

California State Polytechnic University, Pomona

Chem 315  
Midterm Exam  
Spring, 2009  
Beauchamp

Name: \_\_\_\_\_

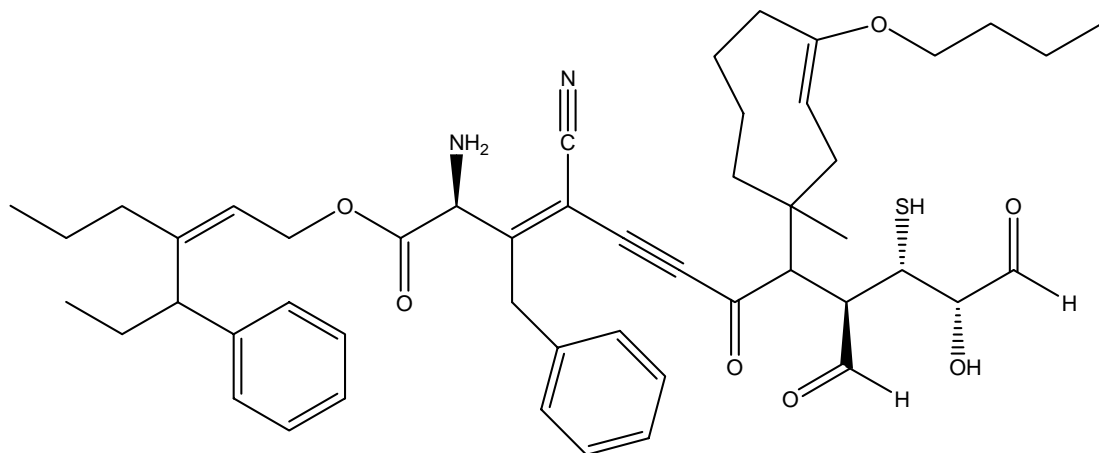
Topic	Total Points	Credit
1. Nomenclature (1)	30	
2. Carbonyl (C=O) and epoxide chemistry	36	
3. Tautomeric mechanisms, arrow pushing, proton transfers, resonance, one in acid and one in base	36	
4. Reactions page using reactions learned thus far (30) (you supply either reagents or products)	40	
5. Multistep syntheses using the reactions learned thus far in the course (possible in 4-5 steps)	30	
6. Complete details of S <sub>N</sub> 1/E1 and S <sub>N</sub> 2/E2 reactions. Stereochemistry, arrow pushing, carbocations, rearrangements might be part of the problem	35	
7. Complete arrow pushing mechanisms, one in acid (rearrangements are possible) and one in base (understanding tautomerization will help)	30	
<b>Total</b>	237	

This is a long exam. It has been designed so that no one question will make or break you. The best strategy is to work steadily, starting with those problems you understand best. Make sure you show all of your work. Draw in any lone pairs of electrons, formal charge and curved arrows to show electron movement. Only write answers on the front of each page. Do your best to show me what you know in the time available.

Enthusiasm and persistence can make an average person superior,  
indifference and lethargy can make a superior person average  
William Ward

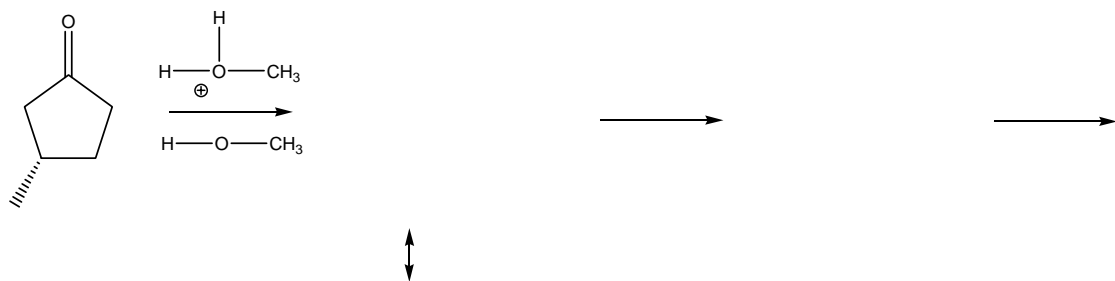
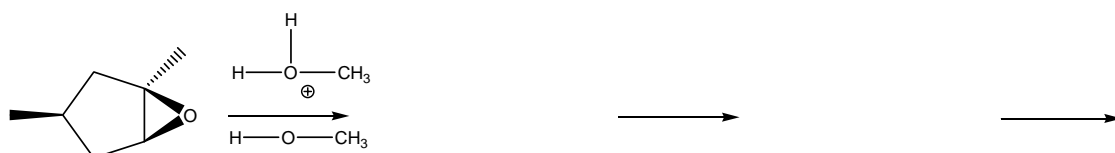
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1. Provide an acceptable name for the following structure. (30 pts)



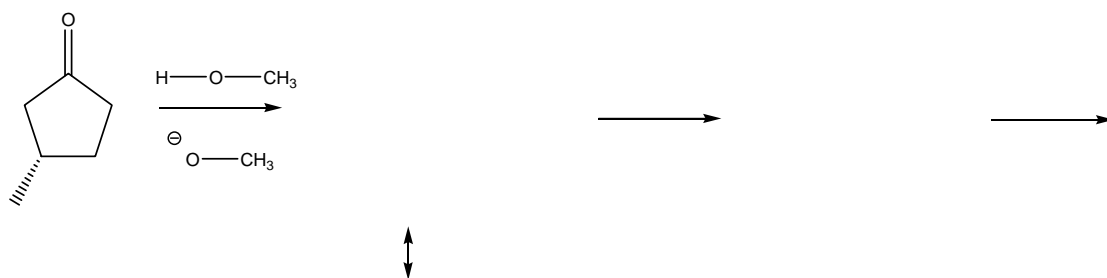
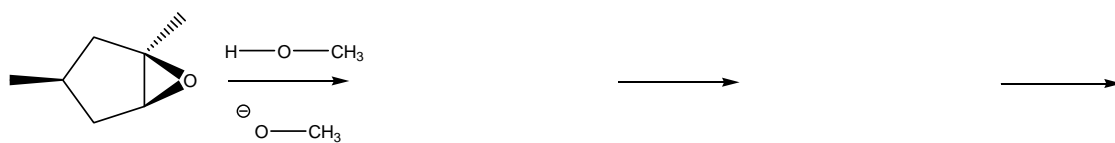
2. Provide complete arrow-pushing mechanisms for the carbonyl and epoxide reactions below. Include curved arrows, lone pairs of electrons, formal charge and correct 3D structures for each step. Draw important pi resonance structures. If stereoisomers are possible, draw them without any additional mechanisms. (36 pts)

a. Epoxides and carbonyl compounds in methanolic acid (addition reactions):



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b. Epoxides and carbonyl compounds in methanolic base (addition reactions):



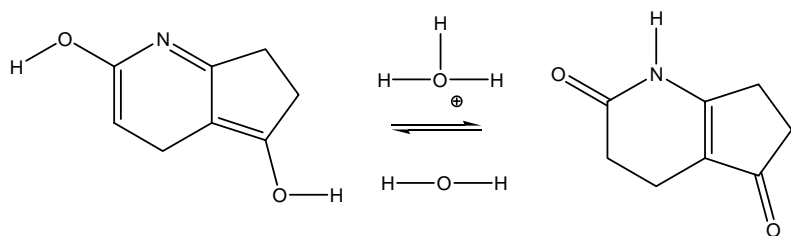
c. Epoxides and carbonyl compounds with 1. LDA 2. electrophile



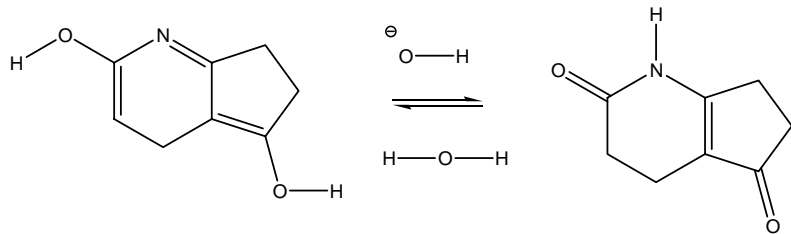
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3. Provide a complete arrow-pushing mechanism (curved arrows, lone pairs and formal charge) to explain the following tautomeric transformations. Show all intermediate resonance structures in each tautomeric change. Indicate which is the "best" resonance structure. (36 pts)

a.

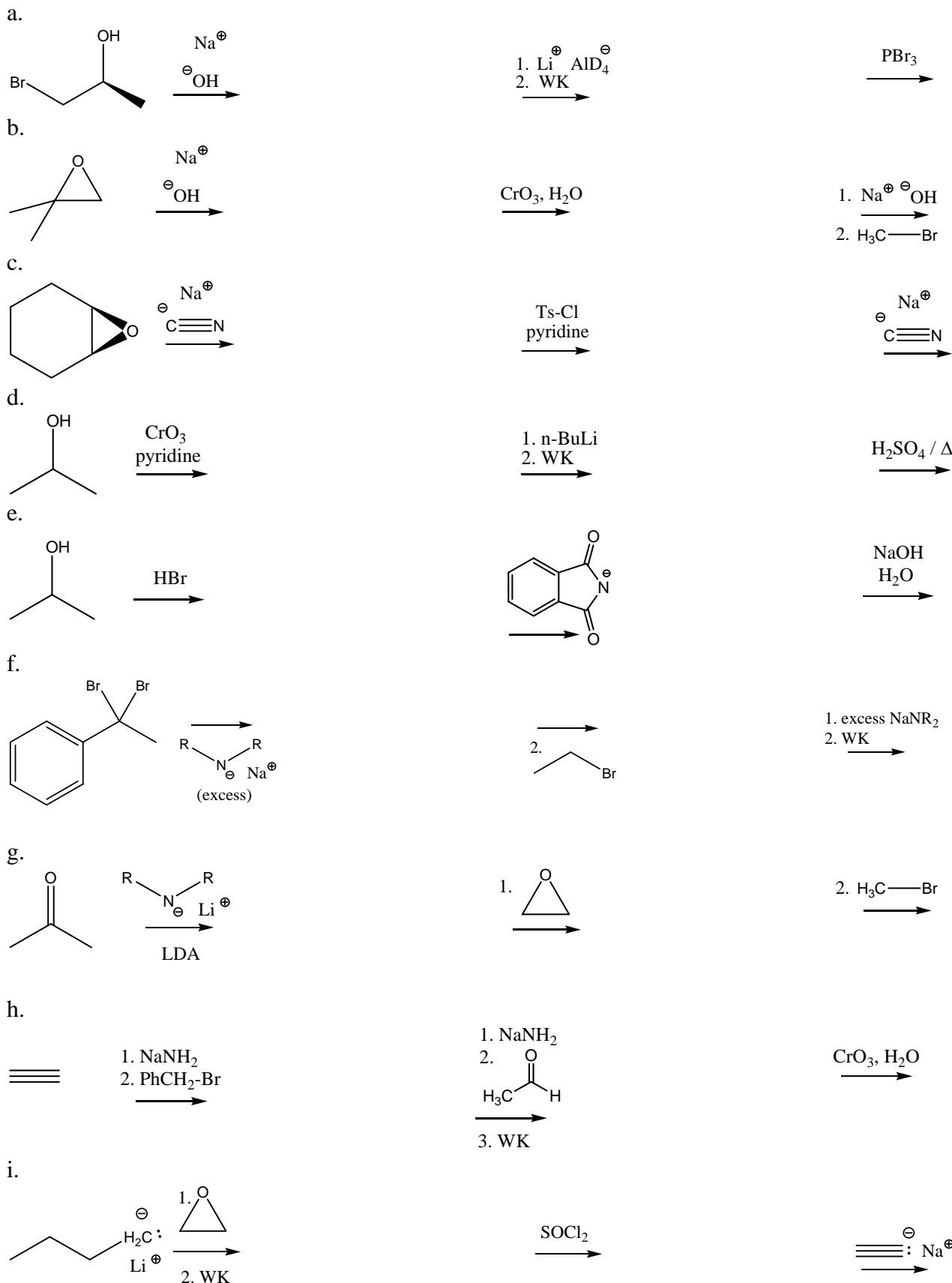


b.



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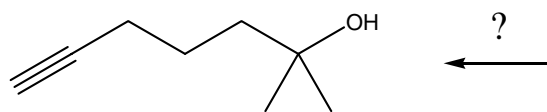
4. Fill in the missing product for each reaction below. Do not waste time by writing mechanisms. (40 pts)



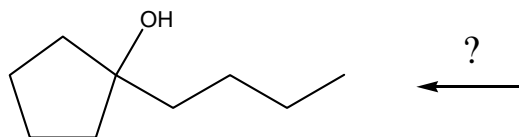
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5. Propose a reasonable synthetic method to accomplish the following transformations using any additional materials available from our course (see last page of exam). Show a reaction arrow with appropriate reagents and the product for each step of your synthesis. Do not show mechanisms. (30 pts)

a.

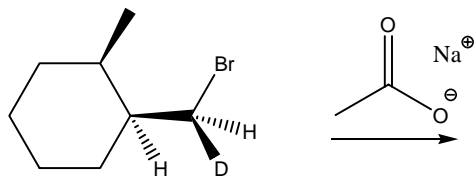


b.

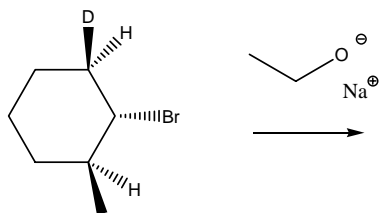


6. Indicate only the major product(s) expected in each reaction below. State what mechanism is operating in each case, and clearly show how it is (they are) formed using 3D structures. Assume that if a more stable intermediate can form, it will generate the major product(s). If multiple “major” products form by one type of mechanism, just show one mechanistic sequence and draw the other possible products. (35 pts)

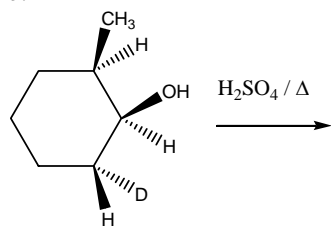
a.



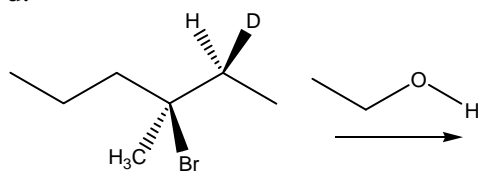
b.



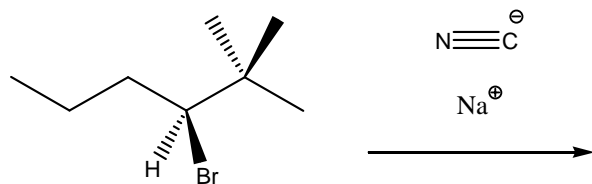
c.



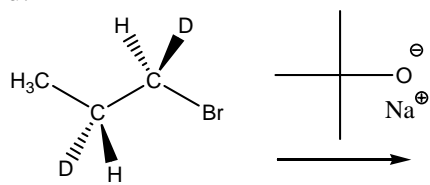
d.



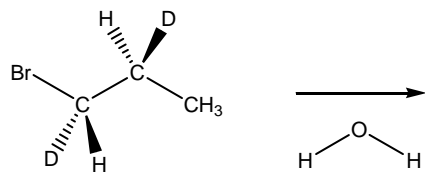
c.



d.



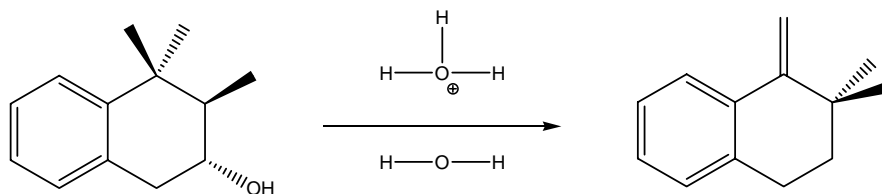
e.



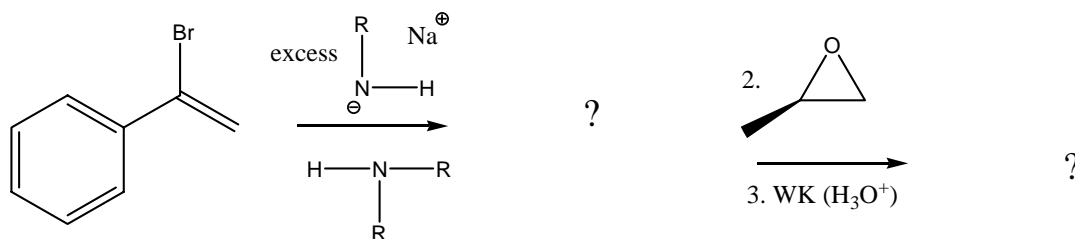
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7. Provide complete arrow-pushing mechanisms for the reactions below. Include curved arrows, lone pairs of electrons and formal charge for each step. If resonance is present, draw at least one additional resonance structure to show you recognize this feature. (30 pts)

a.



b.

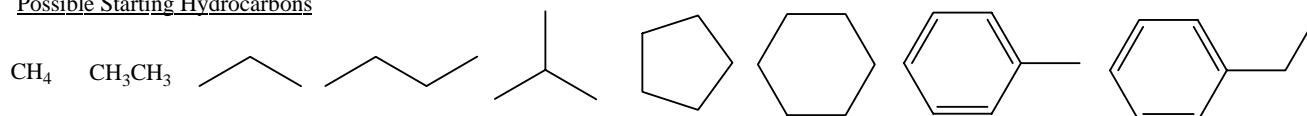


It is not the mountain we conquer, but ourselves.

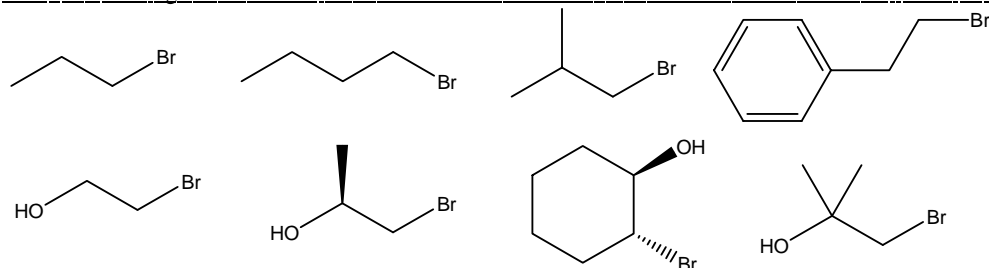


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## Possible Starting Hydrocarbons



Additional starting structures available for now because we cannot make them - YET. Each will be eliminated as we learn how to make them.



Commercially available chemicals and reagents - you can invoke these whenever you need them.

