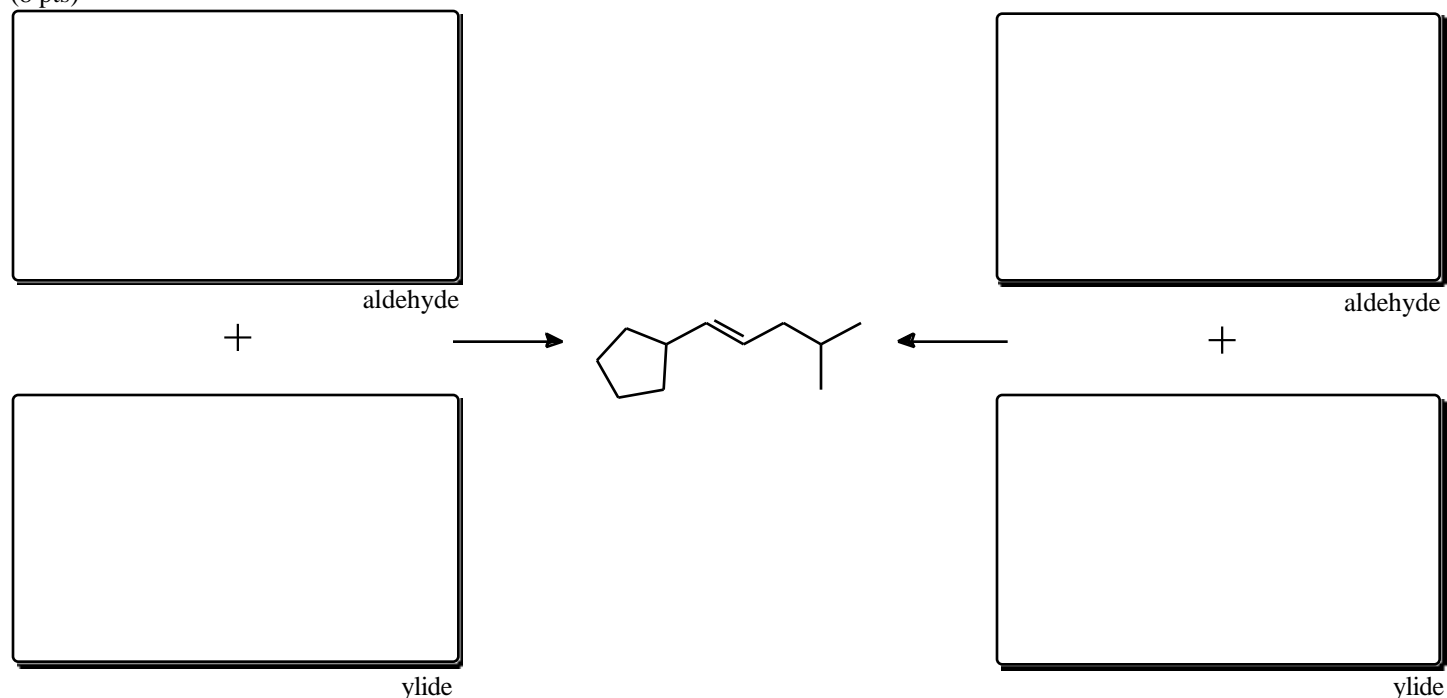




21. The following **alkene** can be synthesized by **2 different Wittig reactions**. **Draw the aldehydes and ylides** necessary for **each** of these **2 Wittig reactions**. Hint: the aldehydes for this problem should each contain 7 carbon atoms and will also include a double bond in their structure.

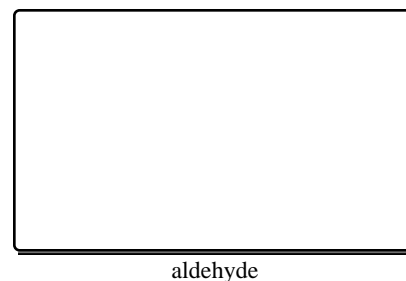
(8 pts)



22. The  $^1\text{H}$  NMR data for one of the aldehydes in **Question #21** is shown below. **Redraw** the structure of this aldehyde and identify which protons of the structure correspond to each of the  $^1\text{H}$  NMR resonances (**a,b,c,d**).

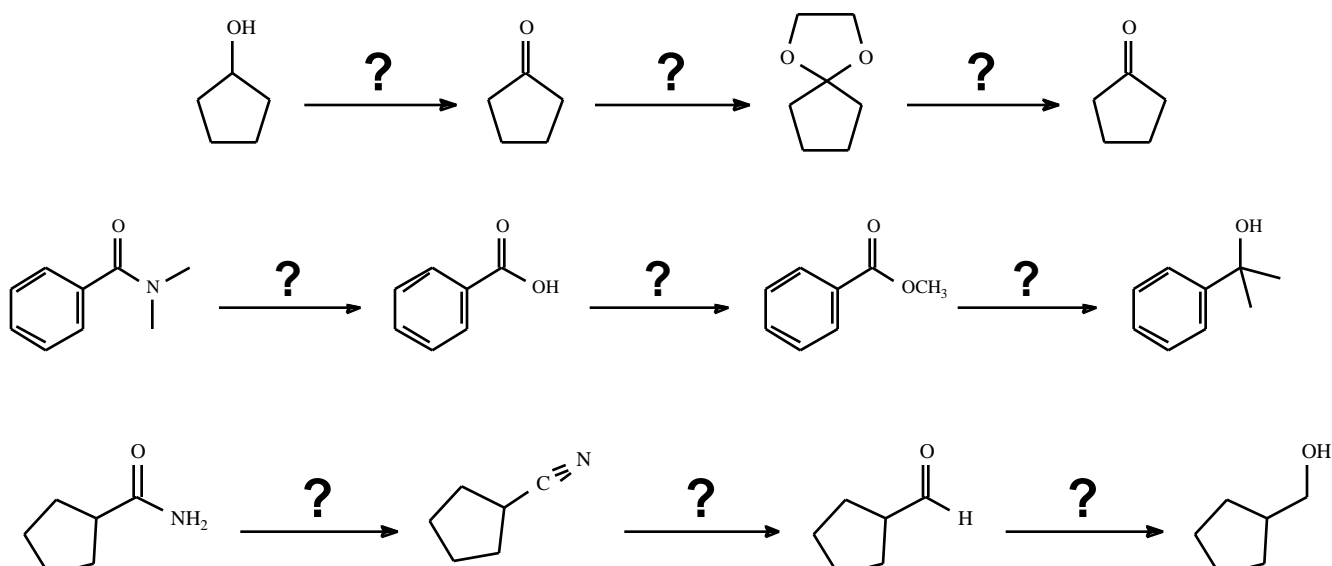
(9 pts)

- a** 0.84 , doublet, 6H  
**b** 2.06 , multiplet, 1H  
**c** 2.78 , doublet of doublets, 2H  
**d** 9.50 , triplet, 1H

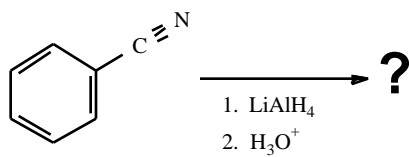
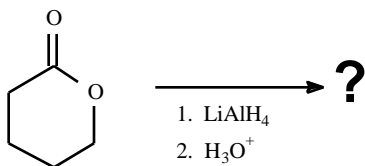
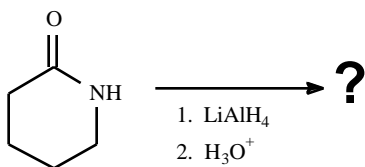
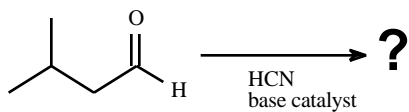
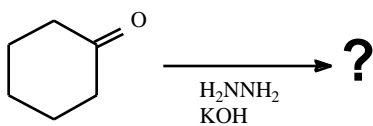
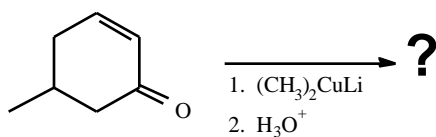
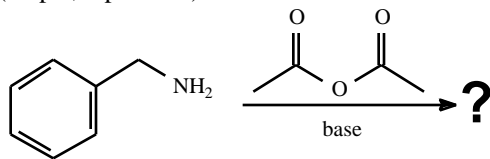


6. **Provide the reagents** for the following transformations.

(18 pts; 2 pts each)

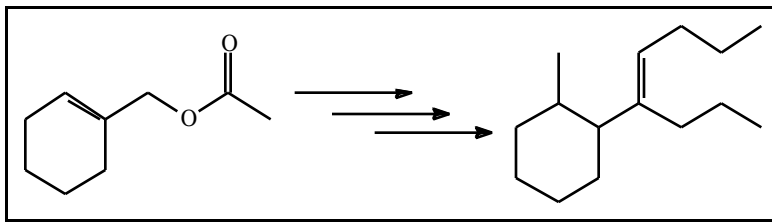


7. Draw the **MAJOR products** for the following reactions. If there is *No Reaction*, please write “**NR**”.  
(21 pts; 3 pts each)



8. Write a *synthesis* for the following sequence. You may use *any reagent/reactant* containing **4 carbons or less**. You may always have *triphenylphosphine* and *butyl lithium* to *make* an *ylide*. If you need a **Gilman** or a **Grignard** reagent, you may use them directly (i.e., you do not need to make them) as long as they do not have more than 4 carbon atoms.

(20 pts)



*Hint: Start with a hydrolysis and end with a Wittig reaction.*