

I. Nomenclature

1. Provide structures for each of the compounds listed below. (12 points)

purine

o-methoxystyrene

benzofuran

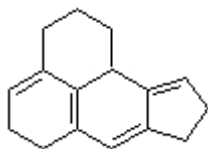
phenanthrene:

pyrimidine:

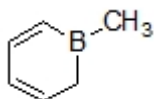
thiophene:

II. Theory

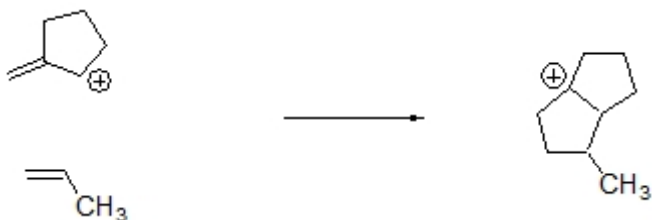
1. Given that 1,3-butadiene has a UV_{\max} value of 217 nm, predict the UV_{\max} value of the unknown conjugated compound below. Show all of your work for full credit. (3 points)



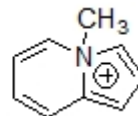
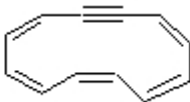
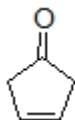
2. Draw the highest occupied molecular orbital for the conjugated system below. (4 points)



3. Using overlap of the appropriate molecular orbitals, predict whether the following pericyclic reaction would be symmetry allowed or forbidden under thermal conditions. (6 points)

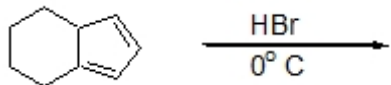


4. What is the net bonding of one of the LUMO molecular orbitals of benzene? (2 points)
5. Assuming planarity of each ring below, classify the following compounds as aromatic, antiaromatic, or nonaromatic. (6 points)



6. The resonance energy of a benzene ring is calculated to be _____ Kcal/mol. (2 points)

7. Draw the two major product of the following reaction. Circle the major product when the reaction is conducted at 0° C. (6 points)



8. Which sequence ranks the following dienes in order of increasing reactivity in a Diels-Alder reaction? (3 points)

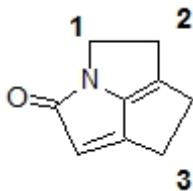
1 (Z) 3-methyl-1,3-pentadiene

2 (Z) 2-methyl-1,3-pentadiene

3 (E) 2-methyl-1,3-pentadiene

- a) 1<2<3 b) 2<3<1 c) 3<1<2 d) 3<2<1 e) 2<1<3 f) 1<3<2

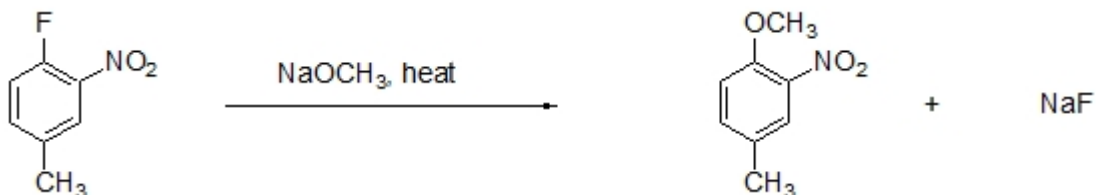
9. Which sequence ranks the indicated protons in order of increasing acidity? (3 points)



- a) 1<2<3 b) 2<3<1 c) 3<1<2 d) 3<2<1 e) 2<1<3 f) 1<3<2

III. Mechanism:

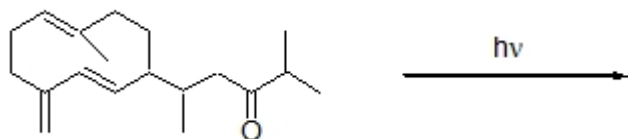
- Provide an electron arrow pushing mechanism for the following reaction. Include all intermediate structures and formal charges. (6 points)



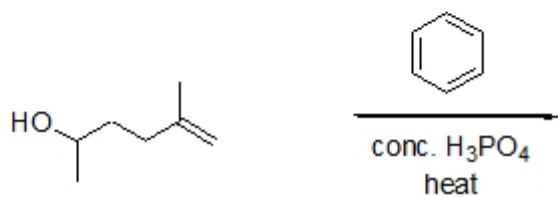
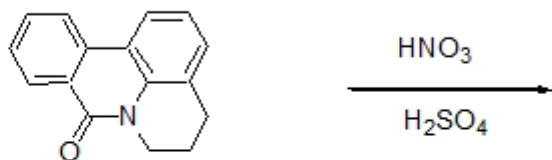
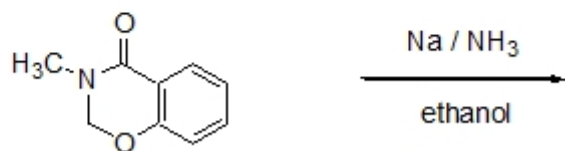
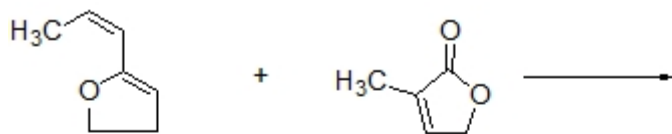
- Provide a structure and name for the active electrophile intermediate in the nitration of benzene. (2 points)
- Provide an energy diagram for the reaction resulting from treating benzene with bromine and ferric bromide. (4 points)

IV. Reactions

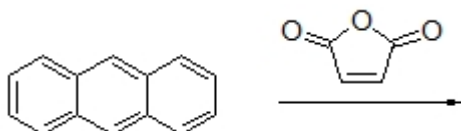
- The following compound was isolated from a soft sponge and undergoes a cycloaddition reaction to produce another naturally occurring component (*J. Nat Prod.* **2011**, 2089). Provide a structure for the expected product of the reaction below. (4 points)



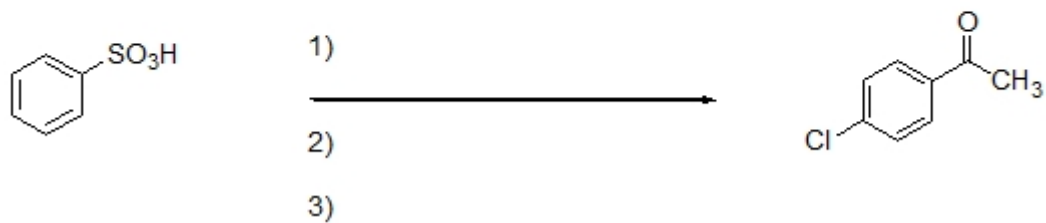
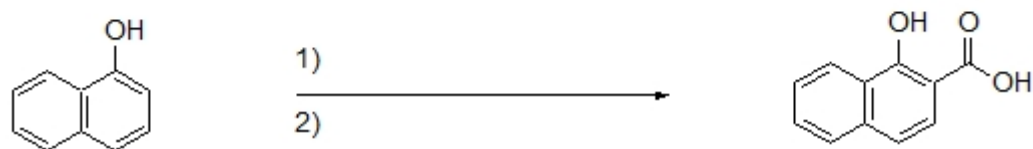
2. Predict the major product(s) of each of the following reactions. Include any relevant stereochemistry. (16 points)



3. Anthracene undergoes a Diels-Alder reaction when treated with maleic anhydride. Predict the structure of the expected product. (3 points)

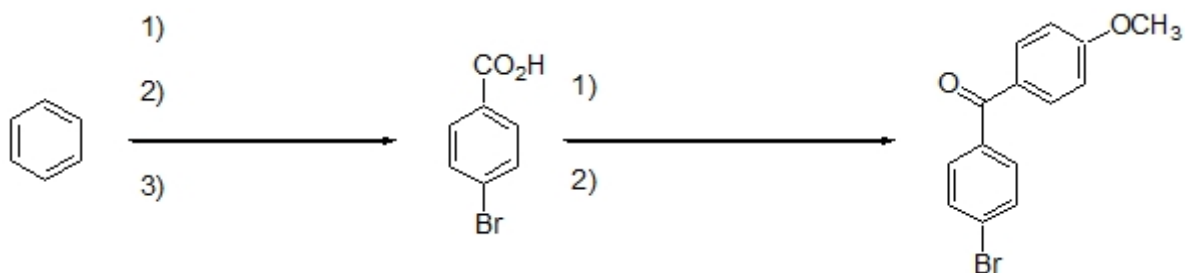


4. Complete each of the following reactions by filling in the necessary reagents. (18 points)



V. **Extra Credit** (5 points)

1. Complete the following reaction by filling in the necessary reagents.



You received _____ points out of 100 points possible. To check your overall performance in lecture see <http://canvas.weber.edu>