

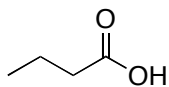
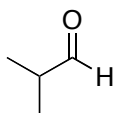
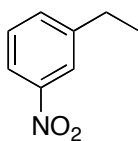
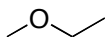
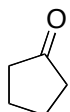
Organic Chemistry

CHM 224

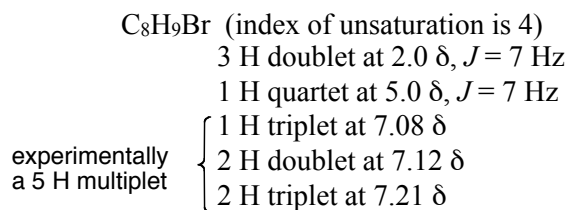
Final Exam Review Questions

This is a compilation example final exam questions.

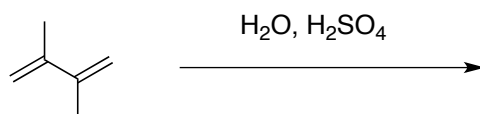
Provide IUPAC names for each of the structures below.



Propose a structure for the compound that displays the following ^1H NMR data:



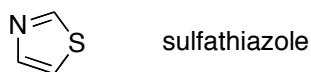
Draw the structure of the following products (there are two), and circle which is THERMODYNAMICALLY more stable.



The following molecule can be created by an intramolecular cyclization (Diels-Alder) reaction. Draw the starting material for this reaction.



Answer the following three questions concerning sulfathiazole, below.

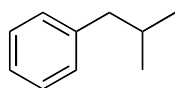


What is the hybridization of the nitrogen atom?

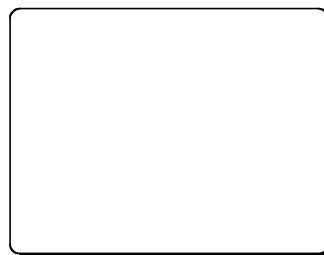
Assuming that the sulfur atom is sp^2 -hybridized, how many pi-electrons are there in the sulfathiazole ring?

Is this molecule aromatic?

Direct Friedel-Crafts alkylation of benzene using 2-methyl-chloropropane and AlCl_3 DOES NOT result in the formation of the isobutylbenzene as the MAJOR product – draw the major product of the reaction that IS formed.



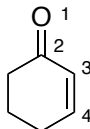
isobutylbenzene
(minor product)



major product

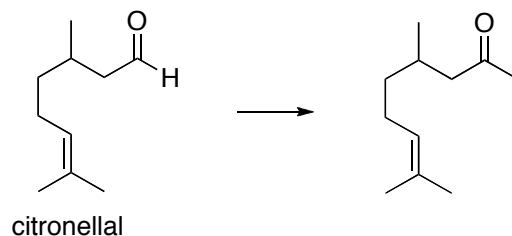
The pK_a of *m*-nitrophenol is 8.28 while that of the *p*-substituted isomer is 7.17 – How do you explain the difference in acidity between *meta* and *para*-nitrophenol? Use drawings of relative resonance structures that may support your statement.

For α,β -unsaturated carbonyl compounds, many nucleophiles do not add to the carbonyl carbon at position 2, but rather add to the carbon at position 4. Suggest a reason for the inherent electron deficiency/electrophilicity at carbon 4, and include any drawings that might support your statement.

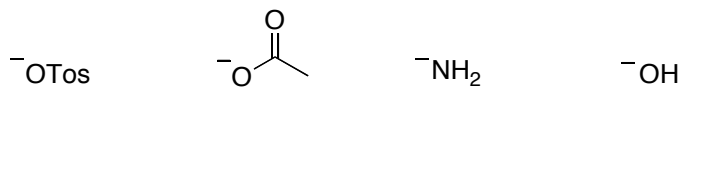


an α,β -unsaturated ketone

Citronellal (and aldehydes in general) can be converted to the corresponding ketone (in this case, a methyl ketone) using a multi-step reaction sequence that includes a Grignard reaction. Provide a procedure for the following transformation – make sure to include all necessary reagents, and use 1), 2)... etc. to indicate the order in which they are being added. You do not need to show a mechanism.

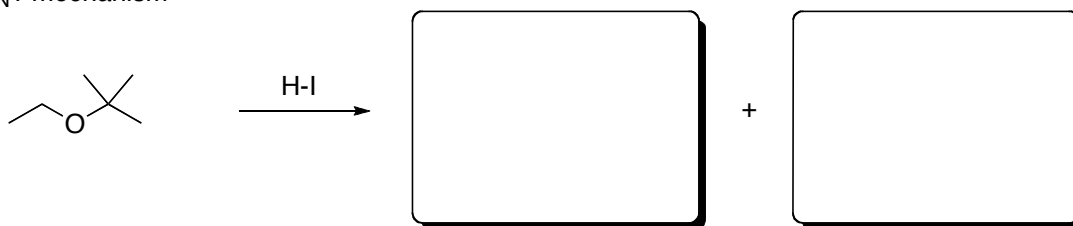


In the blank spaces below, rank the following groups in order of poorest (4) to best (1) leaving group.

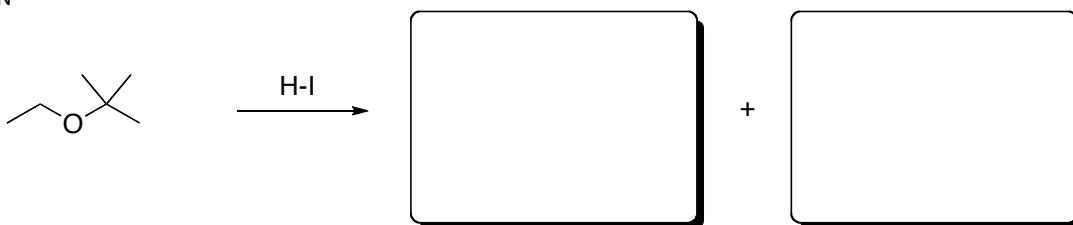


tert-Butyl ethyl ether can be cleaved to an alcohol and alkyl iodide using hydroiodic acid (HI). For the following two schemes, draw the products if the cleavage mechanism were to proceed through an (1) S_N1 mechanism and (2) S_N2 mechanism.

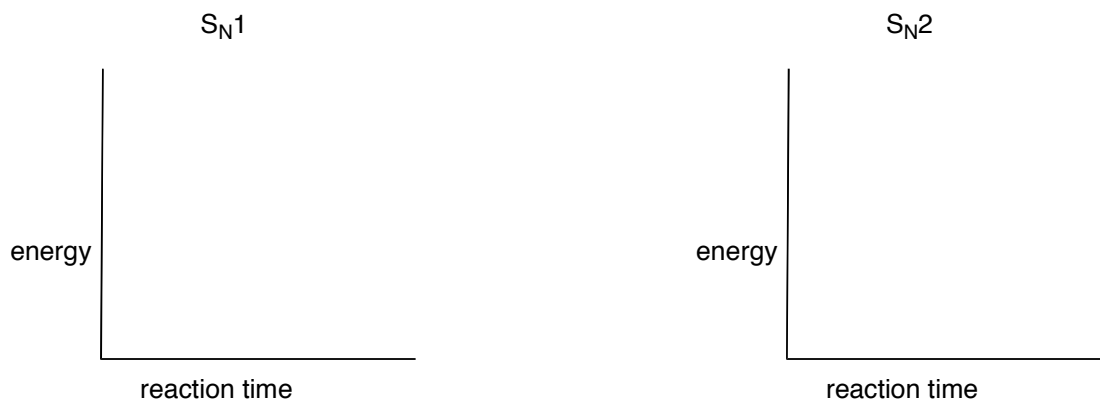
S_N1 mechanism



S_N2 mechanism

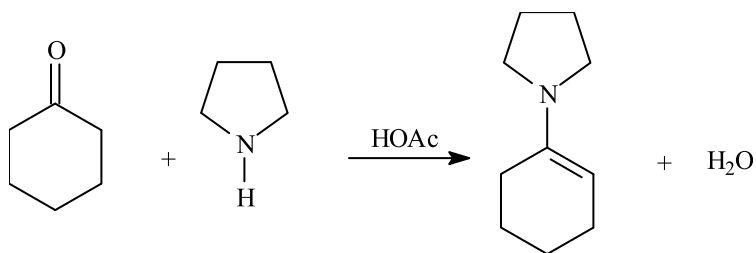


Draw an energy diagram for an S_N1 and S_N2 reaction. Label starting material (sm) and product (p) and use the letter (i) to indicate intermediate and (t) to indicate transition state (where applicable). Assume both reactions are exothermic.



Enamines formed from the cyclic secondary amine pyrrolidine are important intermediates in the synthesis of 1,5-diketones.

Draw arrows showing electron flow for the reaction mechanism for the acetic acid-catalyzed formation of an enamine from cyclohexanone and pyrrolidine.



Consider the following statements in reference to S_N1 , S_N2 , E1, and E2 reactions of haloalkanes. To which mechanism(s), does each statement apply? Write the name of the mechanism(s) that apply below the three that you have chosen to answer.

- (a) Rate is first-order in haloalkane and first-order in nucleophile.
- (b) Substitution at a stereocenter gives predominantly a racemic product.
- (c) Rate is first-order in haloalkane and zero-order in base.
- (d) Rate is first-order in haloalkane and first-order in base.
- (e) Rate is greatly accelerated in protic solvents.
- (f) Rearrangements are common.

Match a structure or term from the following list with each description below. Place the letter or term in the blank to the left of the description.

- a. benzyne
- b. $+NO_2$
- c. R_3C^+
- d. electron-donating
- e. $+NO$
- f. Ylide
- g. $R-C\equiv O^+$
- h. electron-withdrawing

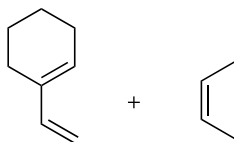
_____ The reactive electrophile in Friedel-Crafts acylation reactions.

_____ The electrophile in aromatic nitration.

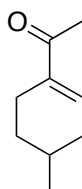
_____ Groups which reduce the nucleophilicity of an aromatic ring

_____ Groups which are aromatic ring activators

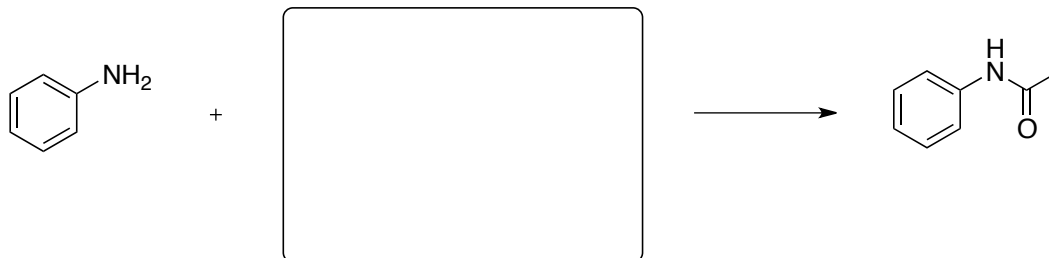
Complete the following Diels Alder reaction:



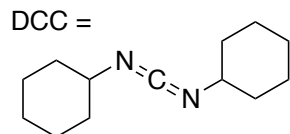
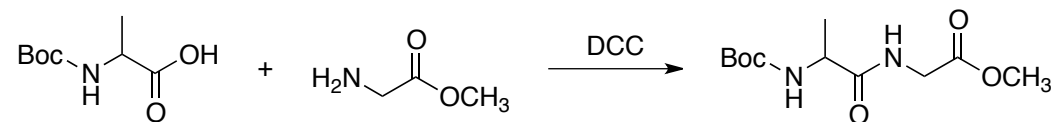
Assuming the following molecule was made via a Diels Alder reaction, from what diene and dienophile did it come from?



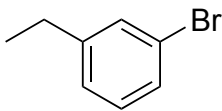
Suggest an anhydride that could be added to aniline (left side) that would result in forming the amide shown below.



A manner to produce amides is shown below, using dicyclohexyldiimide as a coupling reagent. Draw a stepwise arrow-pushing mechanism that details the following conversion.

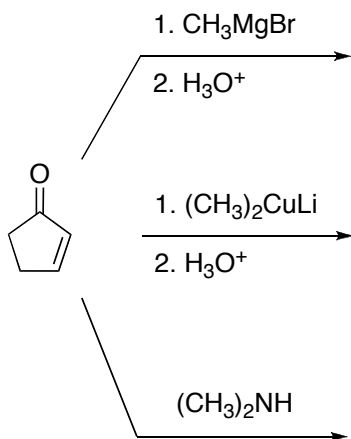


Propose a synthesis of the following molecule from benzene.

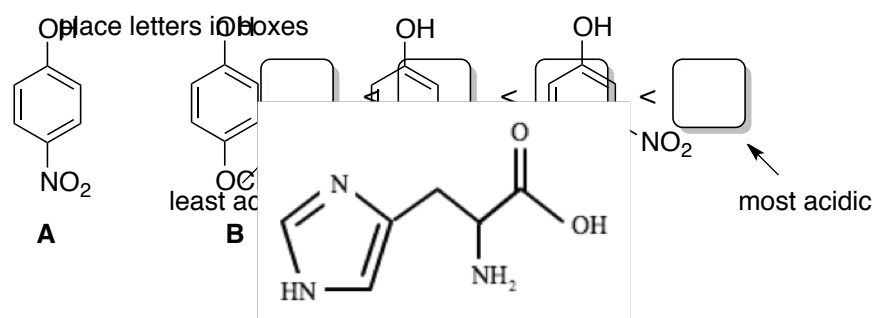


Predict what the ^{13}C and ^1H NMR (you can ignore the H on the oxygen) of the above molecule would look like. For ^{13}C NMR, list the number of signals you would see and the approximate ppm range you would expect to see them in. For ^1H NMR, list each signal, their integration value and expected splitting.

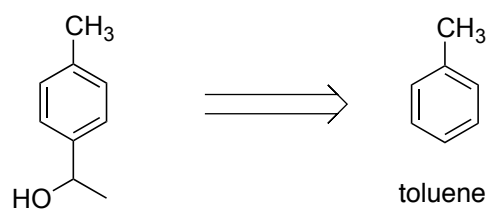
Draw the major organic product(s) of the following reactions:



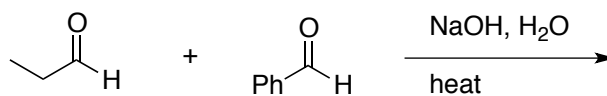
Place the following phenols in order of INCREASING acidity:



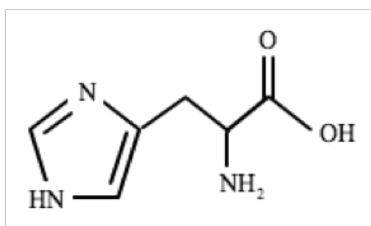
Propose a synthesis of the following molecule from toluene and any additional chemical reagents needed. note: there is more than one possible route.



What is the major organic product obtained from the following reaction?



The pKa for the carboxylic acid, imidazole and primary amine of histidine are 1.8, 6.0 and 9.0, respectively. What is the predominate structure of histidine at a pH of 5?



Draw the major organic product of the following reactions.

