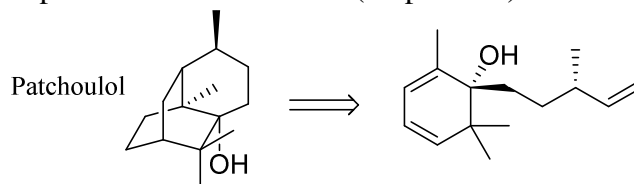


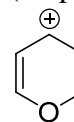
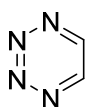


- 1) Patchouli oil, or patchoulol, is responsible for the smell of many types of incense and also hippies. In addition, it is used as a precursor to the chemotherapy drug Taxol. Patchoulol can be synthesized from the precursor shown below. (15 pts total)

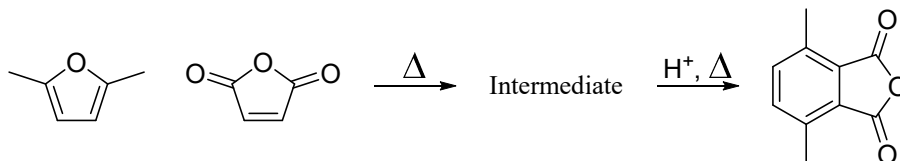


- a. There are two steps in this synthesis: one generates a new ring, and the other changes a functional group. Show the mechanism for the ring formation step. You don't have to show the 3d shape perfectly – just focus on correct connectivity. (10 pts)
- b. What reagents are needed for the second step, to finish converting the precursor to patchoulol? (5 pts)

- 2) Describe each of the structures below as aromatic, nonaromatic, or antiaromatic. Assume each structure is planar. In addition, list the hybridization of each heteroatom. (15 pts total)



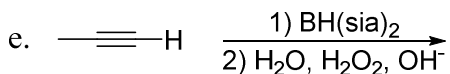
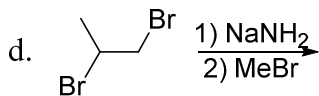
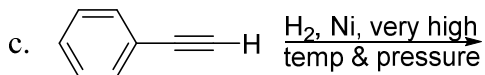
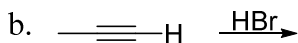
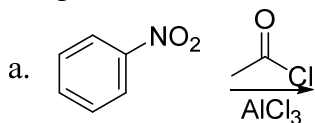
- 3) The reagents shown below react to form an intermediate, which, in the presence of acid, continues on to form the final product shown below. (15 pts total)



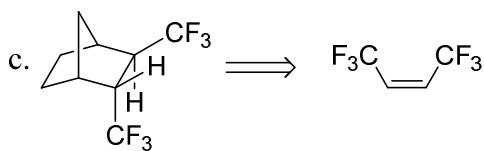
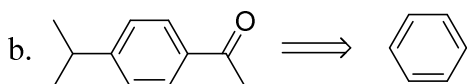
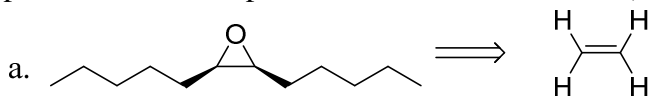
- a. Show the structure of the intermediate, and the mechanism for its formation. (5 pts)

- b. Show the mechanism for the formation of the final product. (10 pts)

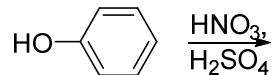
- 4) Predict the major product of the following reactions. If no reaction occurs, then write NR. Show stereochemistry where necessary – if a racemic mixture is formed, you can show only one product and write “racemic” or “rac”. (10 pts; 2 pts each)



- 5) Find a way to synthesize the desired product from the given starting material(s) and any other reagents containing at most 5 carbon atoms. If more than one step is necessary, show the product of each step. Do not show mechanisms. (30 pts; 10 pts each)



- 6) The reaction shown below could hypothetically produce three isomers – the ortho, meta, and para products. (15 pts)



- a. Show the mechanism for the formation of the para product, including all resonance forms for the intermediate. (5 pts)
- b. Show the mechanism for the formation of the meta product, including all resonance forms for the intermediate. (5 pts)
- c. In twenty words or less, explain which of these outcomes is favored and why. (5 pts)
- 7) Extra credit! Calicene, shown below, has a surprisingly high dipole moment for a hydrocarbon. Explain why this is true in thirty words or less, and show the dominant resonance form for this molecule. (10 pts e.c.)

