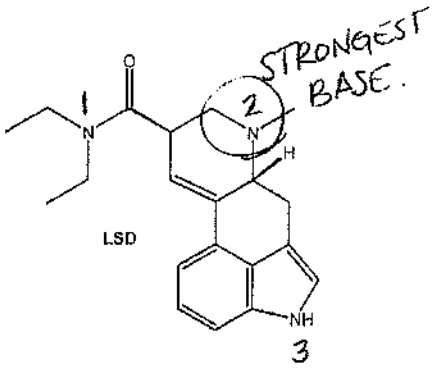
1. (14 pts) (a) Identify the most basic nitrogen in LSD. (b) Clearly explain why that nitrogen is the most basic and why the other two nitrogens are less basic. You must draw representative (not all!) resonance structures that are central to your argument.

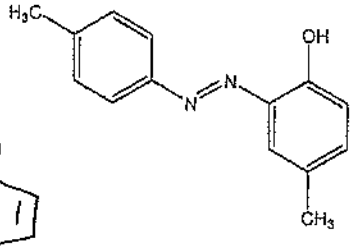


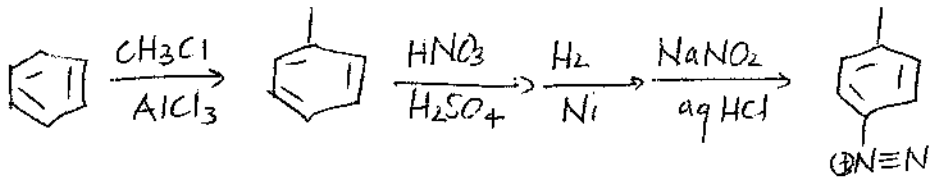
N #1. Lone pair is tied up by inductive effect of C=O and resonance with C=O

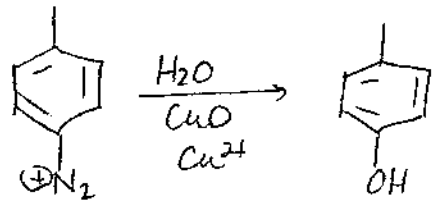
N #2. 3 R groups are e⁻ donating inductively ← making N a stronger base. No resonance to tie up lone pair

N #3. sp^2 groups are e⁻ withdrawing so lone pair is less available. Resonance ties up lone pair. eg. [⟷ others]

2. (12 pts) Outline a synthesis of the following compound. The only aromatic compound you are allowed to use as a reactant is benzene. You can assume that any other nonaromatic reagents are available. Mechanisms are not required.



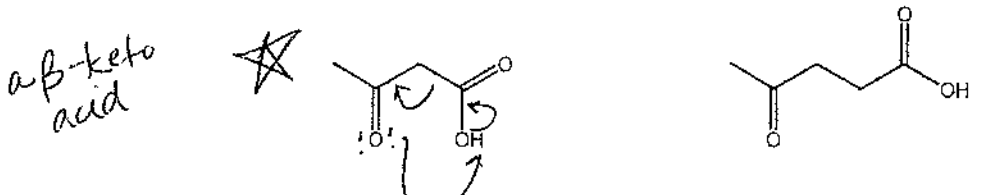


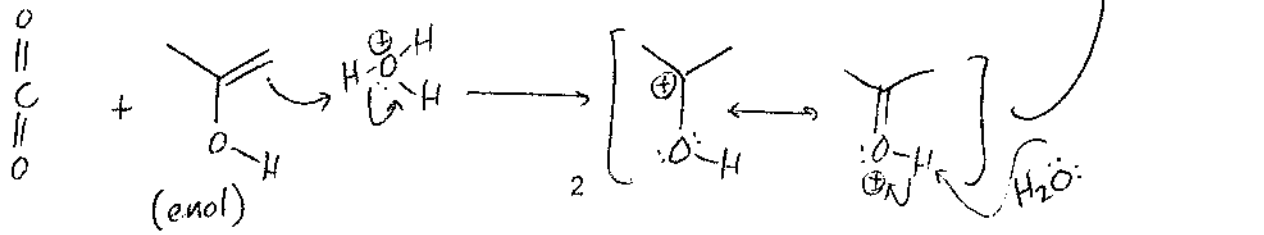


(from above)

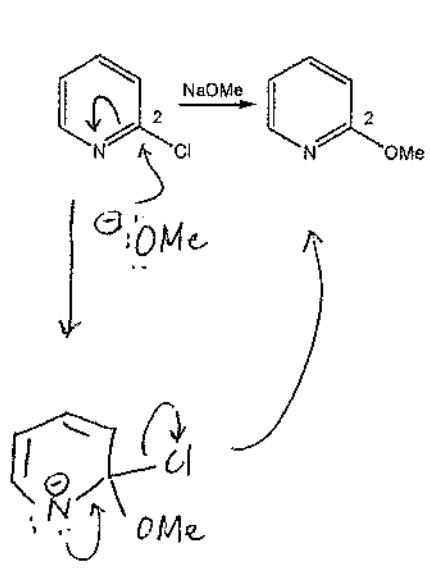
COMBINE to make Target (via electrophilic arom. subst)

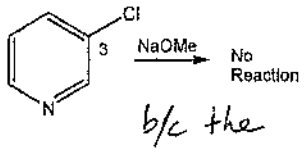
3. (12 pts) (a) Which of the following molecules will readily decarboxylate under ~~the given conditions~~? (b) Draw a mechanism to illustrate the decarboxylation and formation of the major product obtained from the successful reaction. Use H_2O, H_3O^+ as needed.



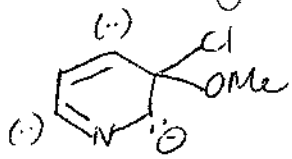


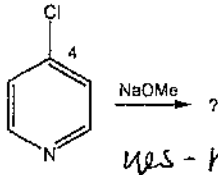
4. (12 pts) 2-chloropyridine reacts with sodium methoxide via an addition-elimination mechanism. (a) Draw a mechanism to show why 2-chloropyridine successfully reacts. (b) Explain why 3-chloropyridine does not react. (b) Predict whether 4-chloropyridine will successfully react with sodium methoxide. Explain.



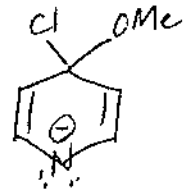


b/c the lone pair of the anionic intermediate can't be stabilized by placement on the more electronegative N.



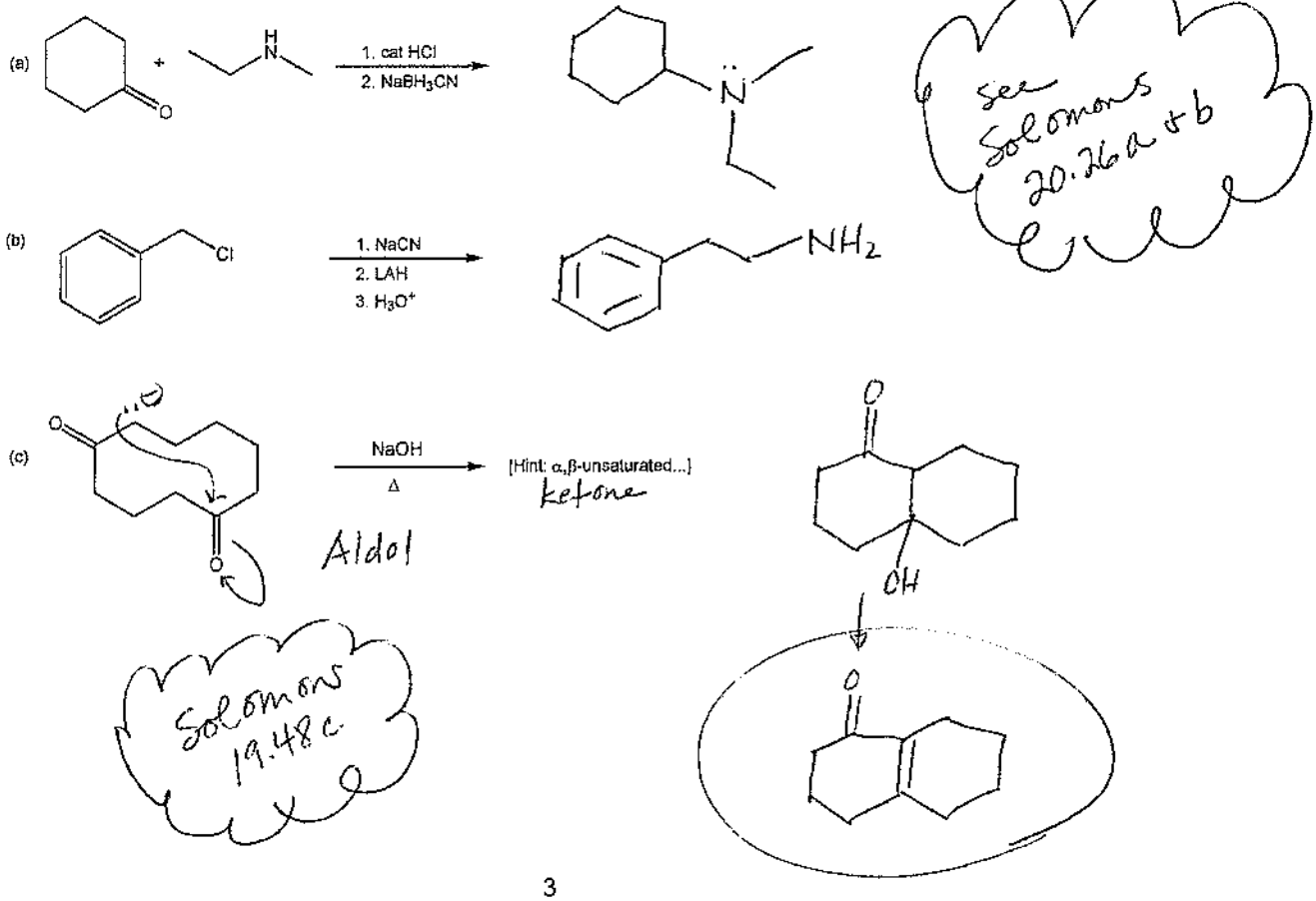


yes - reacts.



intermediate stabilized by ⊖ on N.

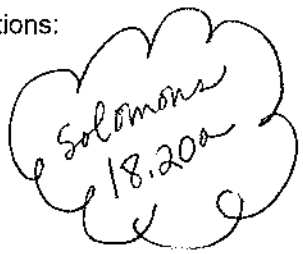
5. (16 pts) Provide the major organic product from each of the following reactions. No mechanisms required.



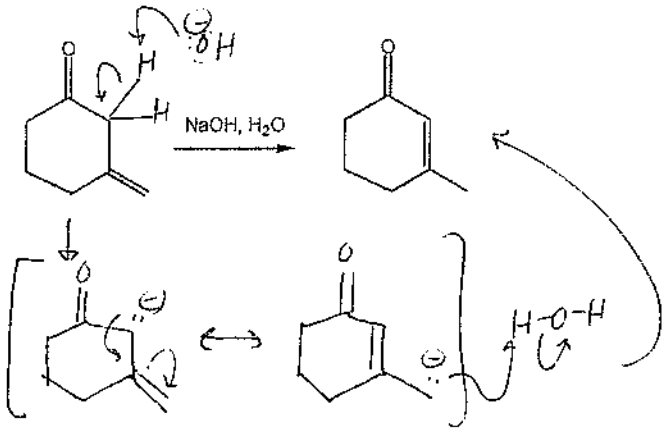
see Solomons 20.26a & b

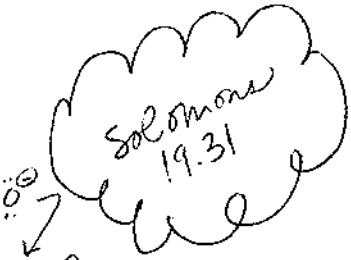
Solomons 19.48c

6. (34 pts) Write a full curved arrow mechanism for each of the following reactions:



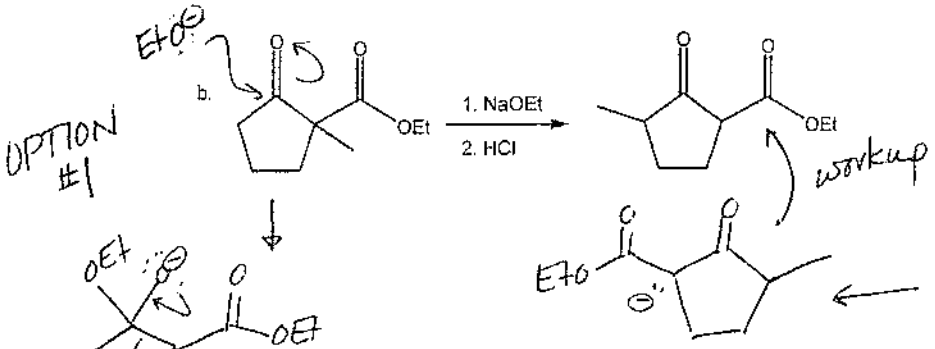
a.

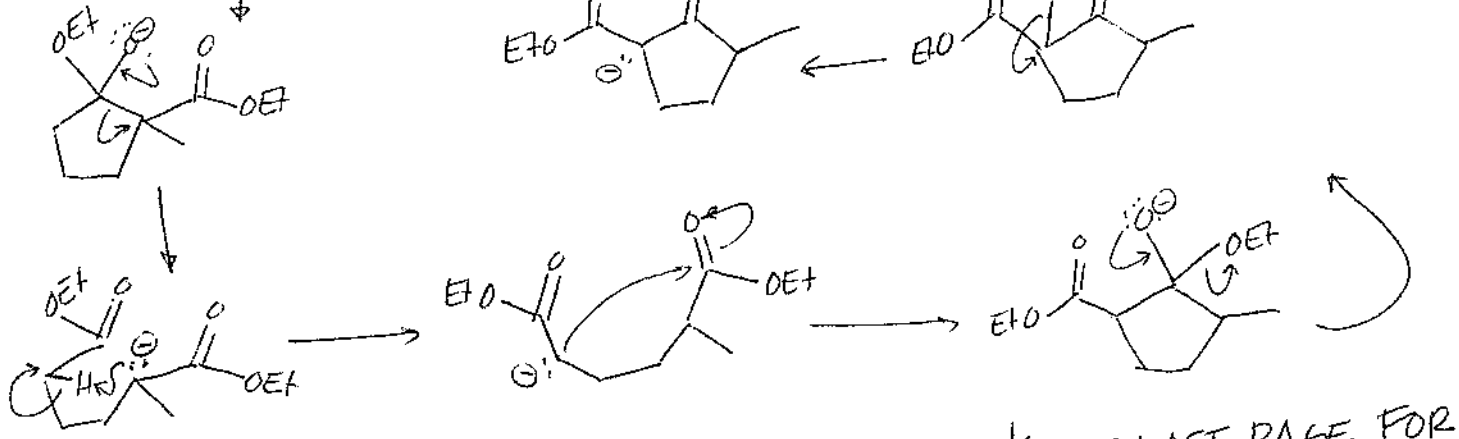




b.

OPTION #1

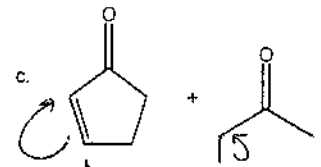




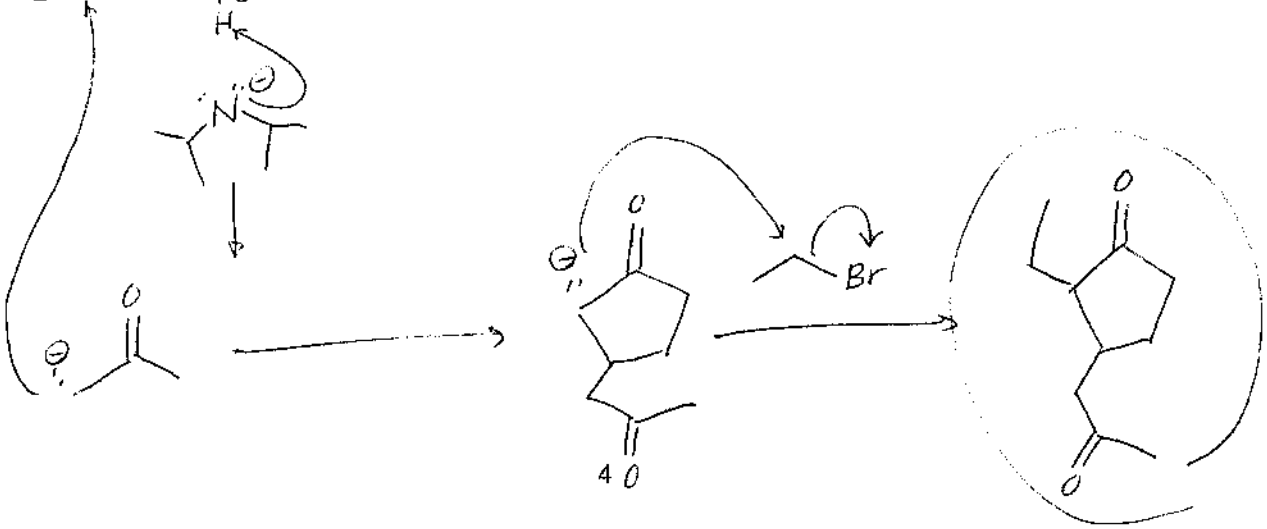
* SEE LAST PAGE FOR 2 OTHER CORRECT MECHANISMS

c.

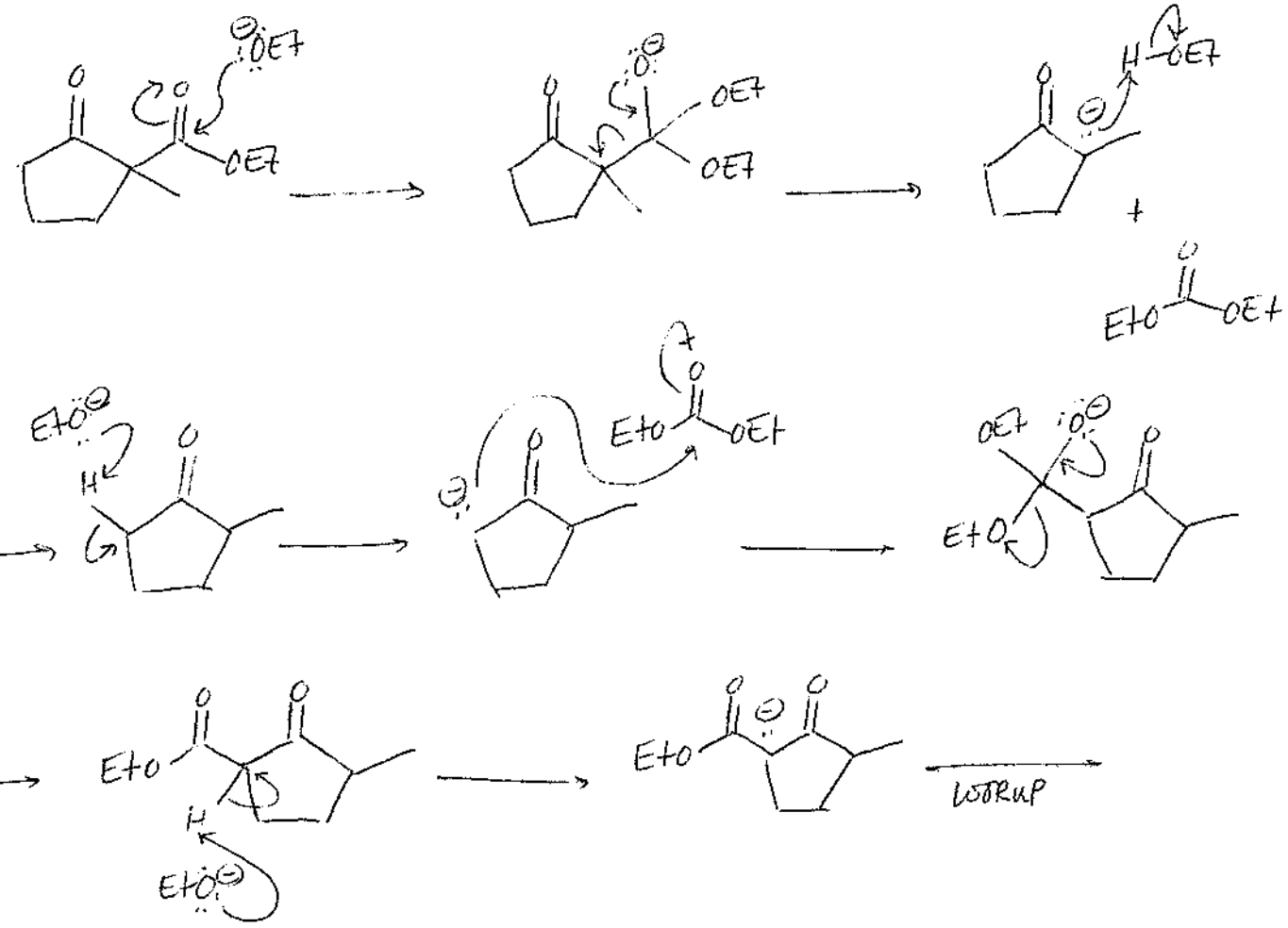
* go for most accessible α-H



Predict the product structure in addition to showing the mechanism



OPTION #2



OPTION #3