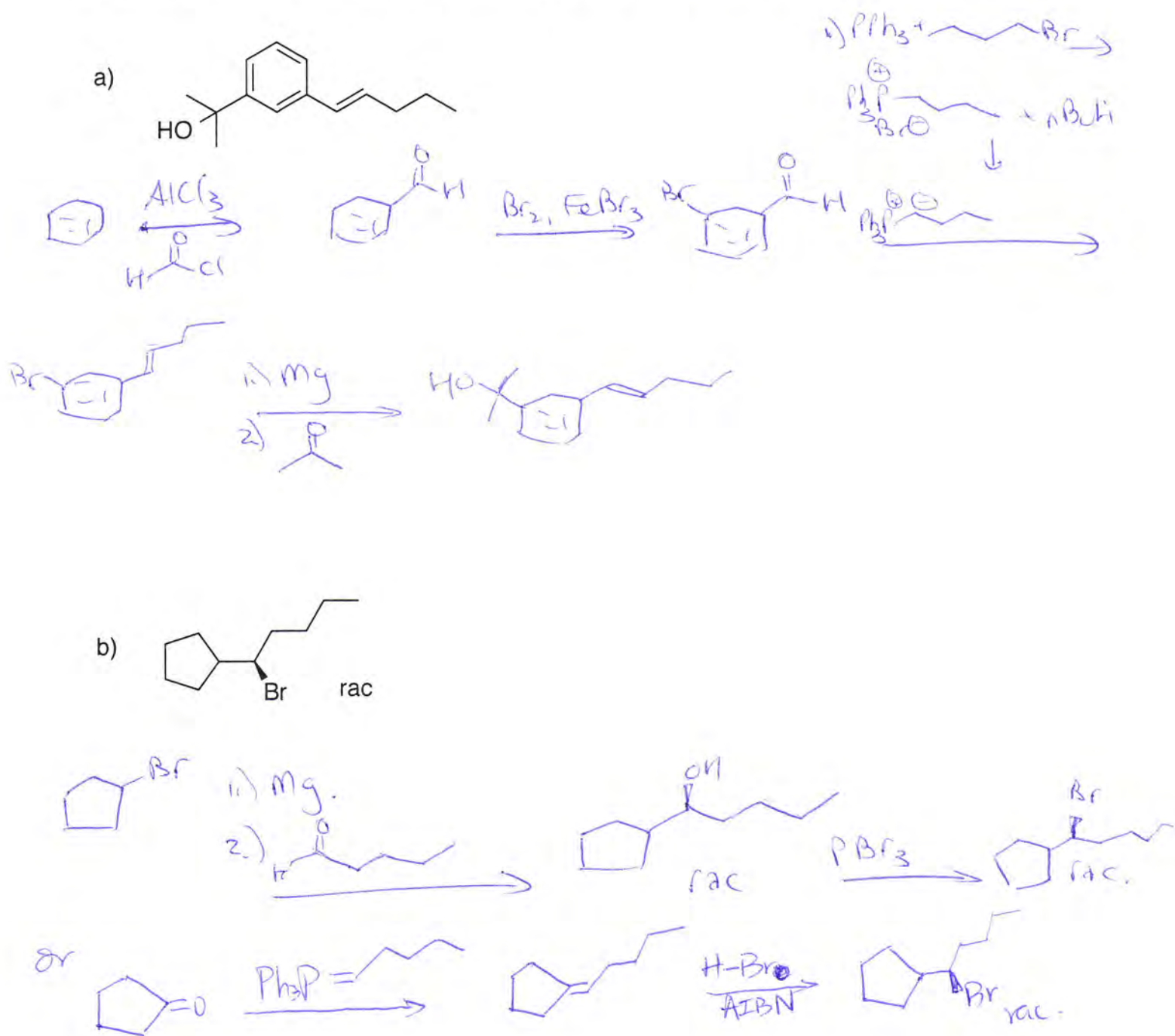
3) (20 pts) Propose reagents for accomplishing the following transformations. NOTE: more than one step may be required! Try to make your synthesis efficient (i.e. the desired product should be the major product, and generally a shorter synthesis is better than a longer one). You must use the starting material given; you may use any other reagents you need.



4) (20 pts) Provide the products and mechanisms for the following **two (2)** reactions. Show every intermediate with the proper changes and all the arrows required for each step of the reaction. (2 pts for product, 6 pts for mechanism).



5) (21 pts) Propose a synthesis of each of the following **three (3)** targets. Allowed starting materials include benzene, triphenylphosphine, and/or any other organic molecules containing **five (5)** carbons or less. You may use any necessary inorganic reagents. Try to make your synthesis efficient (i.e. the desired product should be the major product, and generally a shorter synthesis is better than a longer one). More than one step may be required.



c)

