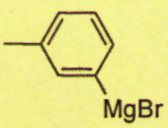
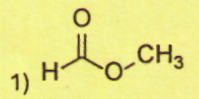
Key

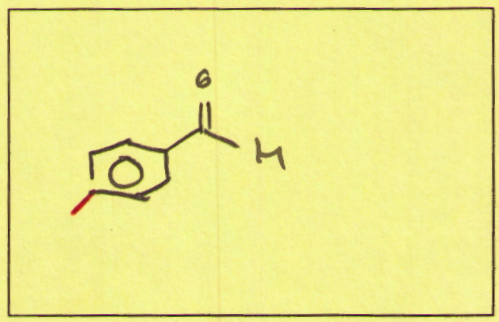
Show the reaction products.

1) (2 pts)

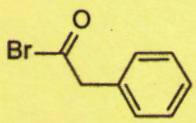


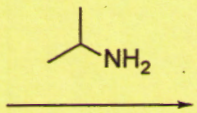
1 equivalent

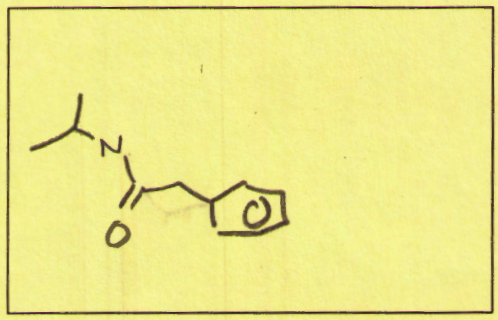




2) (2 pts)

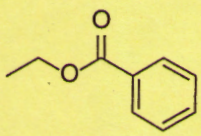


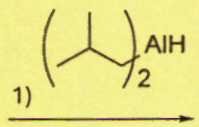


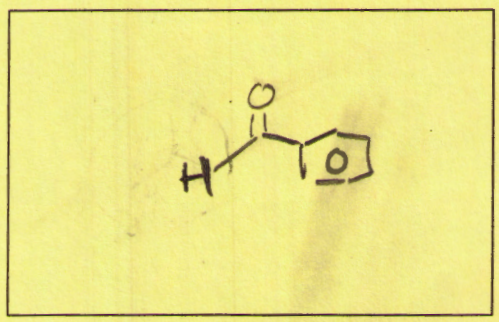


Draw a neutral product

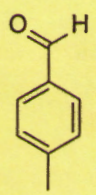
3) (2 pts)

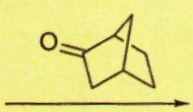


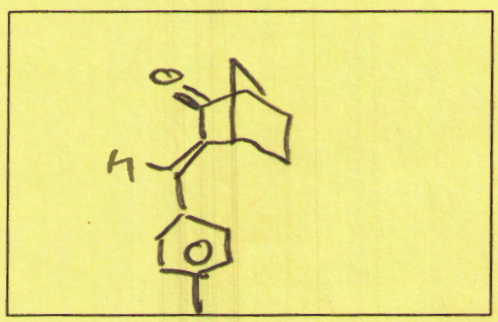




4) A sunscreen, 4-methylbenzylidene camphor, is prepared by a simple cross-aldol condensation using the reaction conditions below. (2 pts)



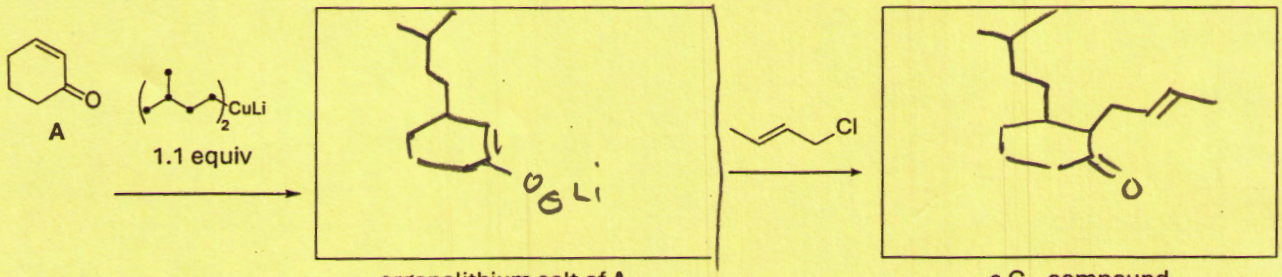




-2 if copied

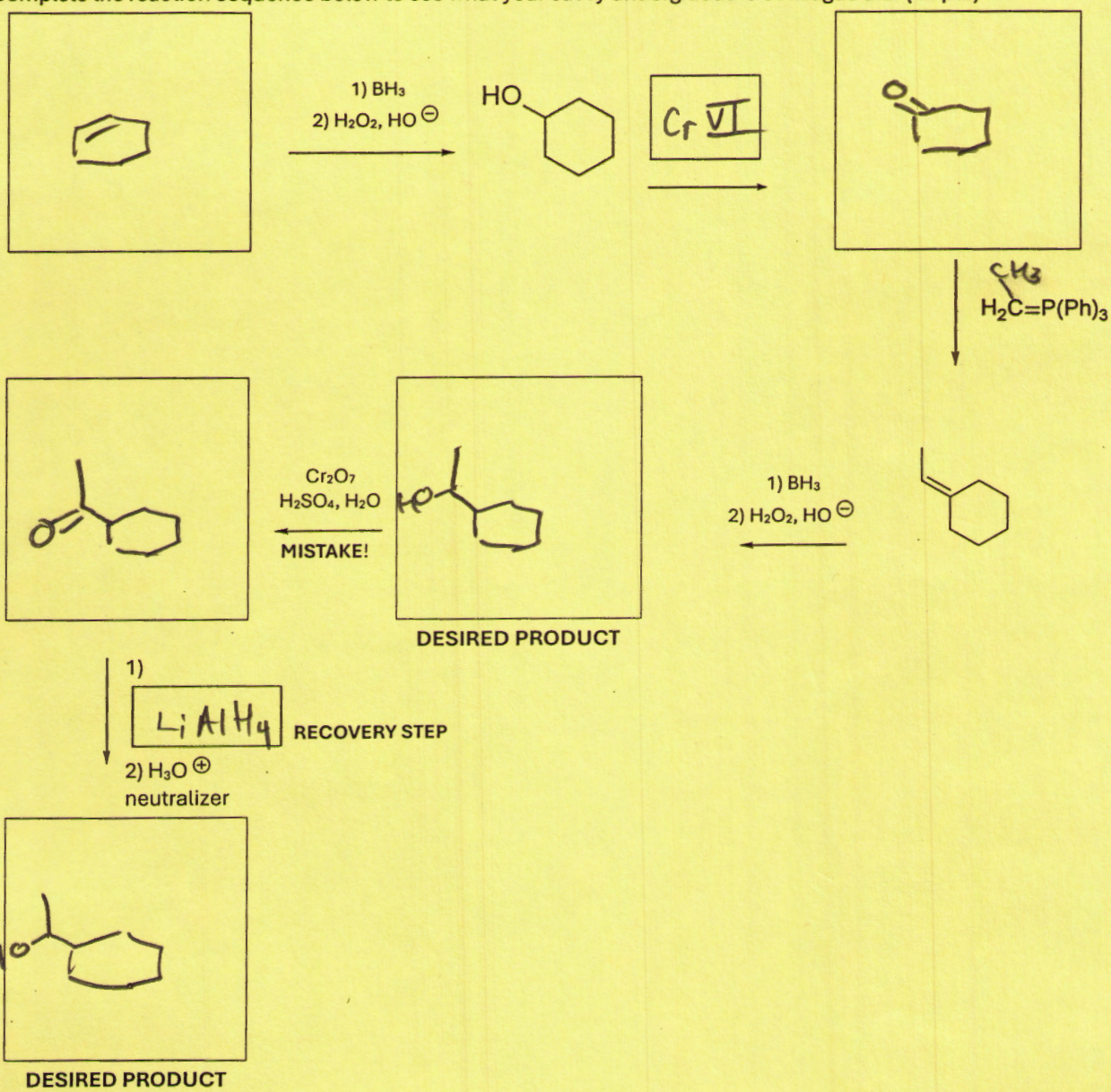
Key

5) Complete the synthesis. The lithium cuprate below is used in slight excess in a reaction that does not contain water as a hydrogen source (i.e., it is an anhydrous solution). The slight excess of the "CuLi" compound traps an organolithium salt after the first step. (4 pts)



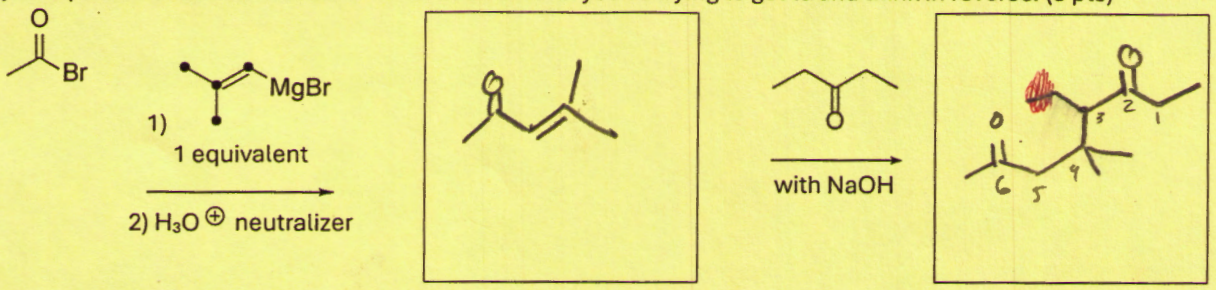
organolithium salt of **A** | a C_{15} compound

6) An undergraduate researcher was tasked with the following synthesis using principles learned in CEM 351 and 352, but made a mistake. Rather than seeking help from ChatGPT or feeling bad about the error, the student remedied the situation. Complete the reaction sequence below to see what your savvy undergraduate colleague did. (12 pts)



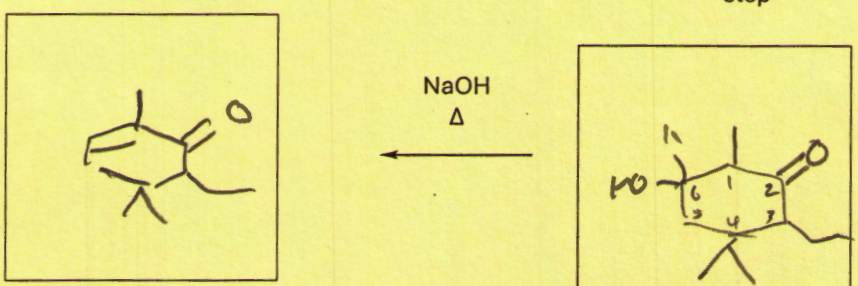
Key

7) Complete the reaction scheme. HINT: Look at what you're trying to get to and think in reverse. (8 pts)



Annulation step

Workspace

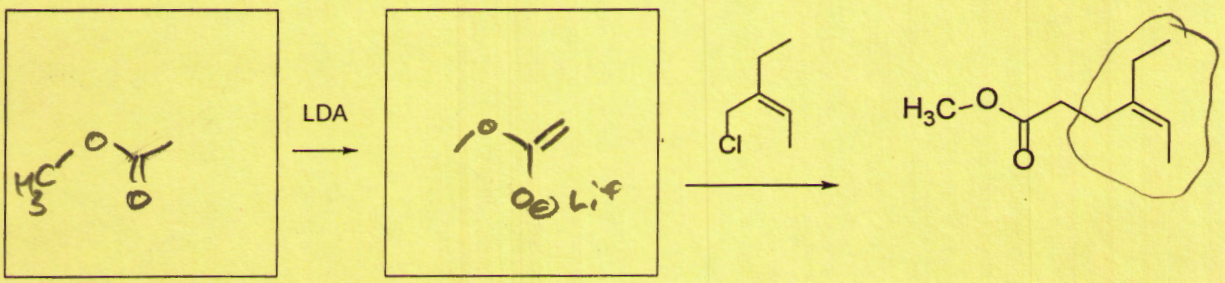


This product isomer **CONTAINS** an ethyl substituent.

8) Complete the following reaction. HINT: Look "downstream" and infer earlier structures from those provided. LDA (Lithium diisopropyl amide) functions as a base (4 pts)

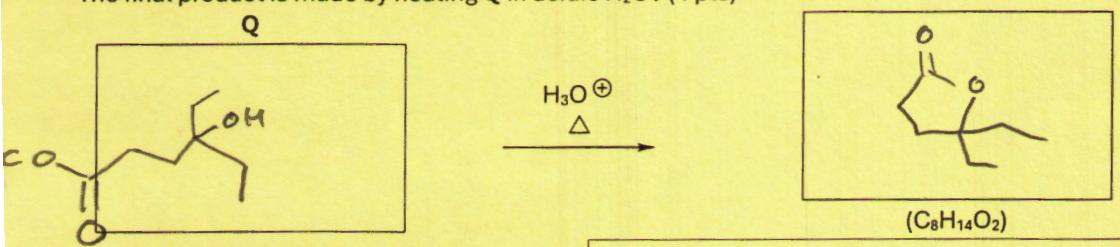
A Lithium enolate

P



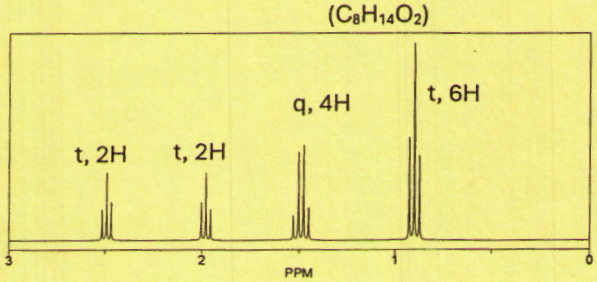
9) Product **P** above is treated with 1) $Hg(OAc)_2$, H_2O, then 2) $NaBH_4$. These steps convert **P** to **Q**. What is **Q**? The final product is made by heating **Q** in acidic H_2O? (4 pts)

Q



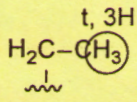
$(C_8H_{14}O_2)$

^1H NMR of the Final Product to help verify your product



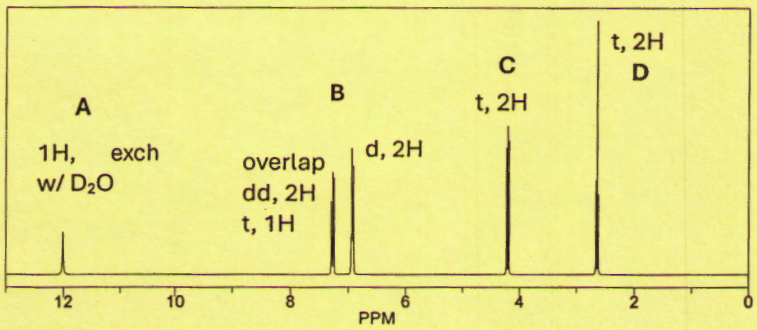
Key

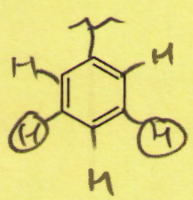
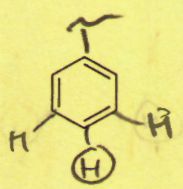
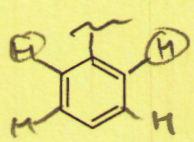
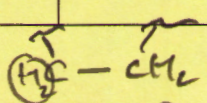
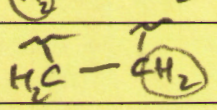
10) ^{1}H NMR. **CIRCLE THE OBSERVED EQUIVALENT H's [PROTONS],** and show fragments/connectivities that yield the splitting patterns. (5 pts)



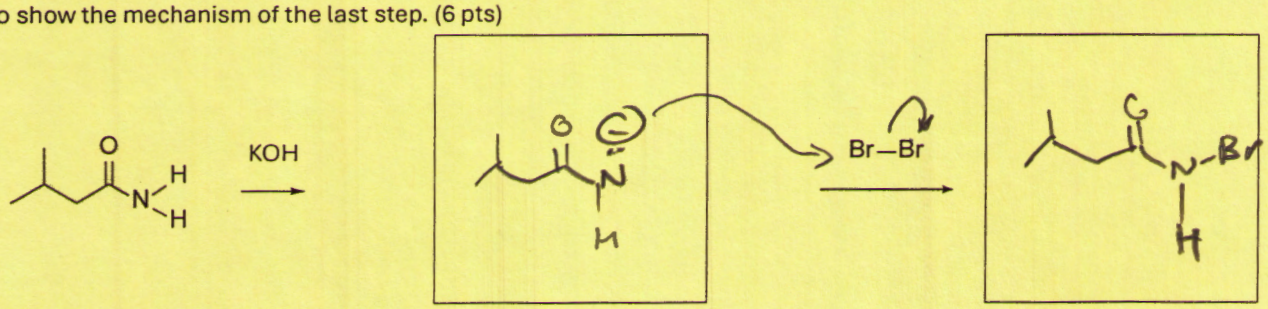
(An Example)

$C_9H_{10}O_3$



B (detail the **aromatic** ring H's by showing which is(are) the			
dd	**t**	**d**	3 pts
			
C			1 pt
D			1 pt

11) These are the initial steps leading to a Hoffman Rearrangement product. Fill them in below, and include the curved arrows to show the mechanism of the last step. (6 pts)



an anion

DRAW CURVED MECHANISM ARROWS TO SHOW HOW THE LAST PRODUCT IS MADE **FROM** THE **ANION**