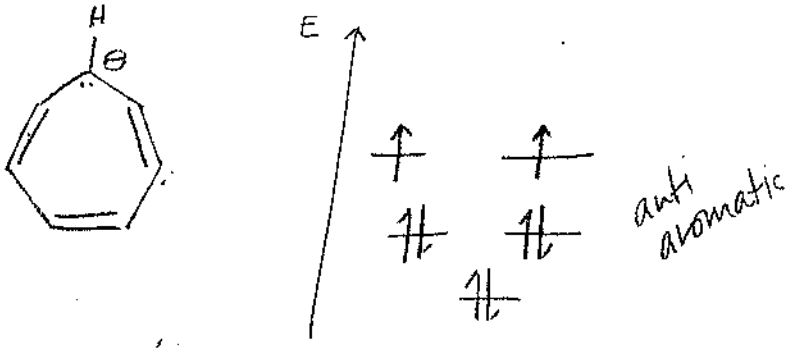
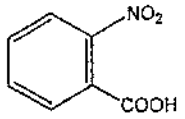
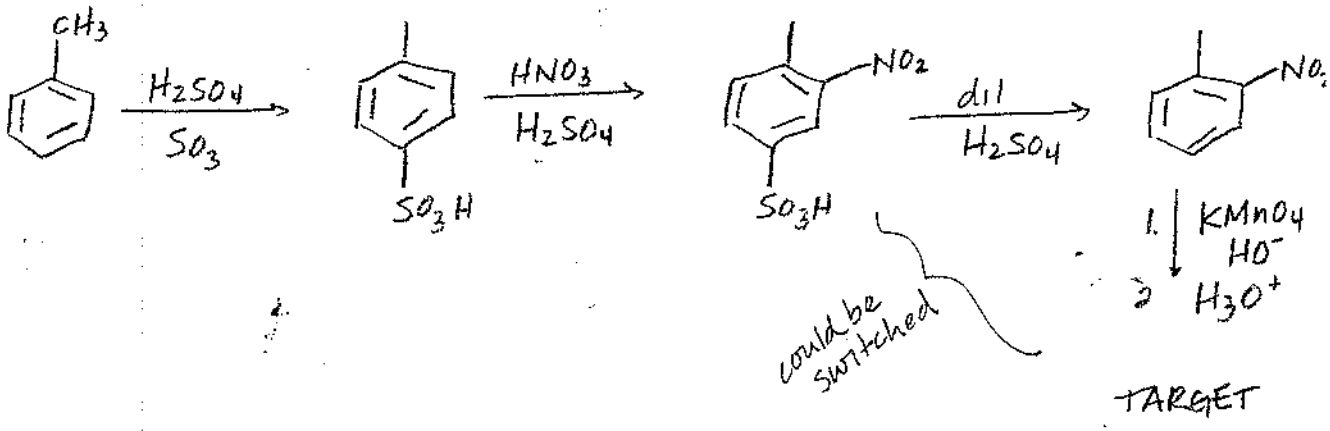
EXAM 1 (8 am)

1. (8 pts) Would you expect cycloheptatrienyl anion to be aromatic on the basis of the electron distribution in its π molecular orbitals? First, draw the structure of the cycloheptatrienyl anion. Then, **briefly** explain using a combination of diagram and words.

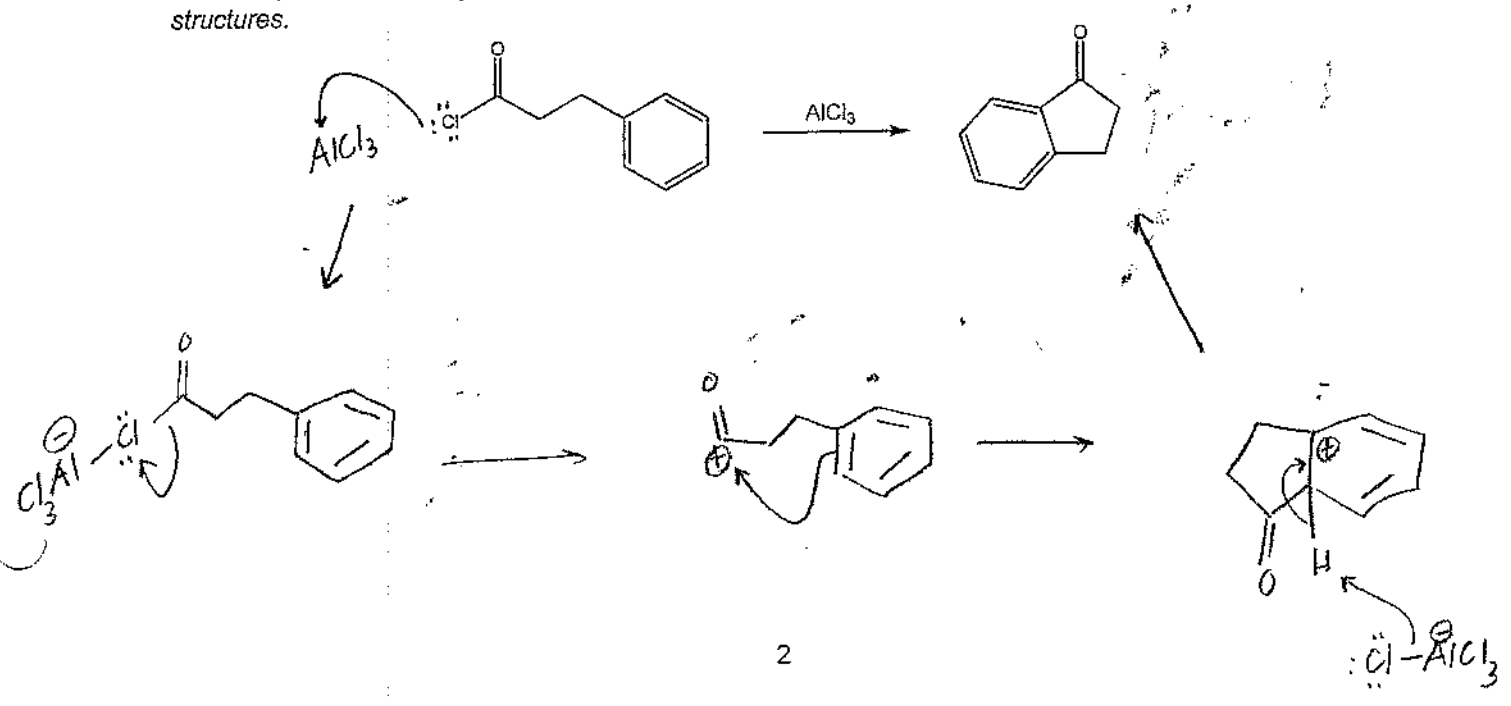


2. (12 pts) Starting from **toluene** and whatever reagents you might need, show how you would synthesize the molecule to the right. You do not need to show the mechanisms of the transformations.

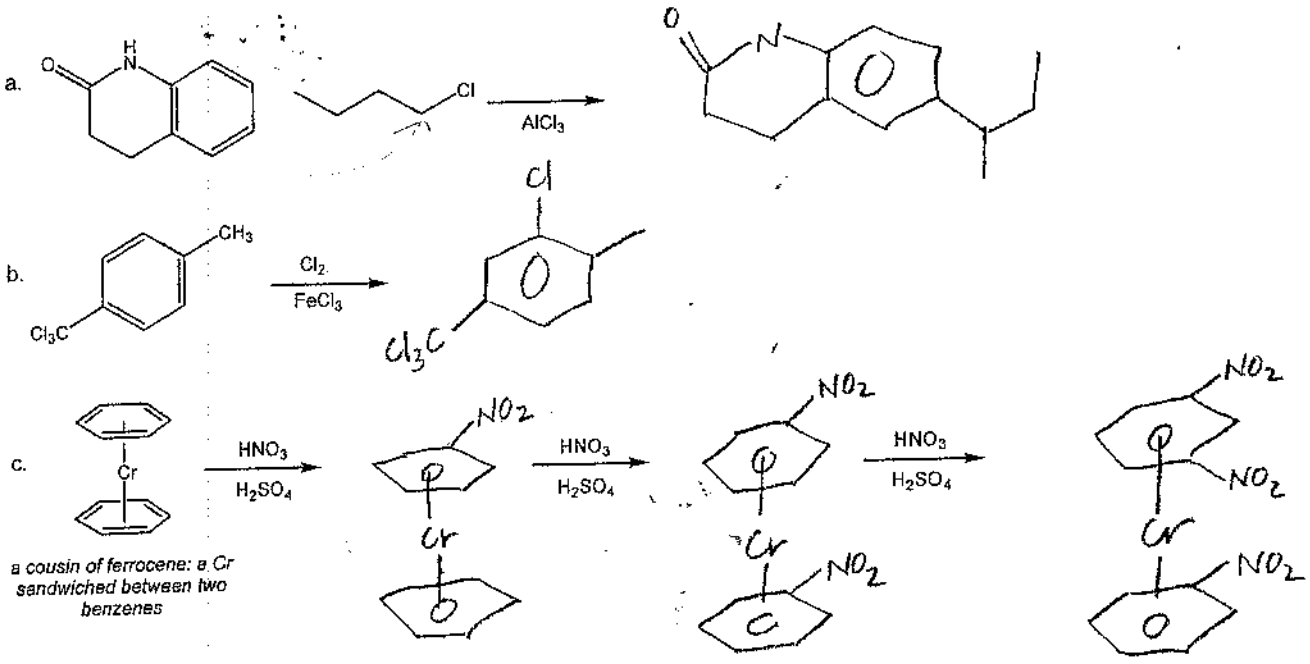




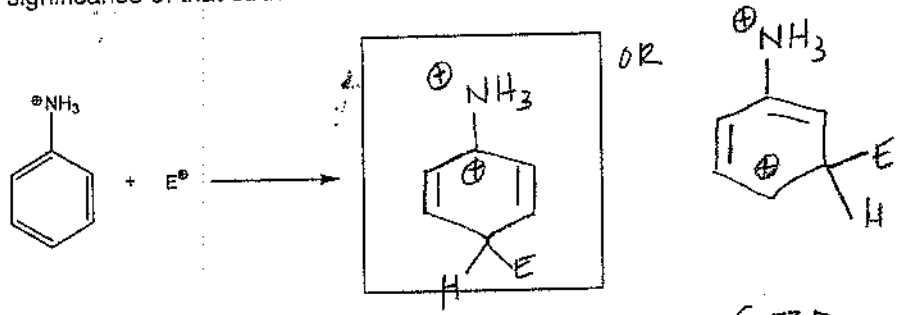
3. (12 pts) Provide a complete mechanism for the following reaction. *If an intermediate or product is resonance stabilized, it is necessary to show only ONE structure; you do not need to show all possible resonance structures.*



4. (18 pts) Predict the major product for each of the following reactions.

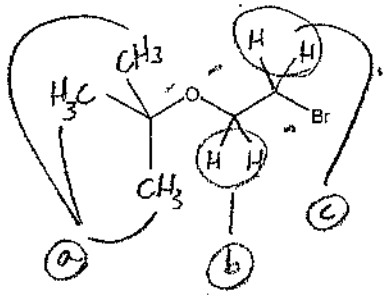


5. (10 pts) Is the NH_3^+ group an *o,p*-director or a *m*-director? Draw **one** resonance structure for the carbocation intermediate in the box below that is crucial to justifying your answer. **Briefly** explain the significance of that structure.



meta. avoids the unstable situation of two ⊕ on adjacent atoms

6. (10 pts) Predict what the ^1H NMR spectrum will look like for the molecule shown below:
   (i) Label the magnetically different H's as a, b, ...
   (ii) Give the expected relative areas expected for a : b : ...
   (iii) Indicate which signal is most deshielded.
   (iv) Indicate the splitting pattern (singlet, doublet, etc) expected for each signal.

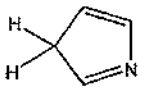


9 : 2 : 2

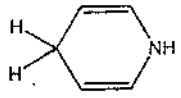
s t t

most deshielded

7. (10 pts) Predict which compound is most acidic (consider the protons in bold). **Briefly** explain your choice using a combination of drawings and words.

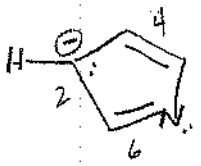


1

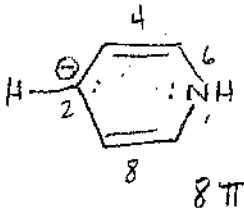


2

conjugate bases:



vs.



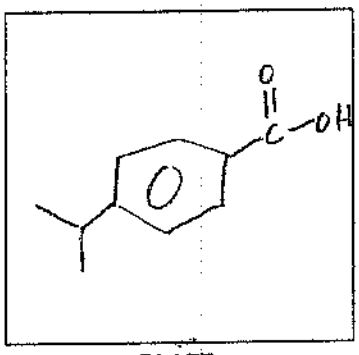
6 π e⁻
aromatic, stable
conjugate base
so 1 is more acidic

8 π e⁻
antiaromatic (or Non if not planar)
or sp^3

8. (20 pts) Shown below are ^{1}H NMR, ^{13}C NMR, and mass spectra for an unknown compound **BLAZE** that has the molecular formula $C_{10}H_{12}O_2$. Propose a structure for **BLAZE** using the data provided. Draw your proposed structure in the box below.

For full credit, you must do the following:

a. Calculate the IHD.
b. Assign all signals in the ^{1}H NMR spectrum (a, b, etc) to labeled protons in the structure.
c. Show that the splitting pattern of two of the signals is consistent with your structure.
d. Assign all signals in the ^{13}C NMR spectrum (A, B, etc) to labeled carbons in the structure. Think reasonable.
e. Write "base peak" and "molecular ion" next to the corresponding signal(s) in the MS.



BLAZE

IHD = 5

BLAZE

$C_{10}H_{12}O_2$