# CHEMISTRY 12A FALL 2017

## EXAM 3

Answers

NOVEMBER 21, 2017

**NAME- WRITE BIG** _____

**STUDENT ID:** _____

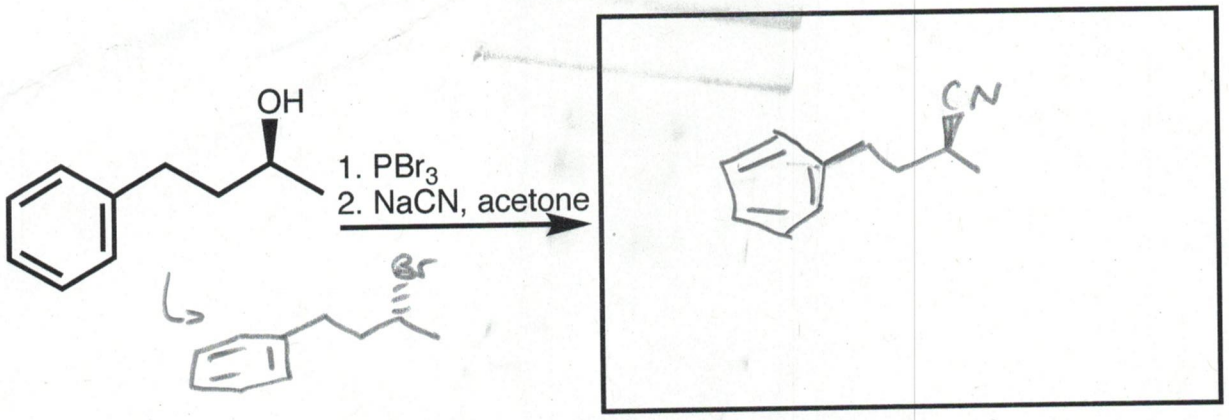
**SECTION AND/OR GSI IF YOU ARE IN THE LABORATORY COURSE:** _____

- **You will have 75 minutes in which to work.**
- **BE NEAT! Non-legible structure drawings will not be graded.**
- **Only answers in the answer boxes will be graded – you can write in other places, but we only grade the answers in the boxes.**
- **All pages of the exam must be turned in.**
- **No calculators**
- **No stencils**
- **Molecular models may be used**

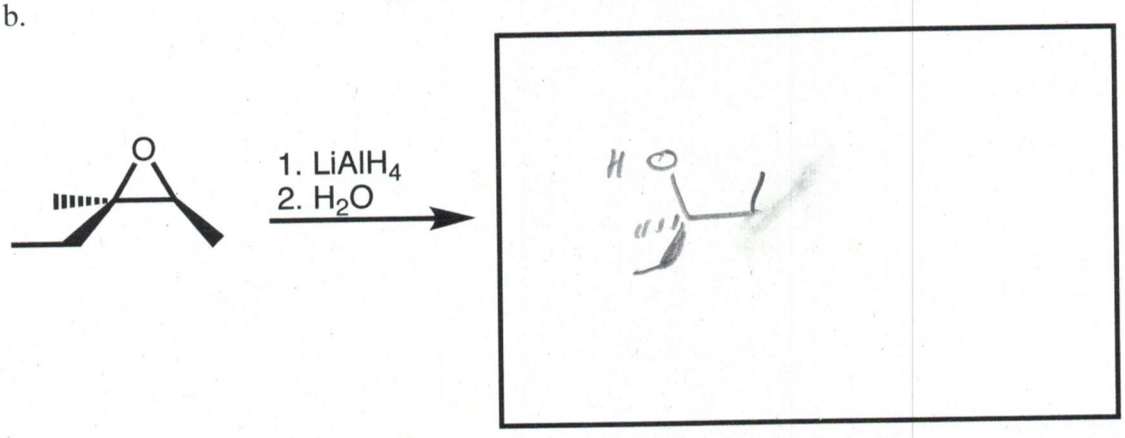
| Problem | Points (Maximum) |
|---|---|
| **1** | 32 |
| **2** | 12 |
| **3** | 14 |
| **4** | 20 |
| **5** | 30 |
| **6** | 12 |
| ***Total*** | ***120*** |

1. (32 points) For each reaction draw the major organic products, **including all stereoisomers**. Write NR if you think there will be no reaction.

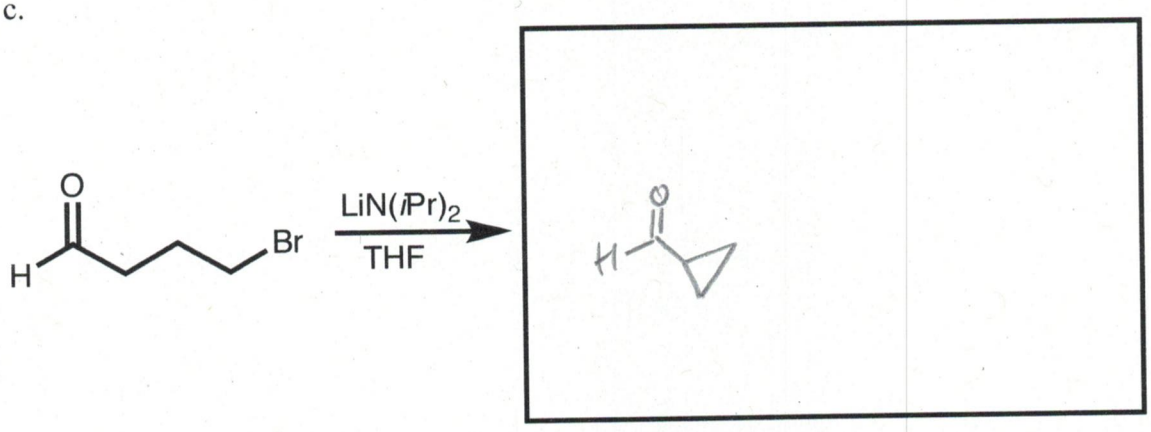
a.



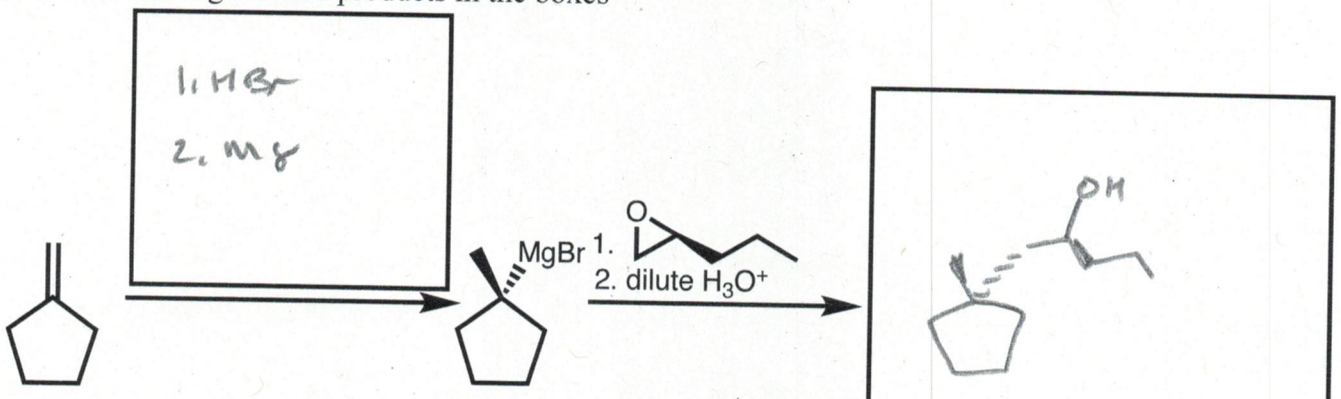

b.




c.

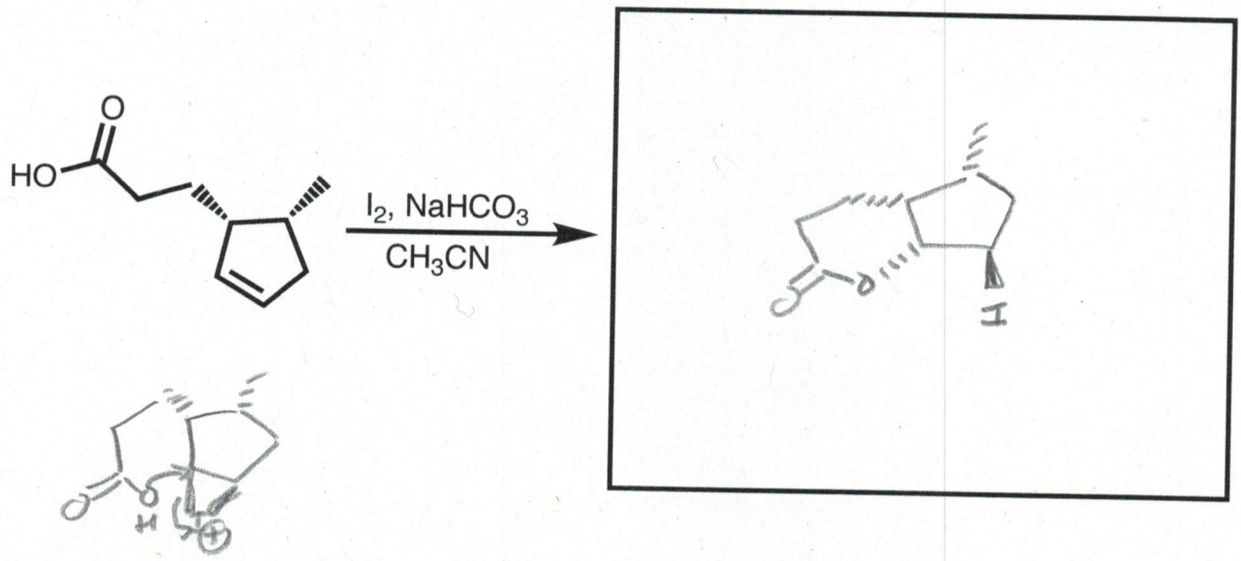


d. Fill in the reagents and products in the boxes

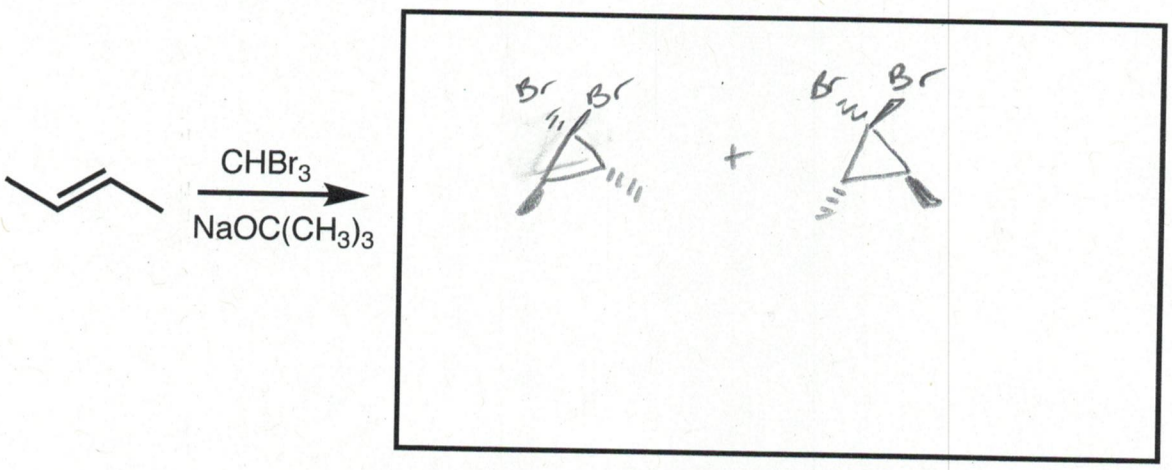



*Note: $H_3O^+$ is to 'work up' reaction and neutralize product*

e.

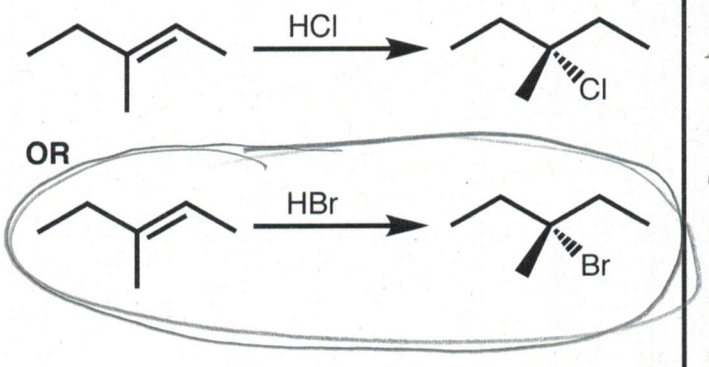



f.



2. (12 points) **Circle** the reaction in the following pairs of reactions that you would expect to go faster. It is possible that both reactions have the same rate. It is possible that one of the reactions shown in each pair does not occur at a measurable rate. You may disregard any other products besides the ones pictured that may form under the reaction conditions. Give explanations in the boxes provided.

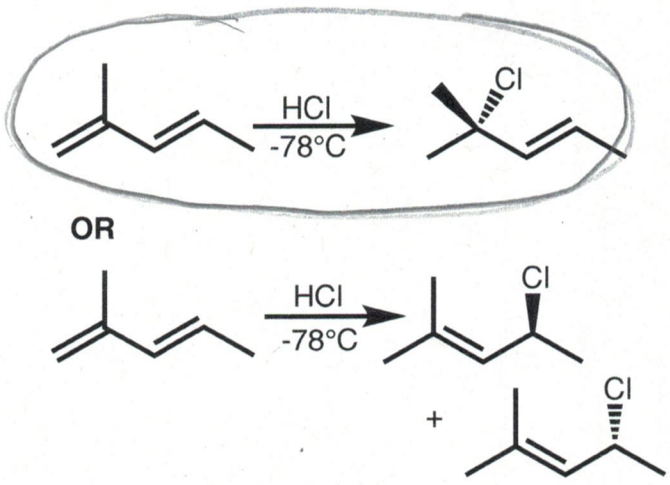
a.




Explanation

HBr is more acidic than HCl because Br is down a column & is bigger & more stable as an anion. Alkene is acting as a Lewis Base & the rate determining step is addition of H–X. Therefore the stronger acid reacts fastest

b.

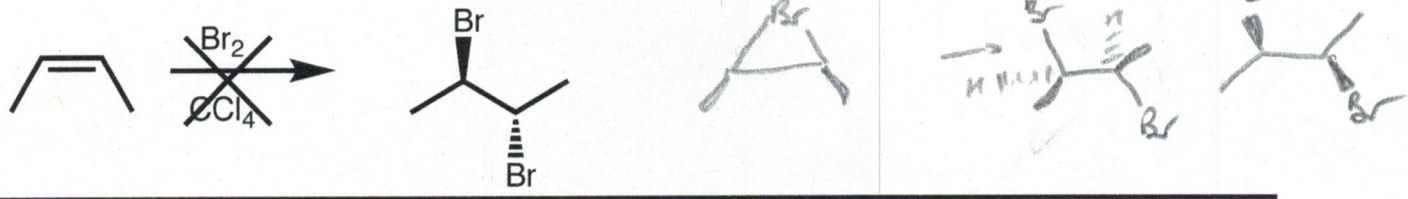


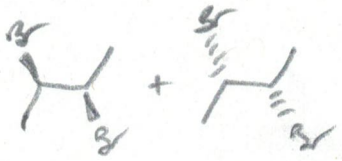
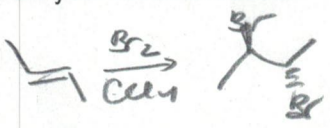

Explanation

This reaction is carried out at low temp & therefore the reaction does not reach equilibrium & the kinetic product forms. This is the 1,2 addition because $Cl^-$ is closest to that carbon after alkene is protonated.

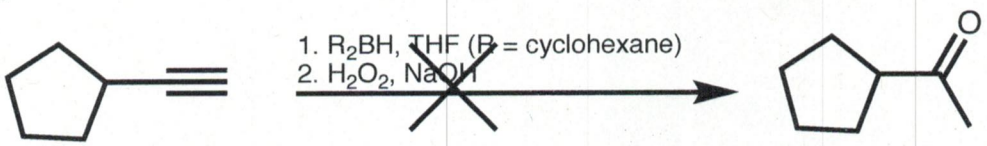
3. (14 points) The following reactions would not occur as written. i. What product would actually be made? ii. Why was the desired product not formed? iii. How could you change either the substrate **or** reaction conditions to give the desired product?

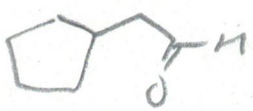
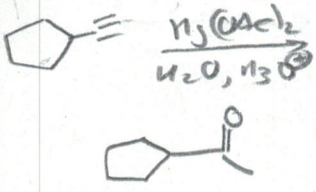
a.




| What product is actually made? (Draw structure or NR for no reaction) | Why was desired product not formed? (Explain in 1 sentence) | How could substrate **or** reaction be changed to give the indicated organic product? Draw your revised reaction. |
|---|---|---|
|  | $Br_2$ reacts to form  Reaction of $Br^-$ is from back of bond, leading to pairs enantiomers |  |

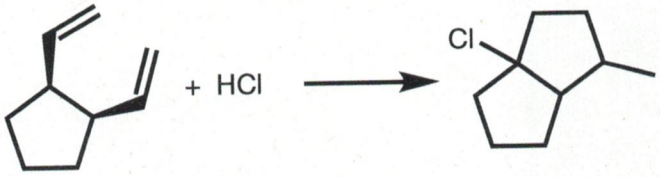
b.

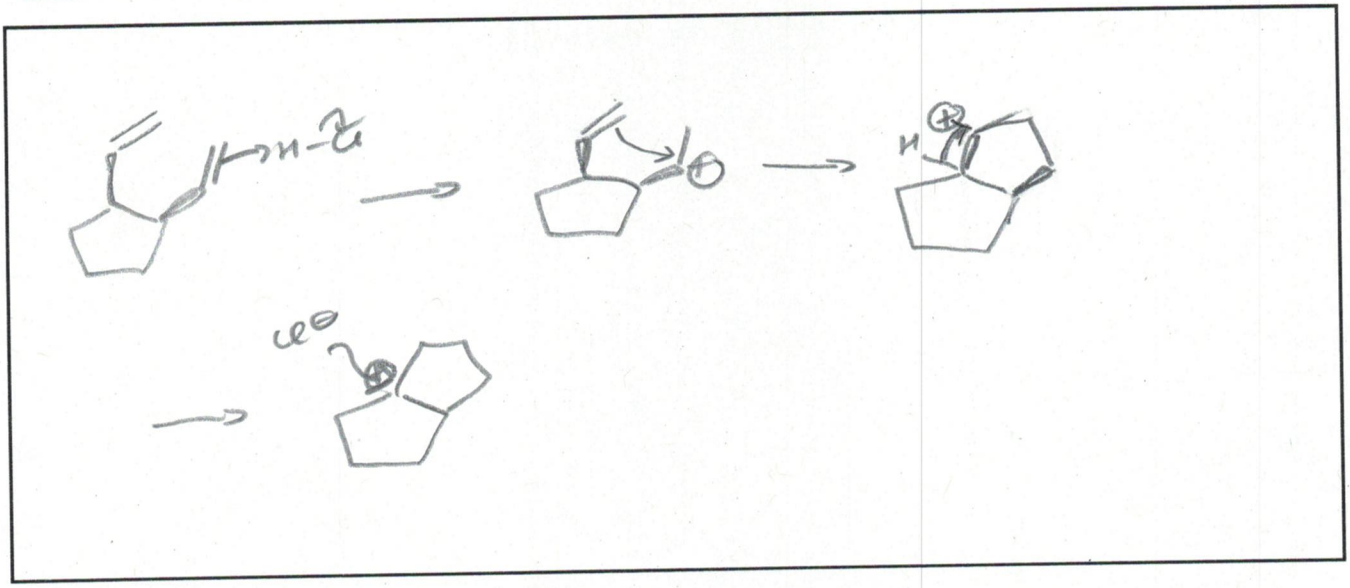



| What product is actually made? (Draw structure or NR for no reaction) | Why was desired product not formed? (Explain in 1 sentence) | How could substrate **or** reaction be changed to give the indicated organic product? Draw your revised reaction. |
|---|---|---|
|  | B-H adds anti-markovnikov to alkyne because B goes to less sterically hindered carbon | $Hg(OAc)_2$ gives markovnikov addition  |

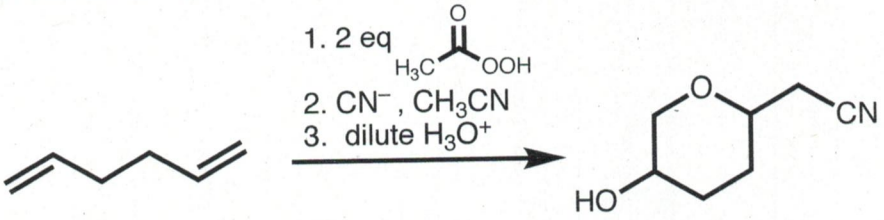
4. (20 points) Draw the mechanism of the following reactions using arrows to indicate the flow of electrons.

a. *You do not need to indicate stereochemistry*



b. *You do not need to indicate stereochemistry.*

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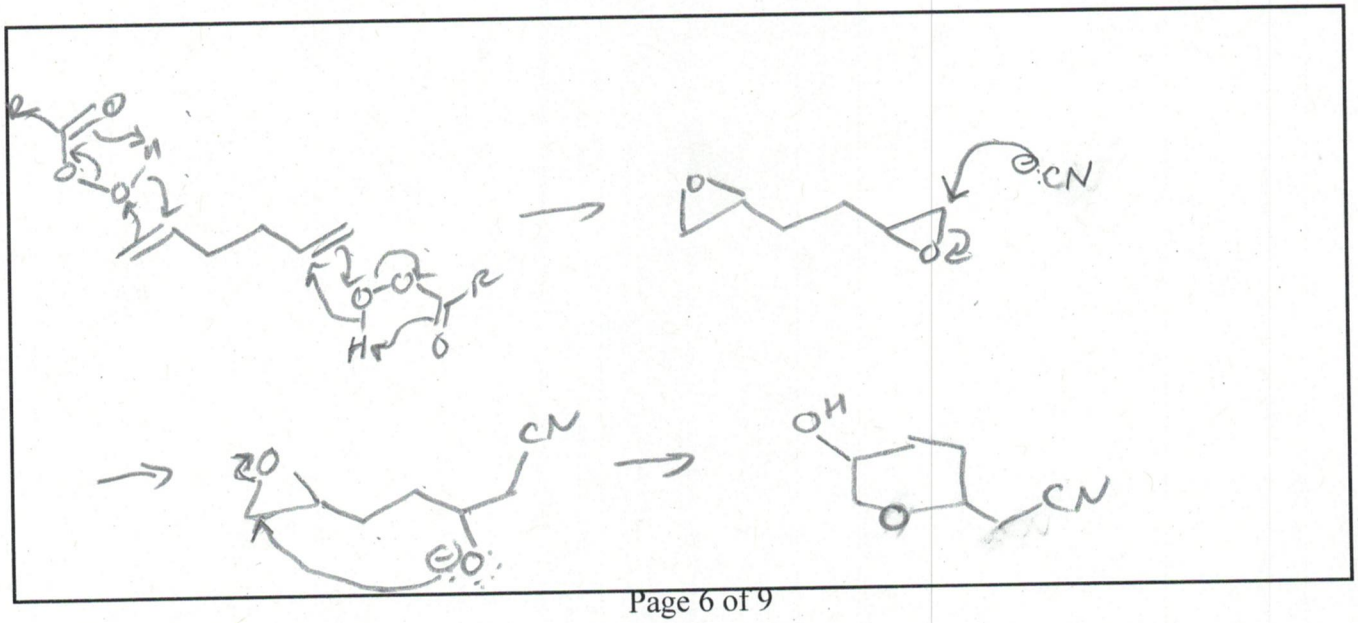
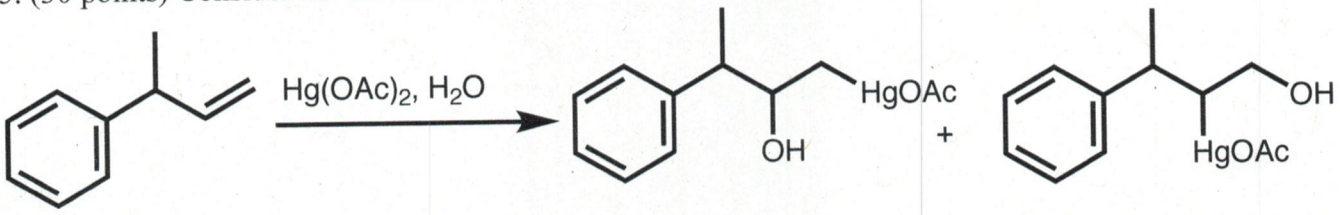
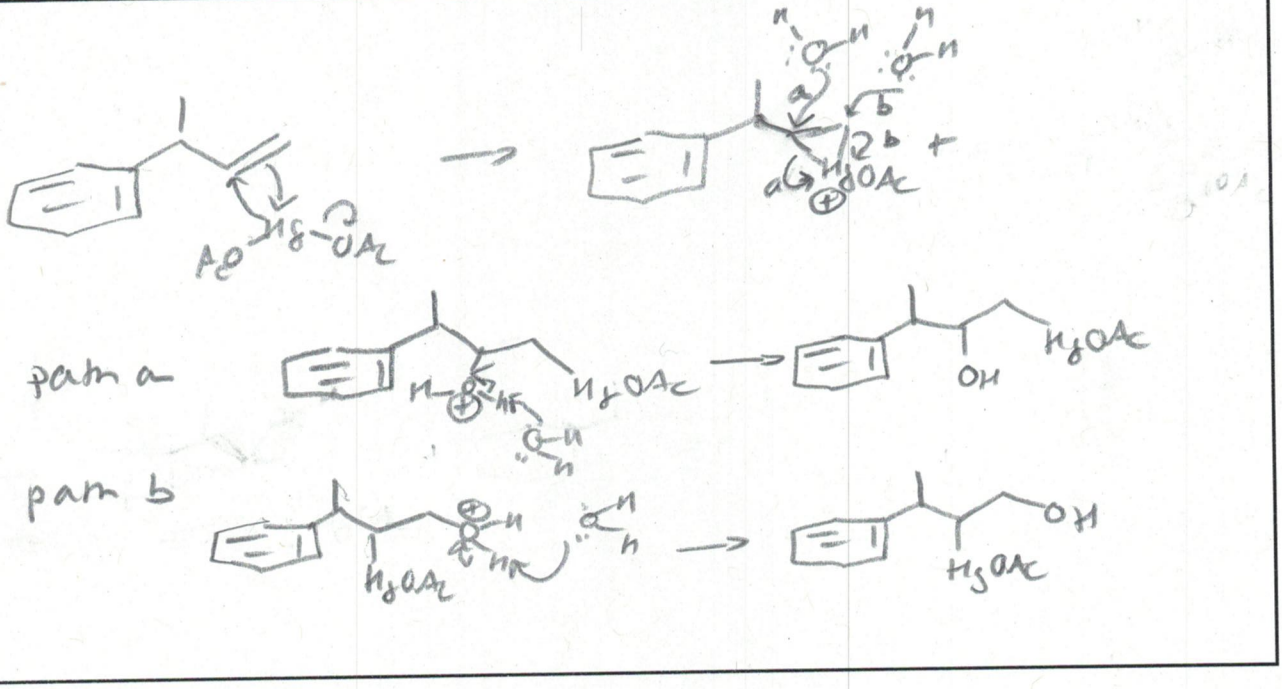


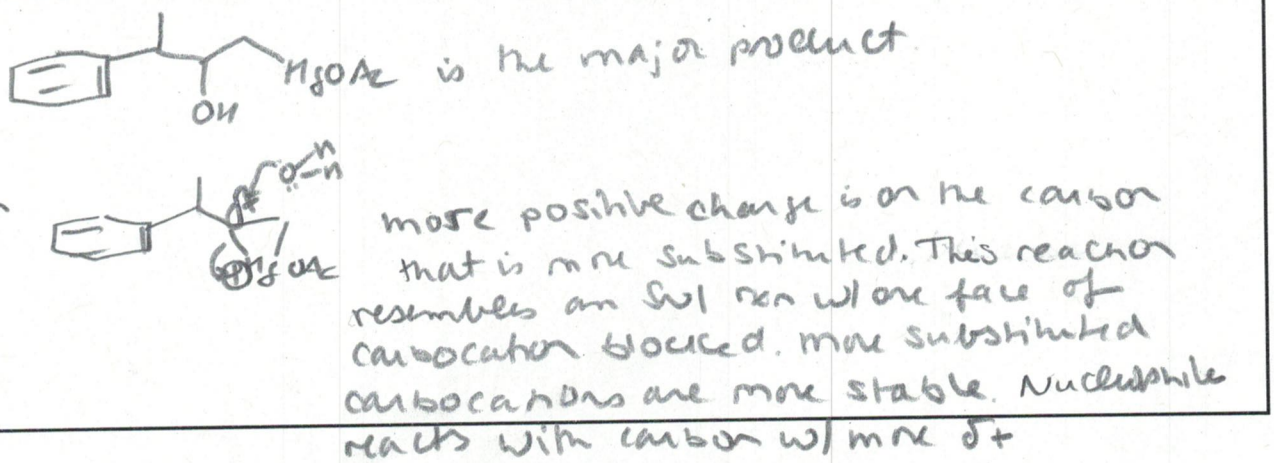
5. (30 points) Consider the reaction below



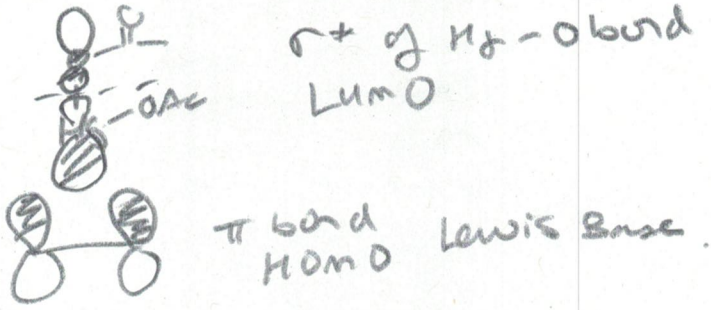

a. Draw a mechanism for this reaction.



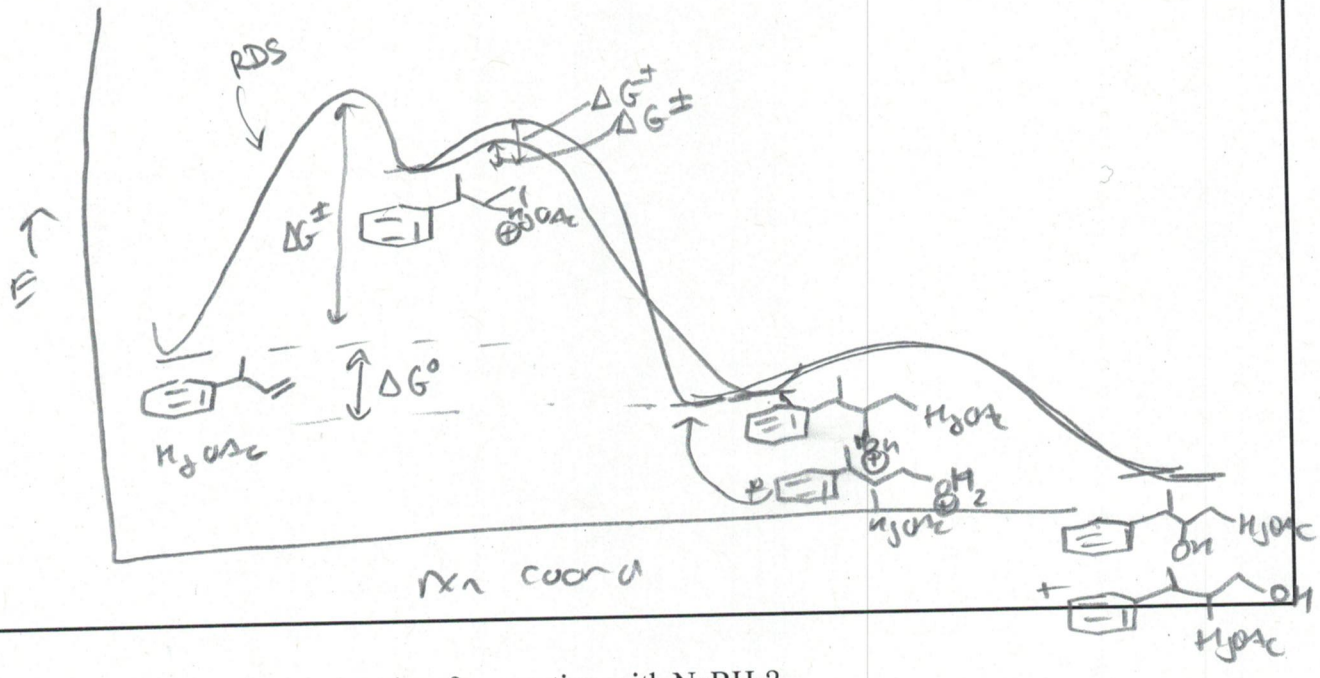

b. Which is the major product and why?



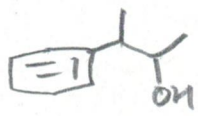
c. In all of the addition reactions we have covered, the alkene acts as the Lewis base and the other reagent as the electrophile or Lewis acid. In the box below, sketch the interaction between the orbital the alkene uses as the Lewis Base and the orbital on the Lewis acid orbital on the $Hg(OAc)_2$ eletrophile.



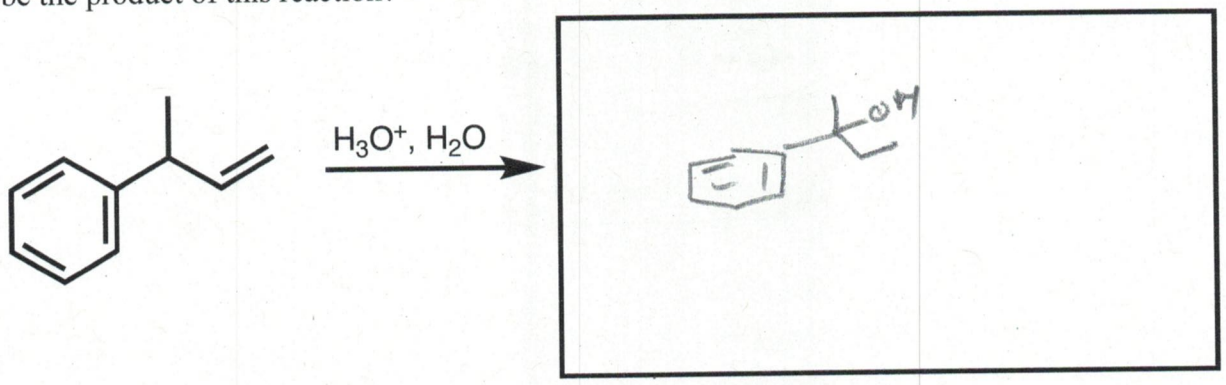

d. Draw a reaction energy diagram for this reaction. Include the formation of both products shown at the beginning of this problem. Label the $\Delta G^{\ddagger}$, $\Delta G°$, and the rate-determining step.




e. What would the major product be after reaction with $NaBH_4$?



f. A second method of hydration of alkenes is the addition of $H_2O$ under acidic conditions. What would be the product of this reaction?




6. (12 points) Synthesize the indicated product from the indicated starting as your only organic reagent. In your synthesis, show each product formed by each set of reagents you use.