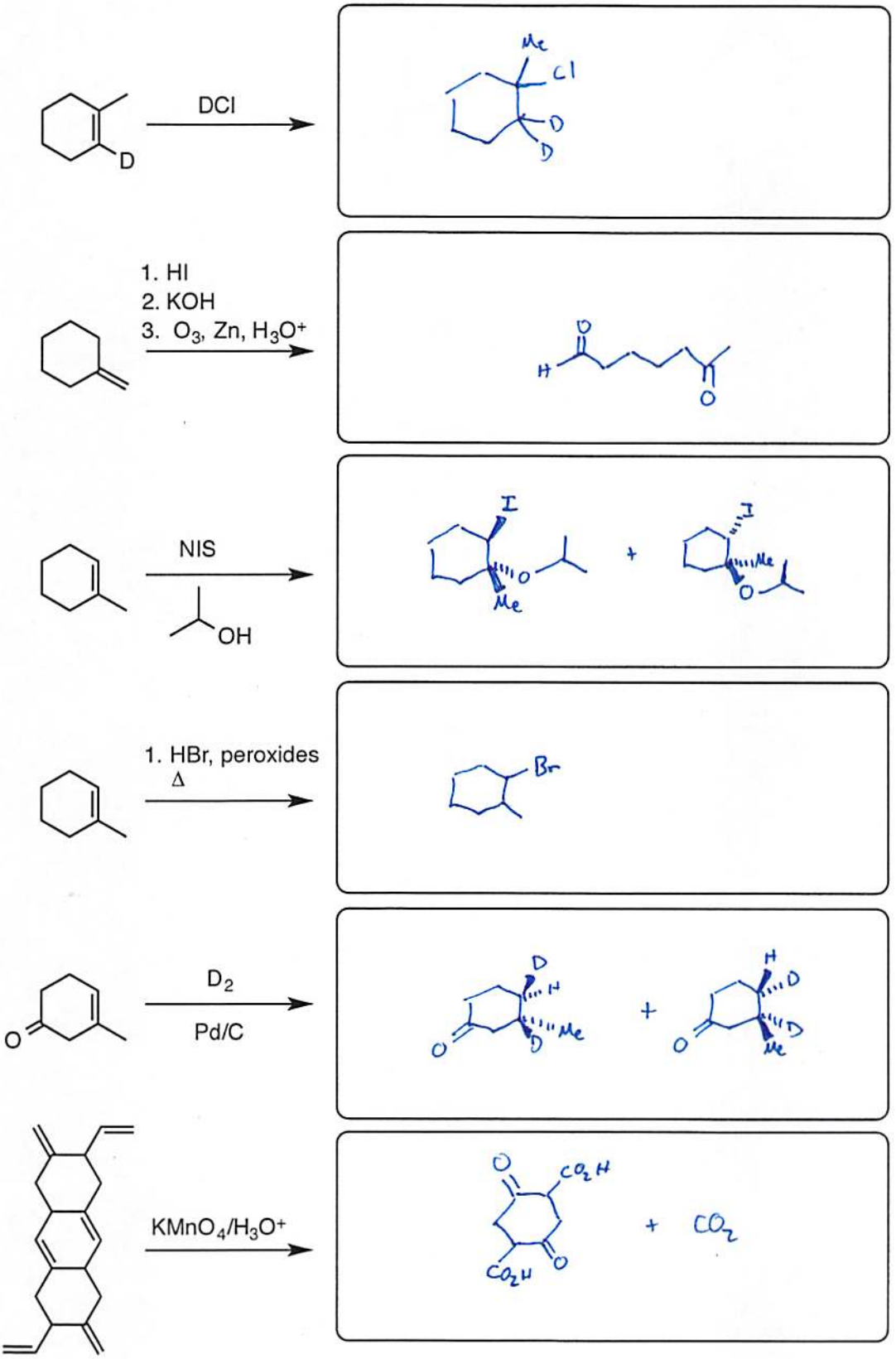
Name:_____

1. 18 pts. Draw the structure of the product(s) for the reactions below. Include dashes and wedges where necessary to show stereochemistry.

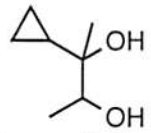


pts. this pg.

Name:_____

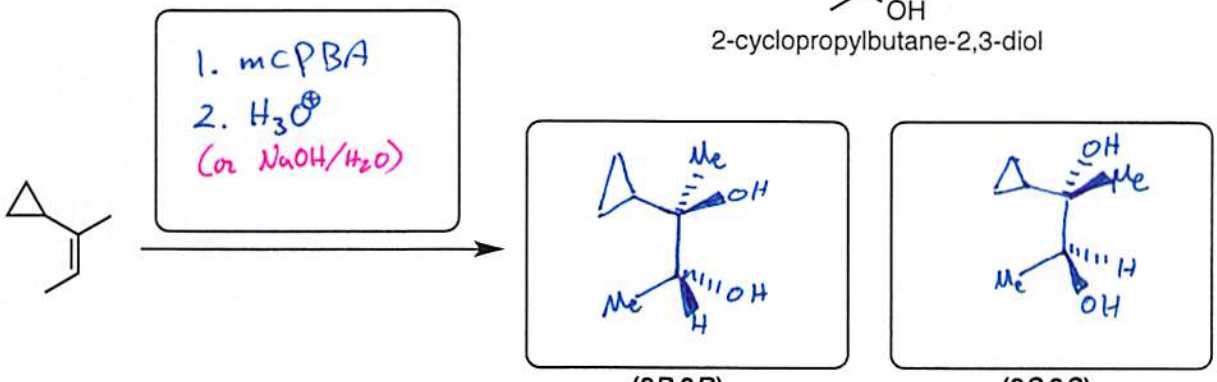
2a. 4 pts. There are four stereoisomers of the compound shown on the right (2-cyclobutylbutane-2,3-diol). In the boxes provided, draw the structures of the *(2R,3R)*- and *(2S,3S)*- stereoisomers.

2b. 6 pts. Synthesis. We have learned approaches to obtain 1,2-diols from alkenes. In the box provided, draw the reaction steps **(NOT the mechanisms)** to convert the *alkene* shown on the left, to the racemic mixture of only the **two** stereoisomers having specific configuration of *(2R,3R)*- and *(2S,3S)*.



2-cyclopropylbutane-2,3-diol

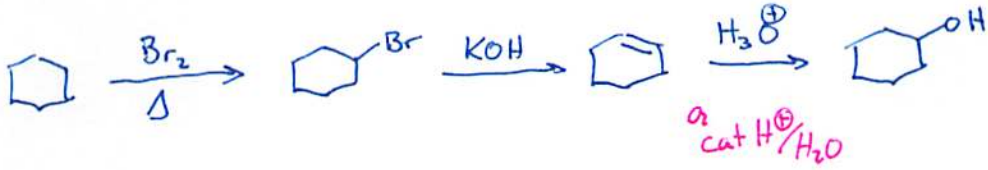
hint: no more than 2 steps



(2*R*,3*R*)-
2-cyclopropylbutane-2,3-diol

(2*S*,3*S*)-
2-cyclopropylbutane-2,3-diol

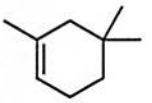
2c. 9 pts. Imagine that you have **cyclohexane** in the lab. But you really need **cyclohexanol** for your key experiment. Assuming that you have all reagents and solvents in the lab, how would you convert **cylcohexane TO cyclohexanol?** (In other words, synthesize cyclohexanol *from* cyclohexane). Provide the reaction steps (not mechanism) in the space provided below.



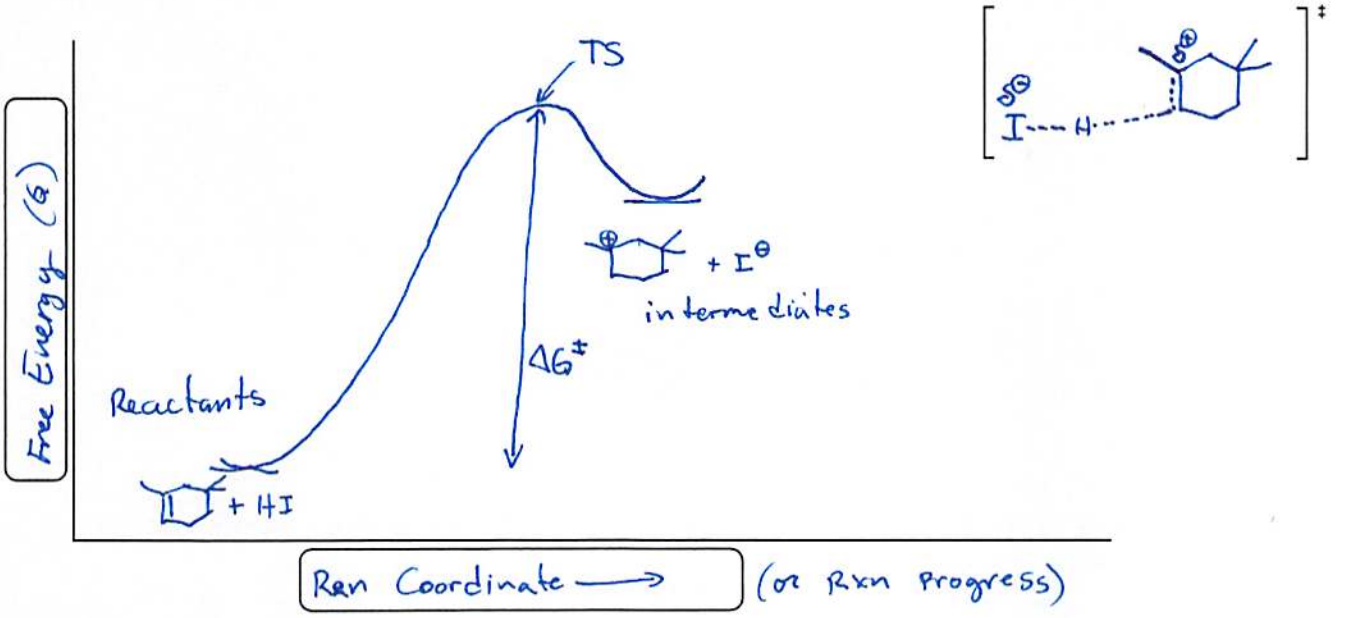
pts. this pg.

Name:_____

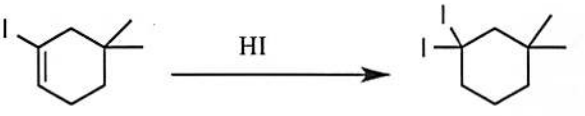
3a. 2 pts. A) The reaction below yields a racemic mixture. Using dashes and wedges, draw the specified enantiomer product.

REACTION **1**:  HI → **(*R*)-enantiomer**  + *(S)*-enantiomer

3b. 8 pts. The ionic electrophilic addition *mechanism for the reaction above* is a two-step process. Draw the reaction coordinate for ***the rate-limiting step only***. *Clearly* label all important points, the transition state(s) "TS", intermediates, reactants, free energy of activation ($\Delta G^{\ddagger}$), and include the **structures** at the energy minimum and energy maximum points.



3c. 7 pts. 1-iodo-5,5-dimethylcyclohex-1-ene reacts with HI by ionic electrophilic addition, *i.e.* Reaction **1** and Reaction **2** undergo similar mechanism to yield their respective products as shown.

REACTION **2**: 

Do you expect **Reaction 2** to be faster, slower, or the same as **Reaction 1**? Draw structures, if it helps your explanation.

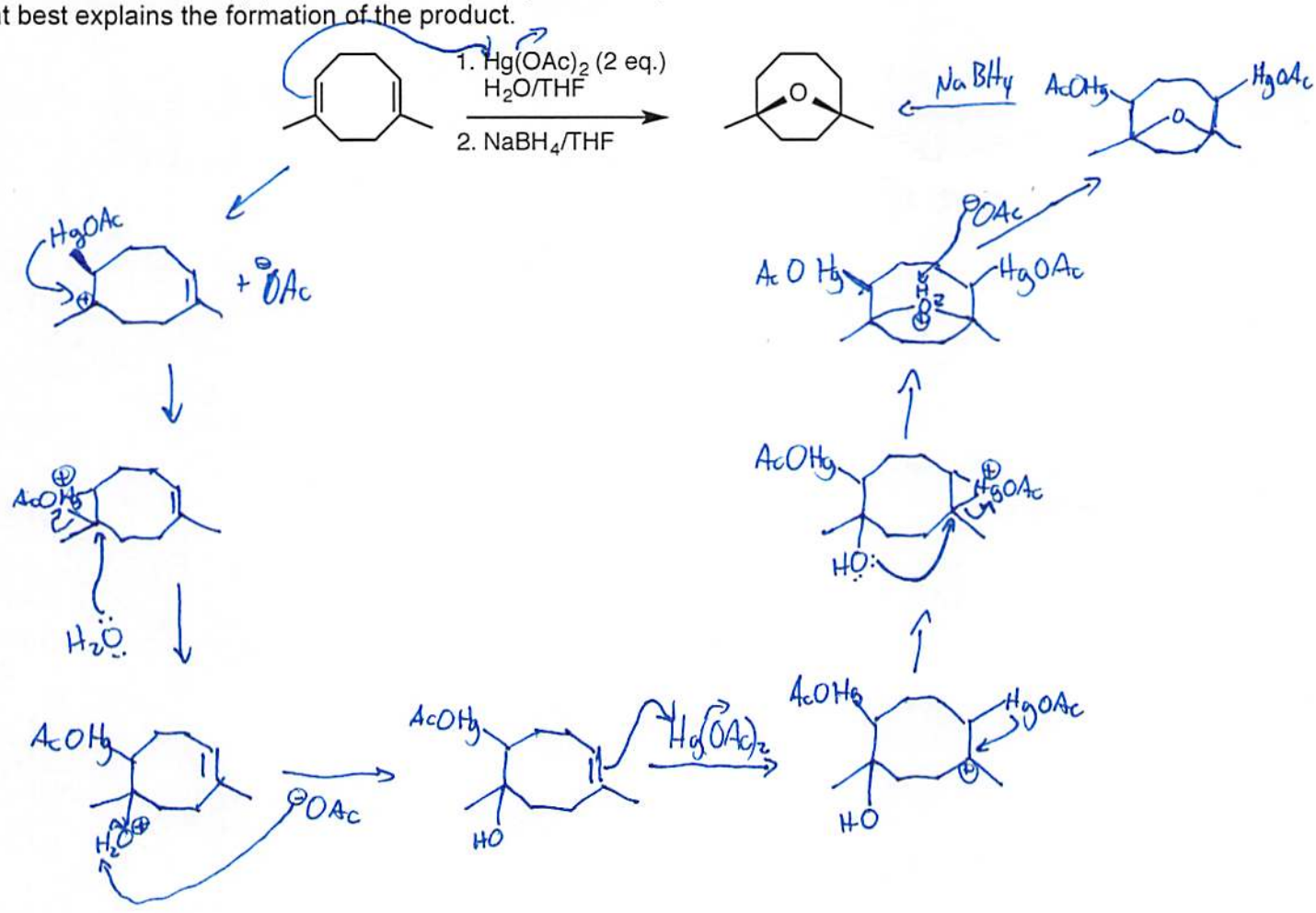
Put an **X** in the appropriate box: [X] Faster [ ] Slower [ ] Same

Briefly explain why: The carbocation intermediate in Rxn 2 is more stable than the carbocation in Rxn 1 by resonance stabilization. Lowering the energy of the intermediates effectively lowers $\Delta G^{\ddagger}$, leading to a faster rxn (Hammond's postulate).

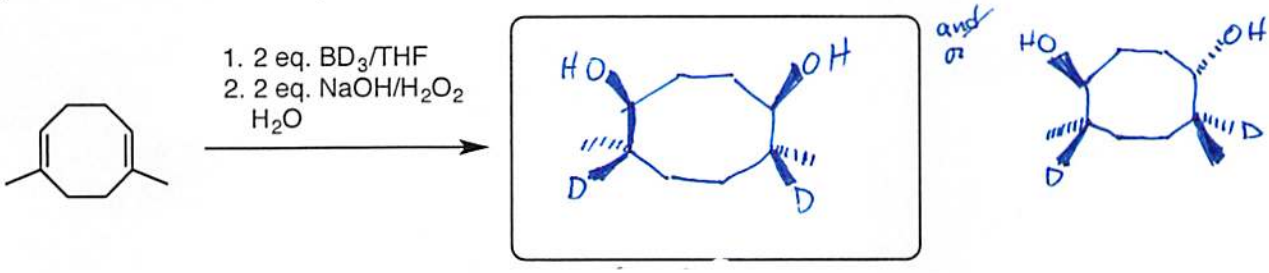
pts. this pg.

Name:_____

4a. 12 pts. The oxymercuration-demercuration of (1*Z*,5*Z*)-1,6-dimethylcycloocta-1,5-diene using *2 equivalents* of mercury(II) acetate yields the *cyclic ether* product shown below. Draw the mechanism that best explains the formation of the product.



4b. 3 pts. Draw the structure of the product(s) for the reaction below. Include dashes and wedges if necessary to show stereochemistry.



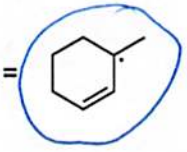
pts. this pg.

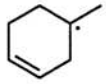
Name:_____

5. 10 pts. Consider the radicals shown below.

5a. Which do you expect to be more stable, A or B, or do they have the same relative stability?

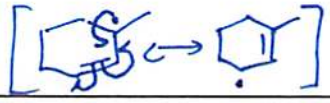
Circle the most stable radical:
(circle both, if they are equally stable)

A = 

B = 

Briefly explain why:

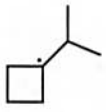
A is a allylic radical, stabilized by resonance.

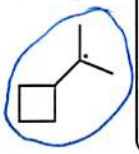


(the other one is just a 3° radical)

5b. Which do you expect to be more stable, C or D or do they have the same relative stability?

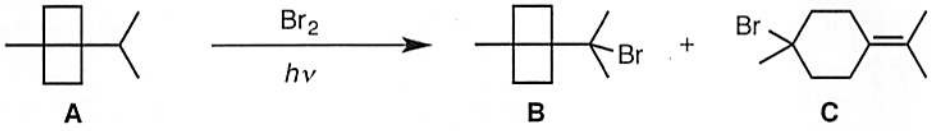
Circle the most stable radical:
(circle both, if they are equally stable)

C = 

D = 

Briefly explain why: C is more strained than D.
-This leads to greater p-character of the radical.
(Both are 3° radicals, but C is constrained to adopt a 90° angle, as opposed to all 120° angles in D).

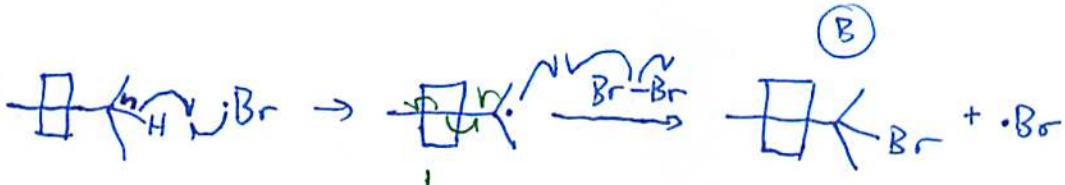
5c. 12 pts. The bromination of compound **A** yields a mixture of products, including compounds **B** and **C**. Draw the **initiation** and **propagation** steps for the **mechanism** that *accounts for the formation* of **products B and C**.

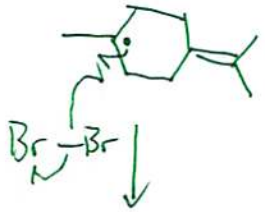


A B C

Initiation: 

Propagation:





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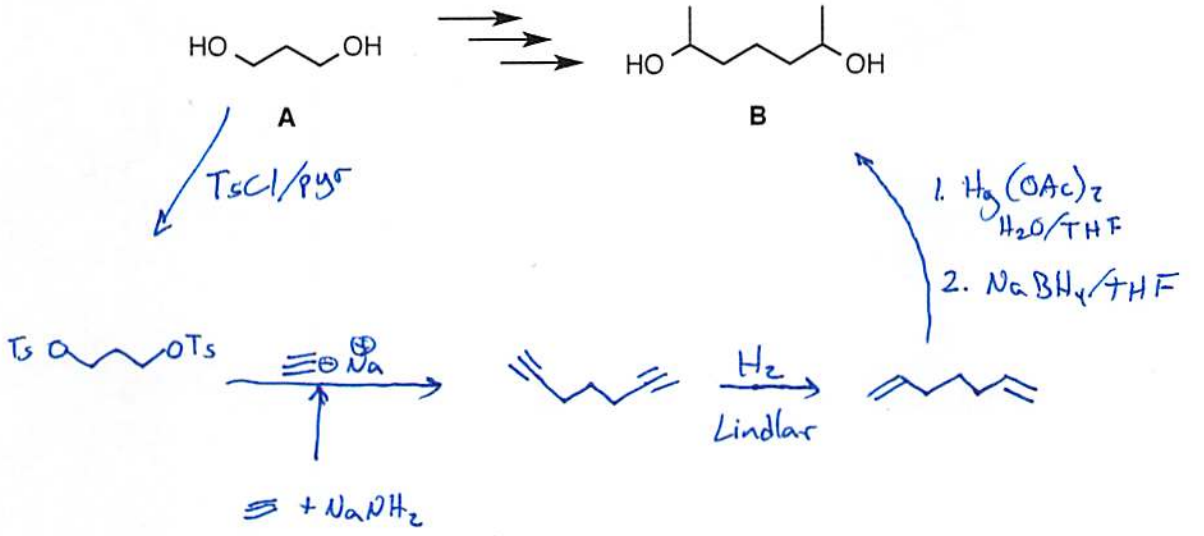
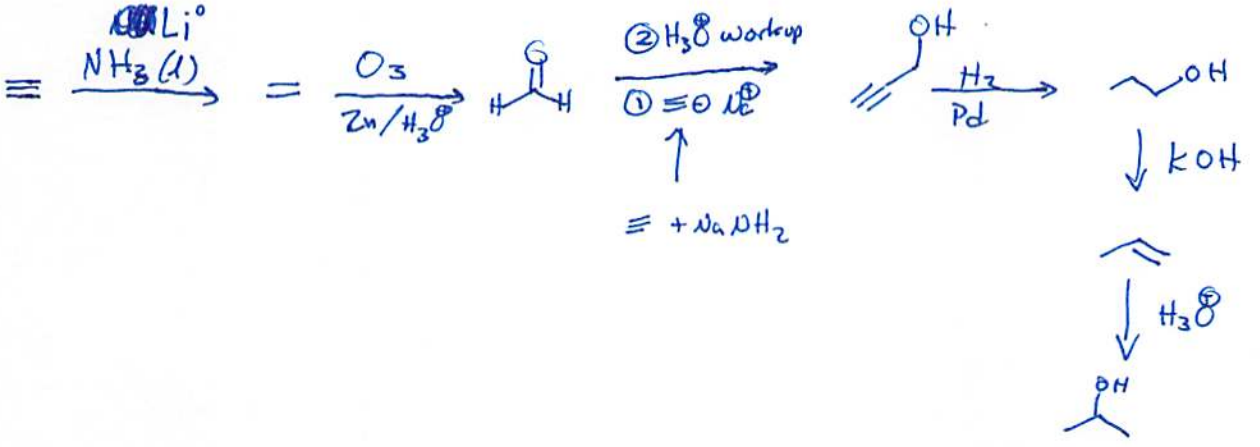
Name:_____

5a. 7 pts. Synthesize compound **B** *from* compound **A**. Note: *acetylene is your only source of carbon* to build your molecule. You can use any other reagent to introduce functional groups only.



5b. 8 pts. Propose the synthesis of **2-propanol** *from* **acetylene**. Note: acetylene is your only source of carbon to build your molecule. You can use any other reagent to introduce functional groups only.



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