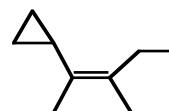
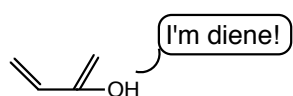
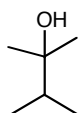


Extra credit: give the IUPAC names for the following compounds:



1. \_\_\_\_\_

5. \_\_\_\_\_

2. \_\_\_\_\_

6. \_\_\_\_\_

3. \_\_\_\_\_

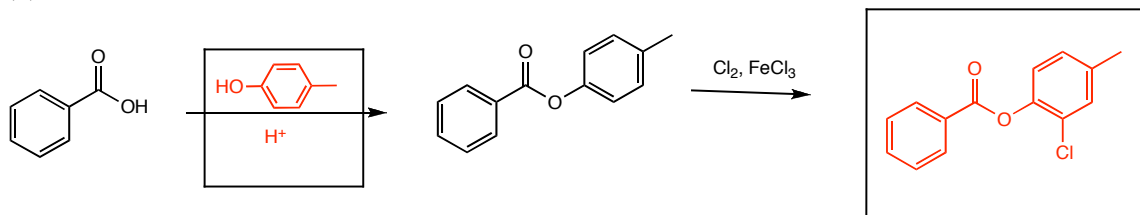
7. \_\_\_\_\_

4. \_\_\_\_\_

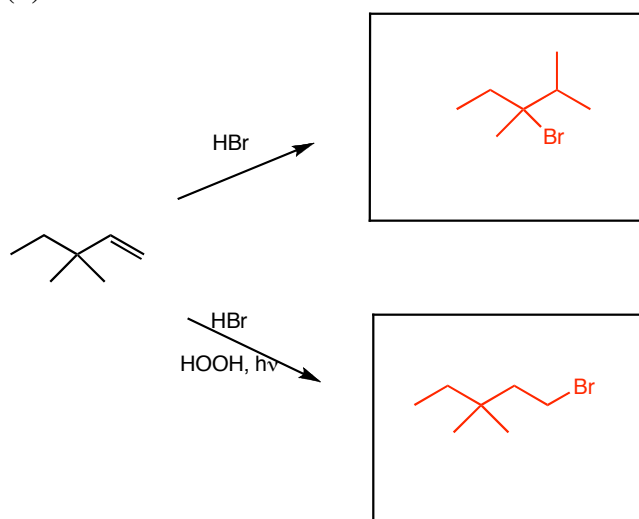


1. Fill in the blanks. Assume a single equivalent of reagent, and that all reactions are quenched. (5 pts. ea.)

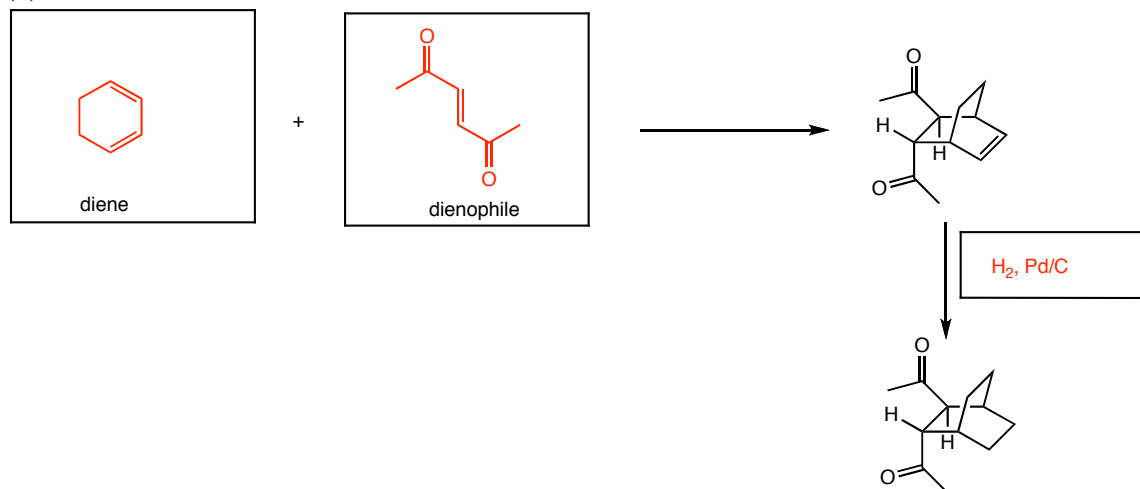
(a)



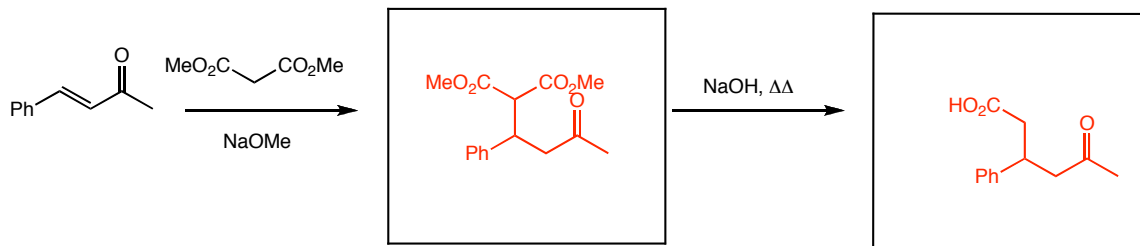
(b)



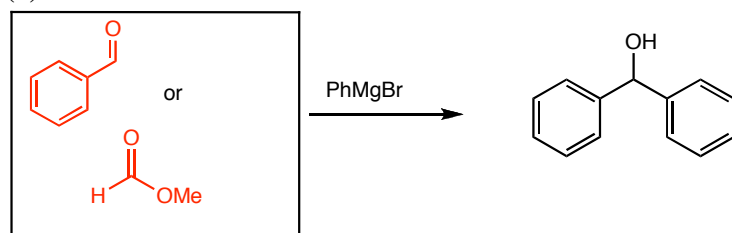
(c)



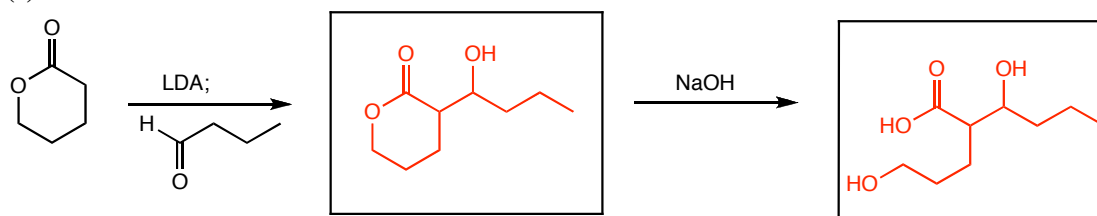
(d)



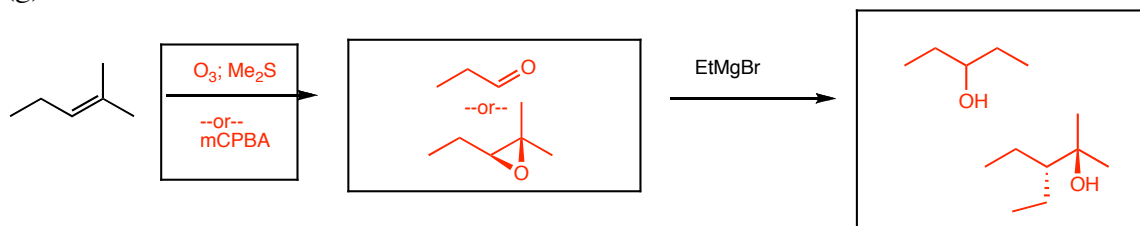
(e)



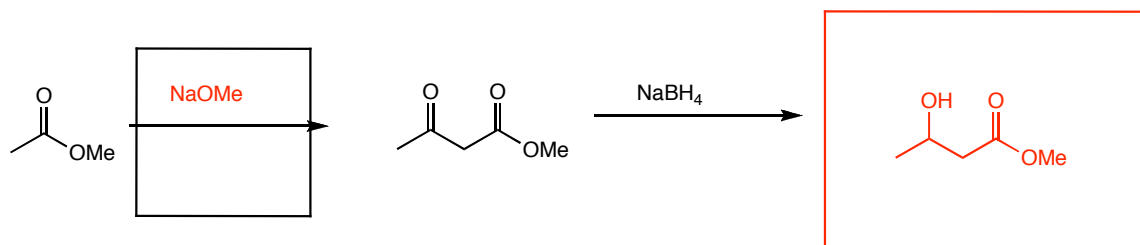
(f)



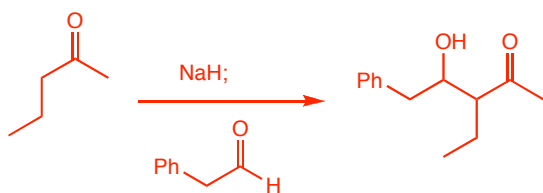
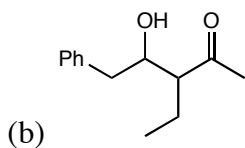
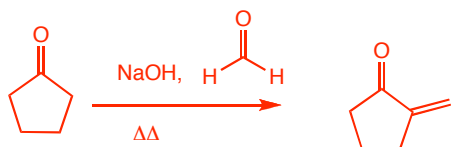
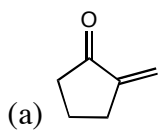
(g)



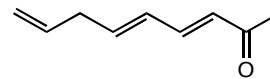
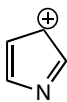
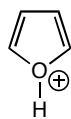
(h)



2. Each of the following compounds can be prepared by an aldol reaction. Provide the appropriate starting materials and conditions to prepare the product. (8 pts ea.)



3. Determine how many  $\pi$ -electrons are contained in the following compounds and if they are aromatic, non-aromatic, or anti-aromatic. (5 pts ea.)



number of  $\pi$ -electrons

6

4

8

Non-, Anti-  
Or Aromatic?

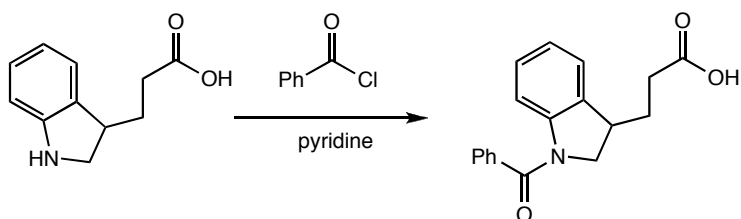
aromatic

anti

non

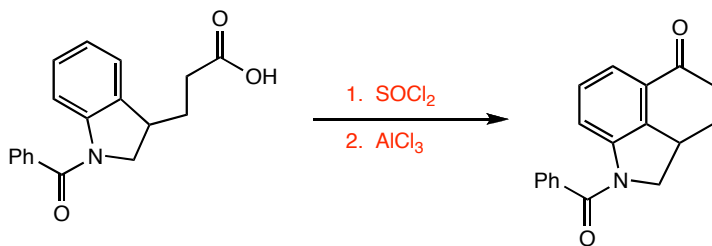
4. The following question involves several steps from the synthesis of LSD. No mechanisms are required unless specifically requested. You may make liberal use of R groups if it is convenient.

(a) In the reaction below, the acid chloride could potentially react with either the carboxylic acid or the amine. Why does the reaction occur exclusively at the amine? (6 pts)

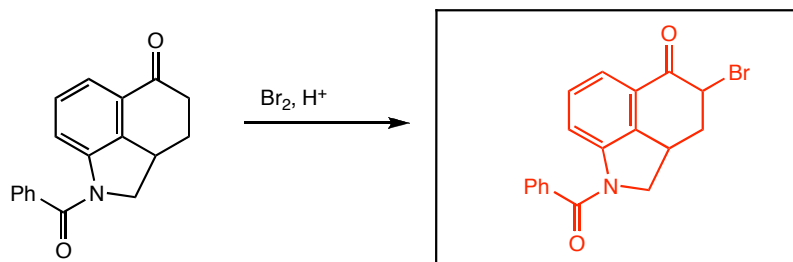


If the reaction occurred at the carboxylic acid, an anhydride would be formed, and the amide is more stable than the anhydride.

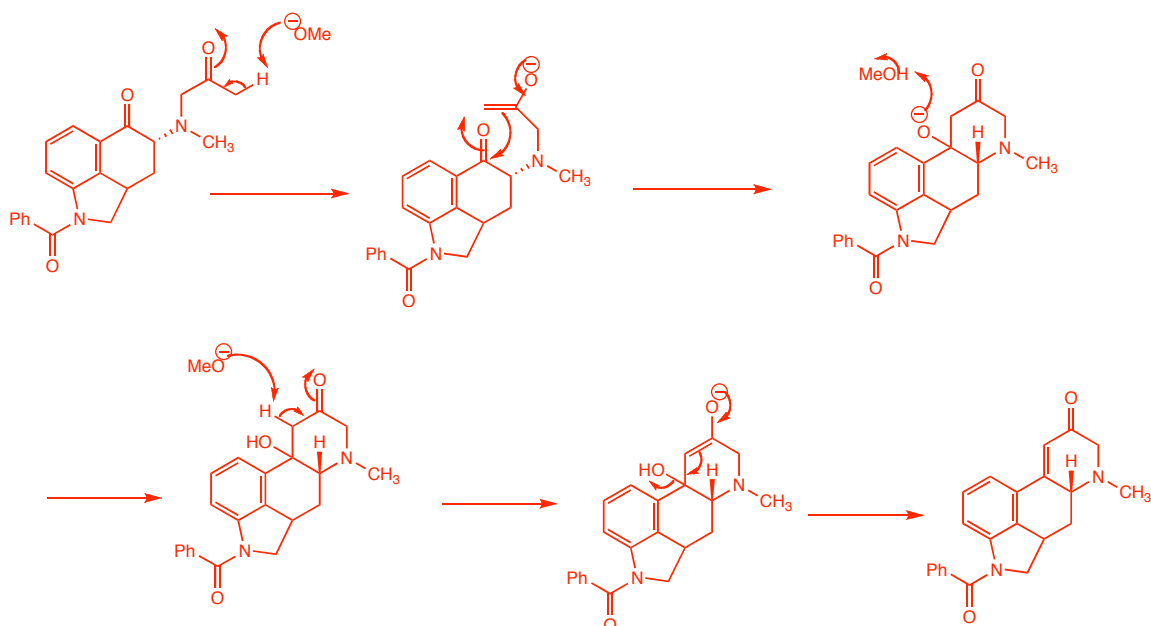
(b) The carboxylic acid shown below cannot be converted directly into the ketone, but instead requires two separate steps. What are they? (8 pts)



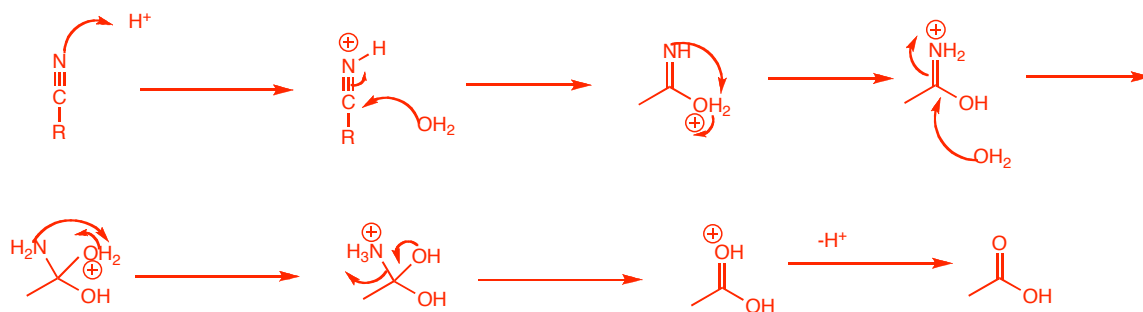
(c) Give the product of the reaction below. (5 pts)



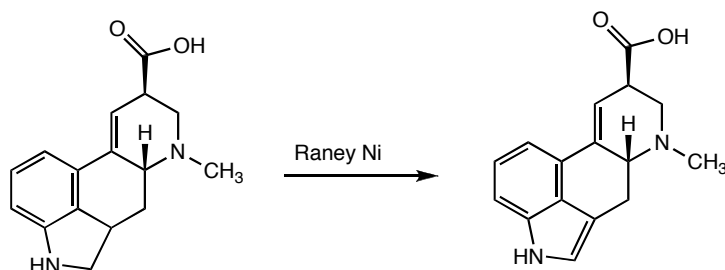
(d) Propose a mechanism for the reaction below. (8 pts)



(e) Propose a mechanism for the hydrolysis of the nitrile shown below (ignore the conversion of the amide into the amine). (10 pts)

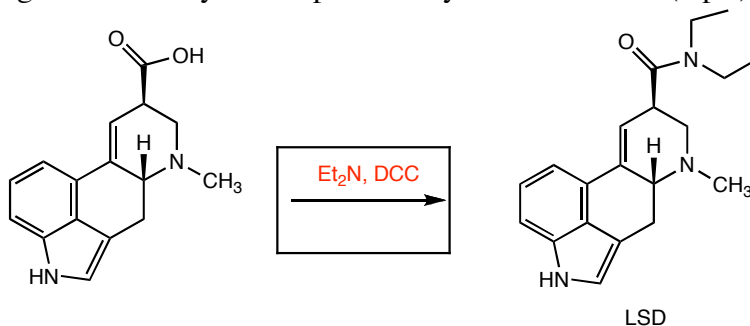


(f) The reaction below is the reverse of a catalytic hydrogenation. Why is this single bond easily converted into a double bond while the other single bonds in the molecule are not? (6 pts)

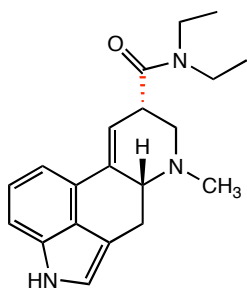


By removing  $H_2$  from this particular bond, the system becomes more aromatic. No other bond in the molecule would add to the aromaticity if it were dehydrogenated.

(g) Give the reagents necessary to complete the synthesis of LSD. (5 pts)



(h) In the presence of base, LSD is converted into iso-LSD, a new compound that does not have the same physiological properties. Suggest a structure for iso-LSD. (6 pts)



5. Rank the following compounds or substituents according to the criteria given: (5 pts ea)

(a) electron withdrawing group

NH<sub>2</sub>

NO<sub>2</sub>

CN

most e<sup>-</sup> withdrawing

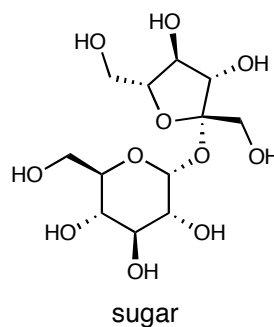
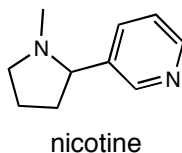
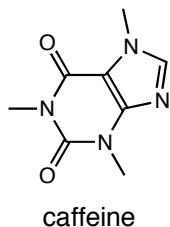
least e<sup>-</sup> withdrawing

\_\_\_NO<sub>2</sub>\_\_\_

\_\_\_CN\_\_\_

\_\_\_NH<sub>2</sub>\_\_\_

(b) Number of <sup>13</sup>C peaks



most peaks

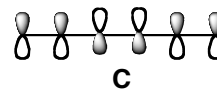
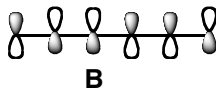
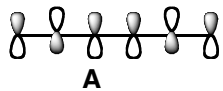
fewest peaks

\_\_\_sugar\_\_\_

\_\_\_nicotine\_\_\_

\_\_\_caffeine\_\_\_

(c) molecular orbital energy



lowest energy

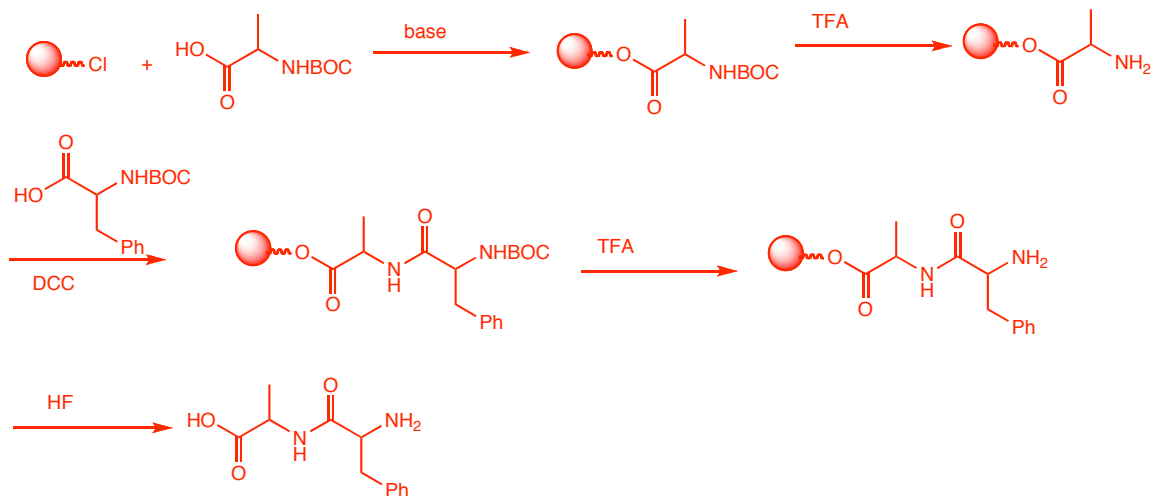
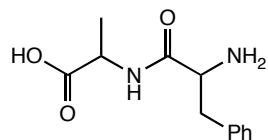
highest energy

\_\_\_C\_\_\_

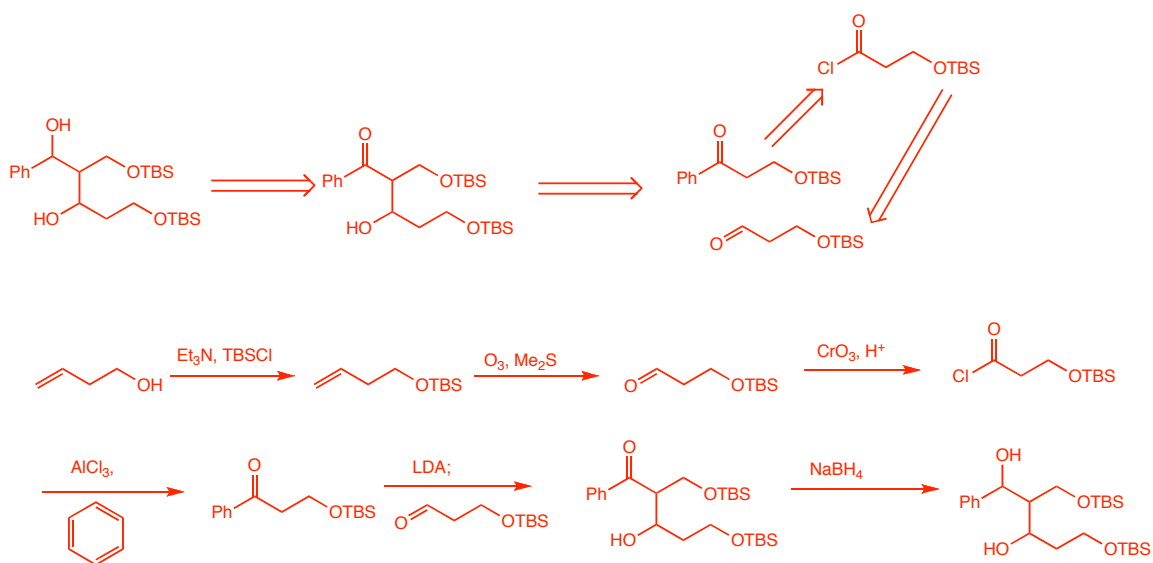
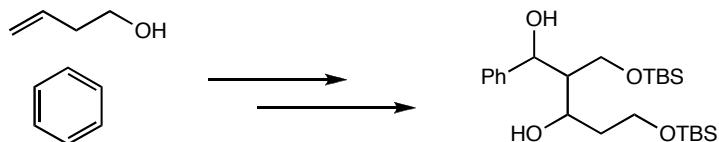
\_\_\_B\_\_\_

\_\_\_A\_\_\_

6. Using solid phase peptide synthesis, show how the following dipeptide can be prepared. (10 pts)



7. Propose a synthesis of the following molecule using the compounds on the left as the only source of carbon. You may use any other inorganic compound you may need. Mechanisms are not necessary. (15 pts)



Extra credit: If you could re-name any reaction, what would you name it and why?