CH310N
Spring 2010

Anslyn

April 20, 2010

Exam 3

Please **PRINT** the first three letters of your last name in the boxes below.

K	E	Y

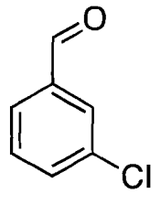
PRINT Full Name _____ **UT-EID**_____

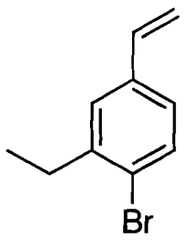
1) _____ (10 pts)
2) _____ (5 pts)
3) _____ (9 pts)
4) _____ (4 pts)
5) _____ (5 pts)
6) _____ (5 pts)
7) _____ (16 pts)
8) _____ (12 pts)
9) _____ (6 pts)
10) _____ (10 pts)
11) _____ (8 pts)
12) _____ (10 pts)
Bonus) _____ (2 pts)

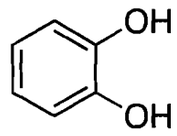
Total Score _____ (100 pts)

1.

a) Using the common names for the parent structures, give names for the following molecules. (3 points)





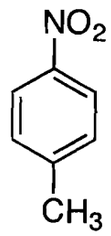


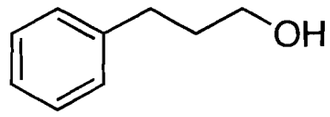
m-Chlorobenzaldehyde

4-bromo-3-ethylstyrene

Catechol

b) Give the IUPAC name for the following molecules. (From homework, problem 21.8, 2 points)

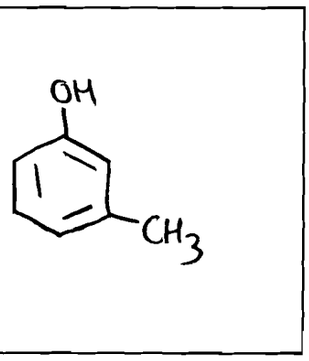




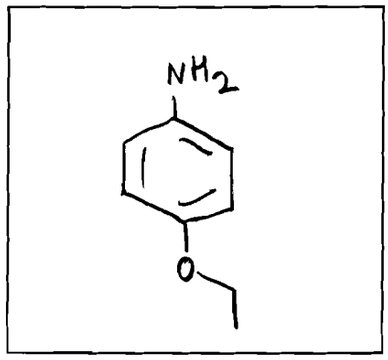
p-nitrotoluene

3-phenyl-1-propanol

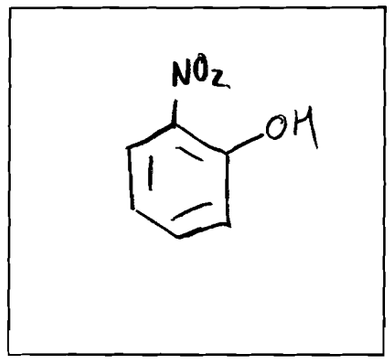
c) Draw the chemical structures for the following common names. (3 points)



m-cresol

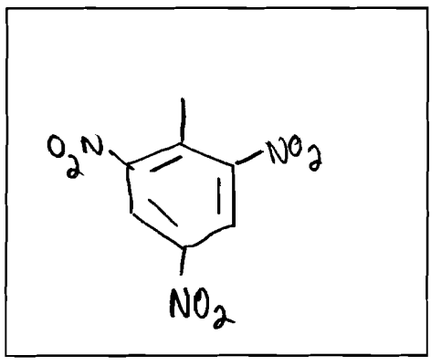


p-ethoxyaniline

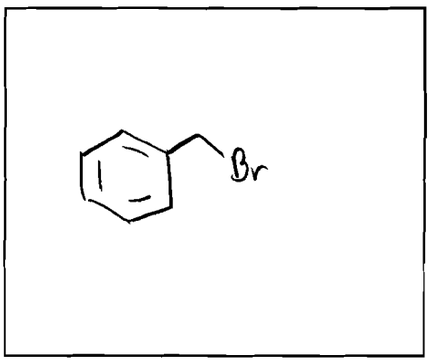


o-nitrophenol

d) Draw the chemical structure for the following IUPAC name. (From homework, problem 21.9, 2 points)

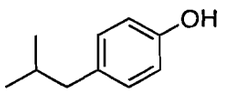


2,4,6-trinitrotoluene

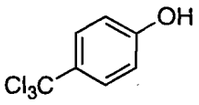


benzyl bromide

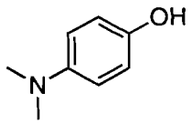
2. Several factors affect the acidity of the hydroxylic proton in a phenol. Put the indicated phenol derivatives in order of decreasing acidity (thus 1 signifies the most acidic species). Please explain why you made these assignments. (5 points)



2



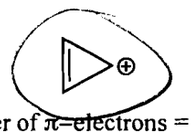
1



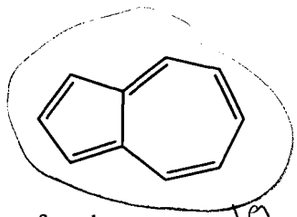
3

Induction helps stabilize anions, so the most electron withdrawing group ($-CCl_3$) gives the greatest amount of stabilization to the anion. This species is the most acidic. The N,N-dimethylamino portion is the most electron donating group, destabilizing the anion the greatest. This makes this compound the least acidic.

3. Please write the number of π-electrons in each of the following compounds. Then **circle** the compounds which are **aromatic** according to the Hückel criteria. (9 points)

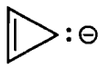


Number of π–electrons = 2

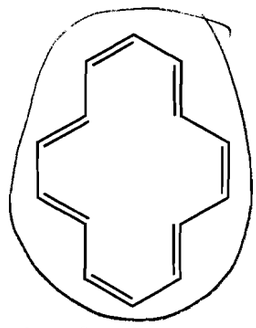


Number of π–electrons = 10

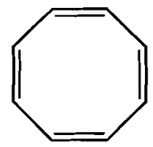
Number of π–electrons = 4



Number of π–electrons = 4

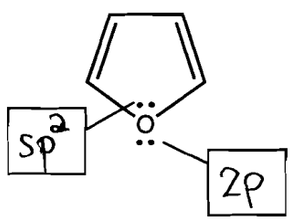


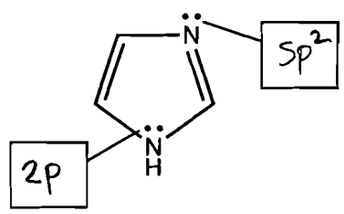
Number of π–electrons = 14



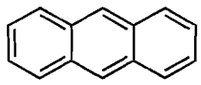
Number of π–electrons = 8

4. For both compounds below, please write the orbital in which each lone pair of electrons resides. (4 points)

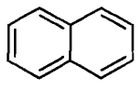




5. Two aromatic species, anthracene and naphthalene, are pictured below. Anthracene absorbs light with a λ_{max} value of 380 nm. Where would you expect naphthalene to absorb light, relative to anthracene? Explain your answer. (5 points)



Anthracene



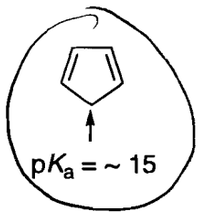
Naphthalene

Anthracene is more conjugated than naphthalene, which means that there is a larger HOMO/LUMO gap for naphthalene. More energy is required to excite an electron, meaning that this molecule absorbs at shorter wavelength.

6. The allylic hydrogens of propene have a pK_a of roughly 40, compared to an unsubstituted hydrocarbon having a pK_a around 50. Cyclopentadiene, however, has a pK_a around 15. (5 points)

pK_a = ~50

pK_a = ~40



pK_a = ~ 15

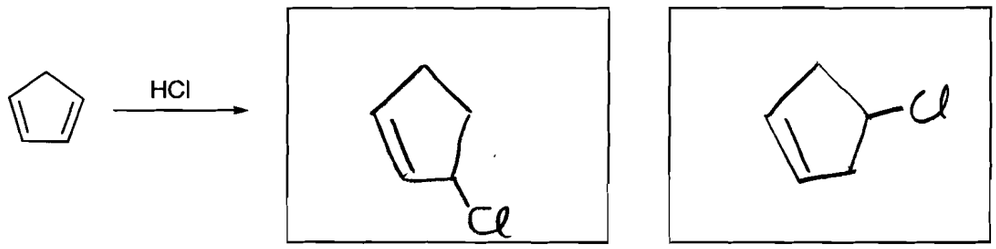
a) Circle the species with the most acidic proton.

b) What accounts for the dramatic difference in pK_a between propene and cyclopentadiene?

Losing a proton in cyclopentadiene creates the anion shown at the right. This species is aromatic after deprotonation, and aromatic species are more stable. This molecule can be deprotonated easier making it a stronger acid.

7. Fill in the box with the appropriate reactant, reagent, or product. Some boxes require more than one step. (16 points)

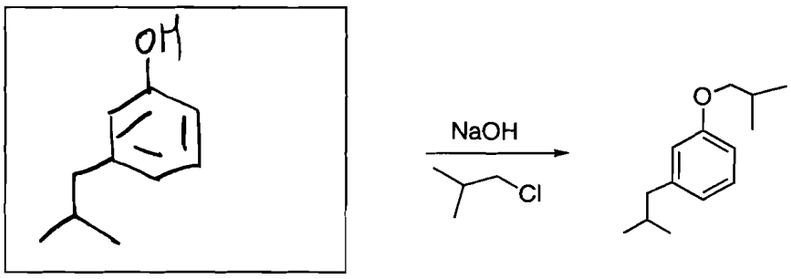
a) From homework, problem 20.11



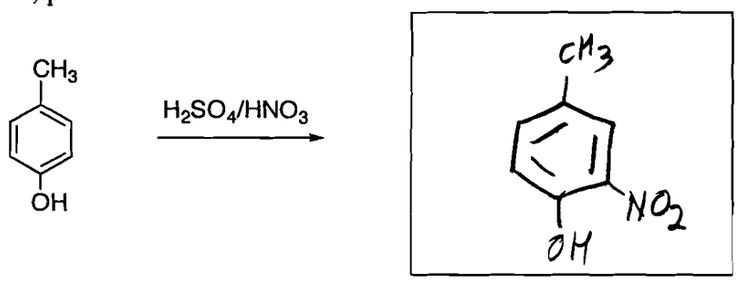
Major product

Minor product

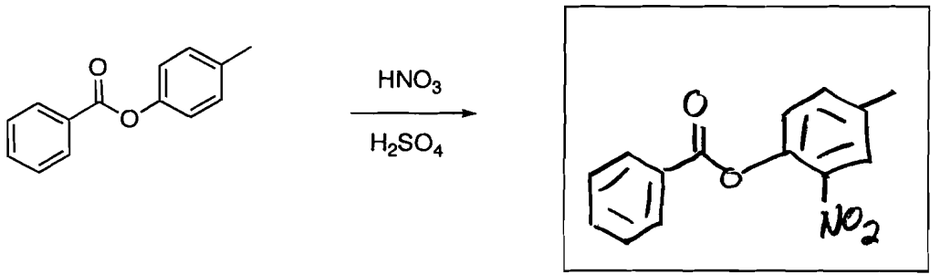
b)



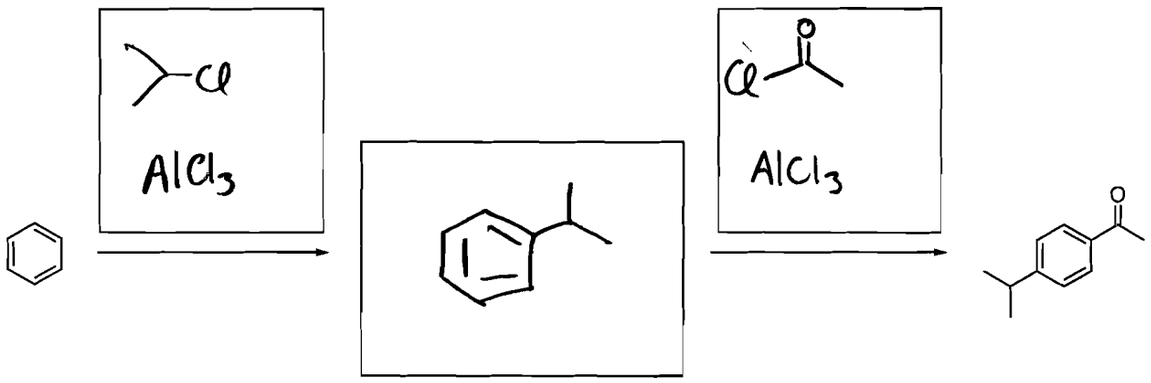
c) From homework, problem 22.15c



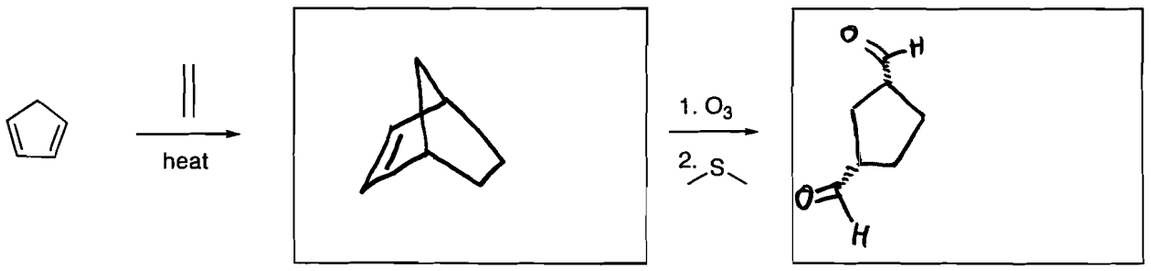
d) From homework, problem 22.21c



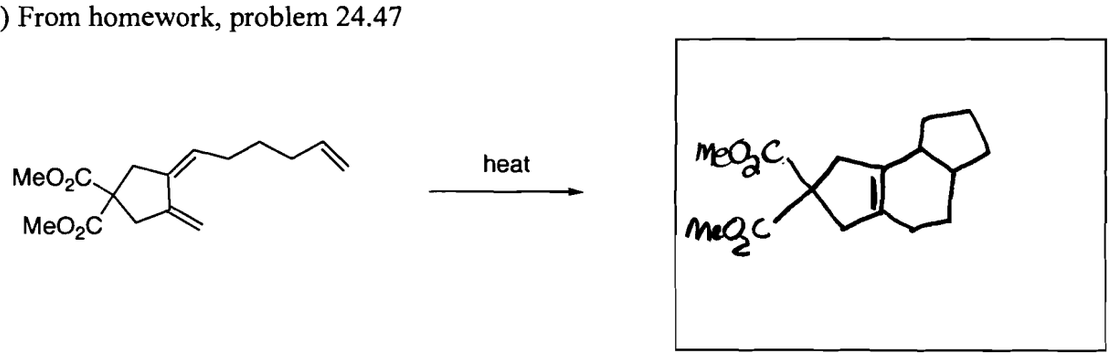
e) From homework, problem 22.41



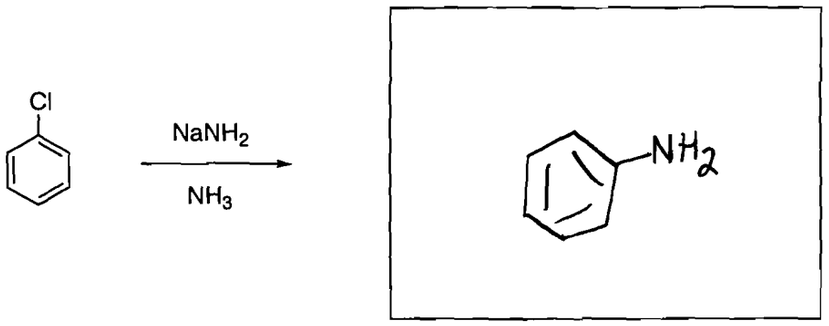
f)



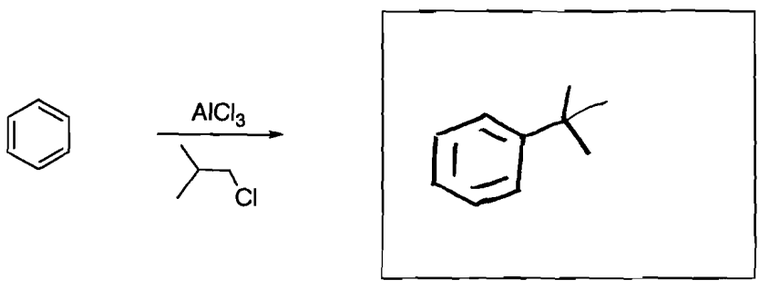
g) From homework, problem 24.47



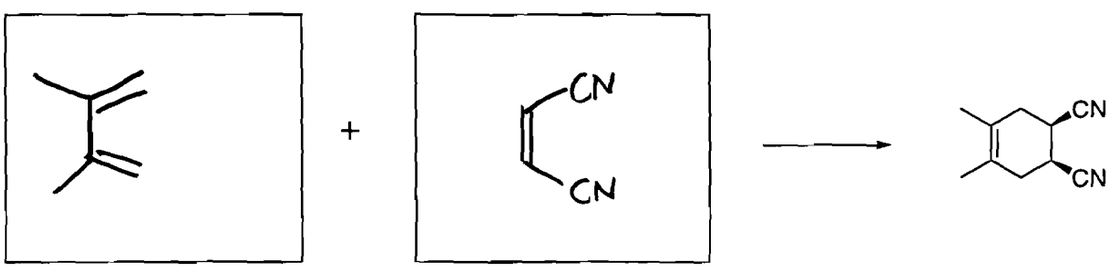
h)



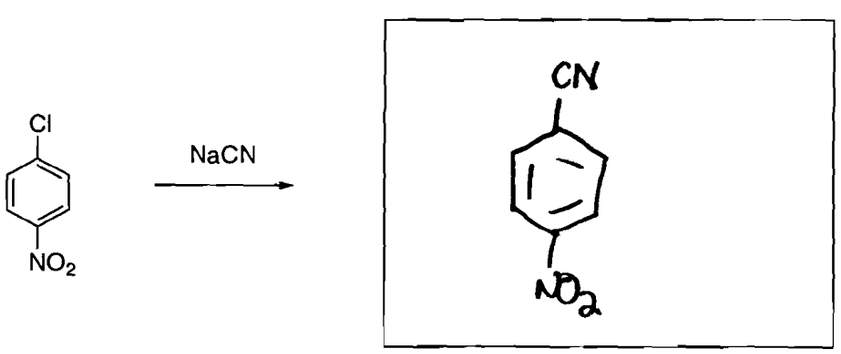
i)



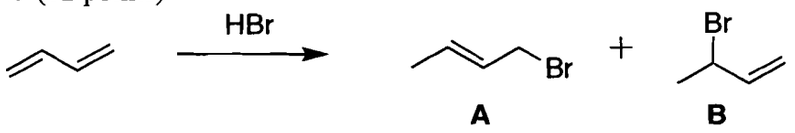
j) From class notes



k)

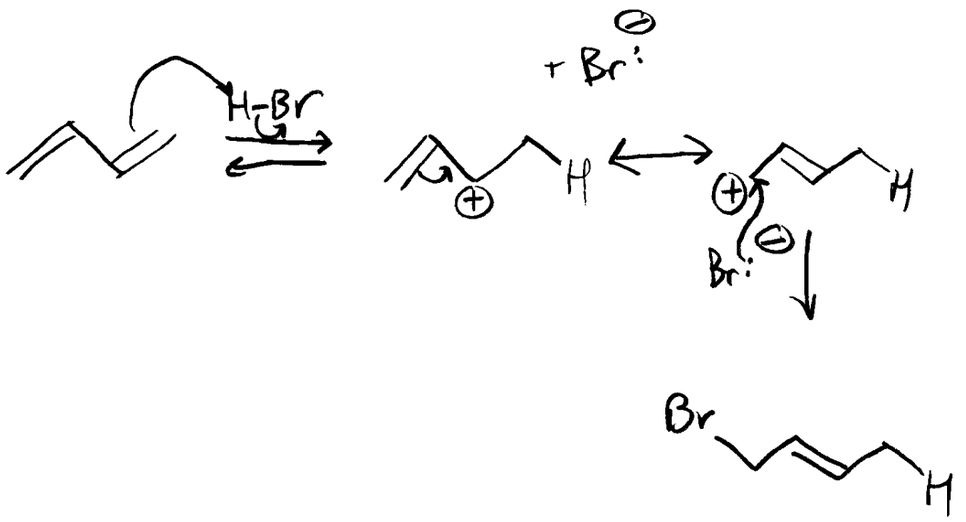


8. (From class) Addition of HBr to butadiene proceeds to make two products, A and B, as shown below. (12 points)

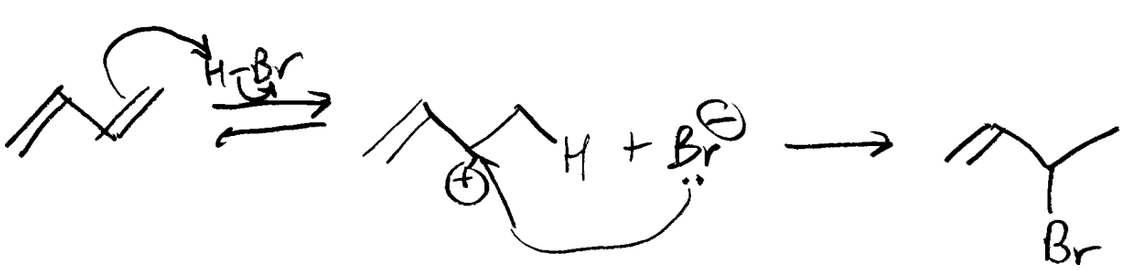


a) Write mechanisms that account for formation of both of the products, A and B, including all participating lone pairs, applicable formal charges, and required arrow pushing to indicate flow of electrons.

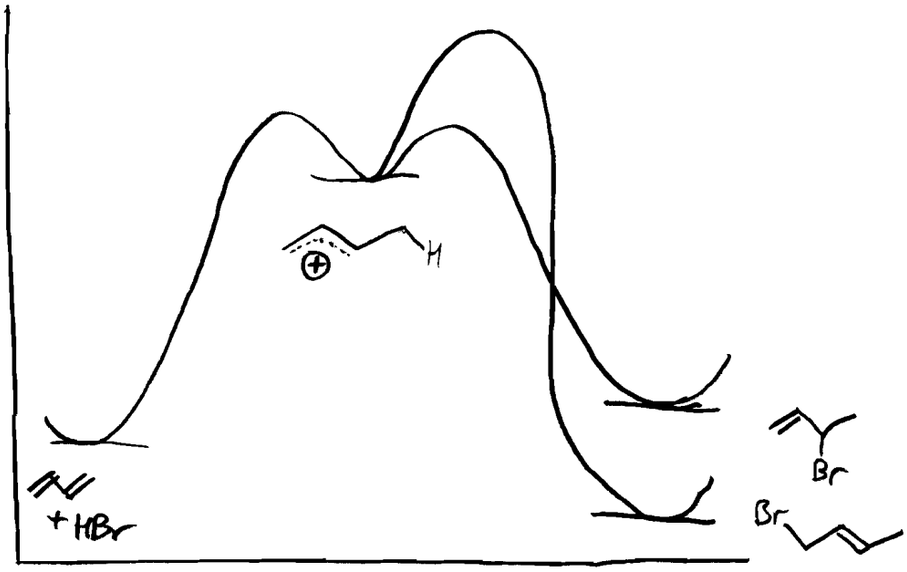
A-



B-



b) Put both reactions on the same reaction coordinate diagram, making sure to show the correct relative energy levels for the peaks and valleys. Structures should be drawn for each valley (also known as a trough).

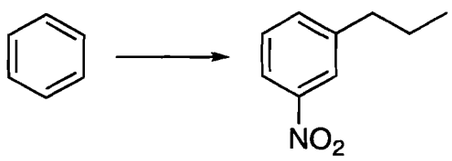


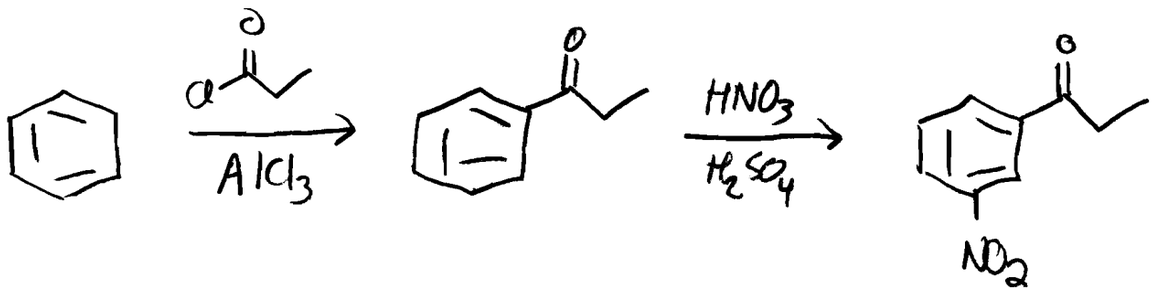
c) Briefly describe reaction conditions that would favor the formation of A as the major product, and then do the same for B.

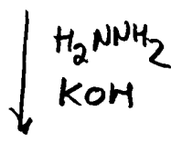
A- High temperature

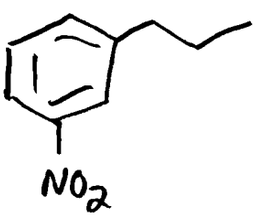
B- Low temperature

9. Please show how you would synthesize the following compound from benzene and any reagent containing 4 carbons or less. (From class notes, 6 points)

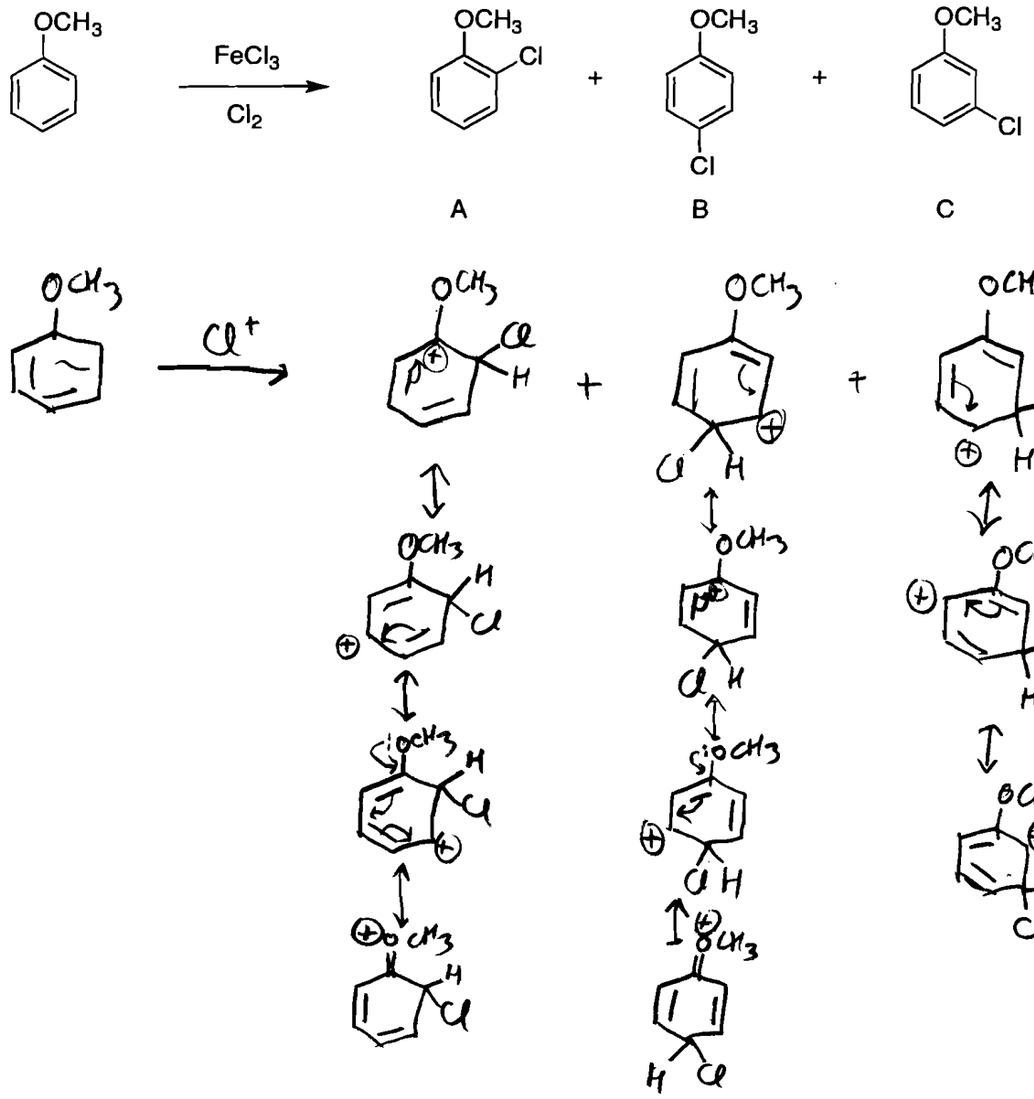






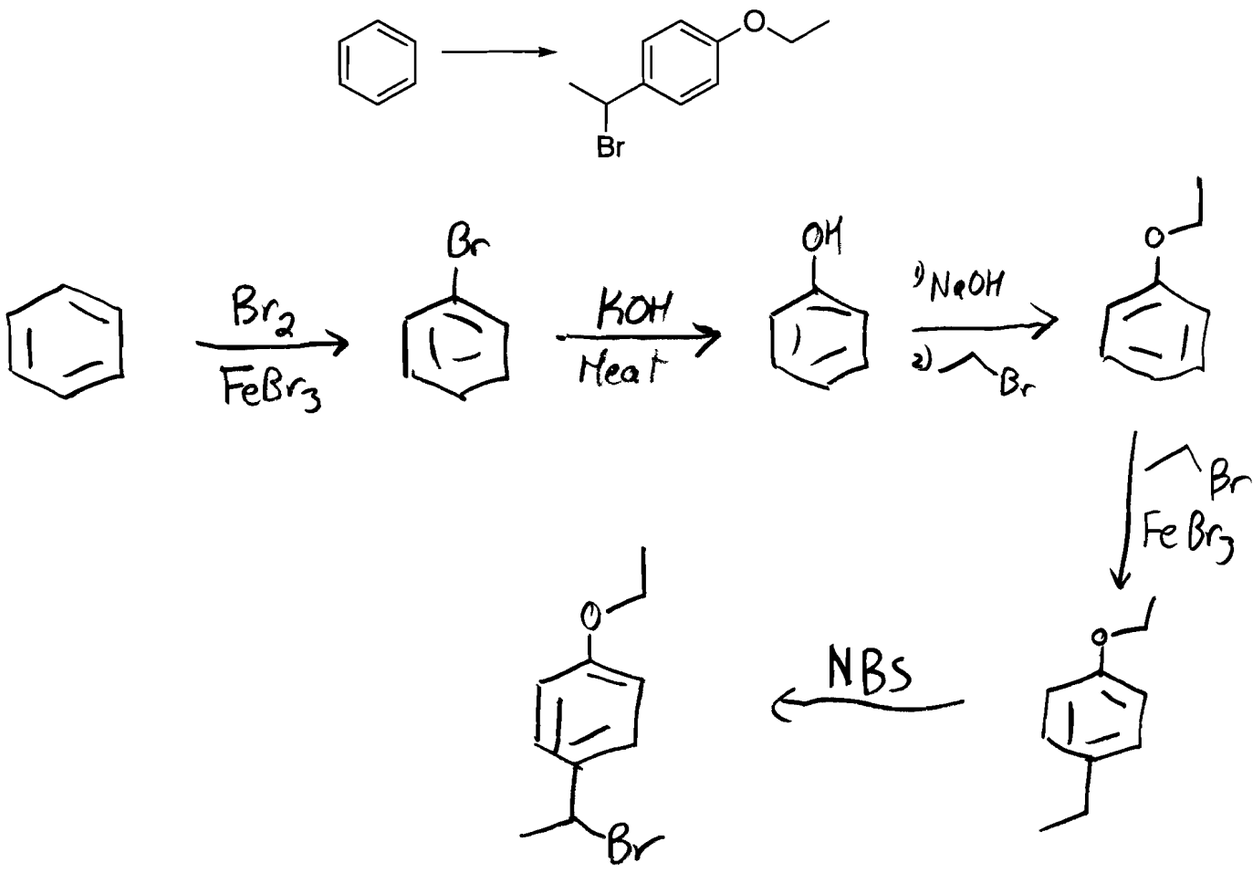


10. Electrophilic chlorination of anisole gives A and B as the predominant products, with C only formed in trace amounts. Please use resonance structures to explain this observed regioselectivity. Then, explain these resonance structures in words. (10 points)

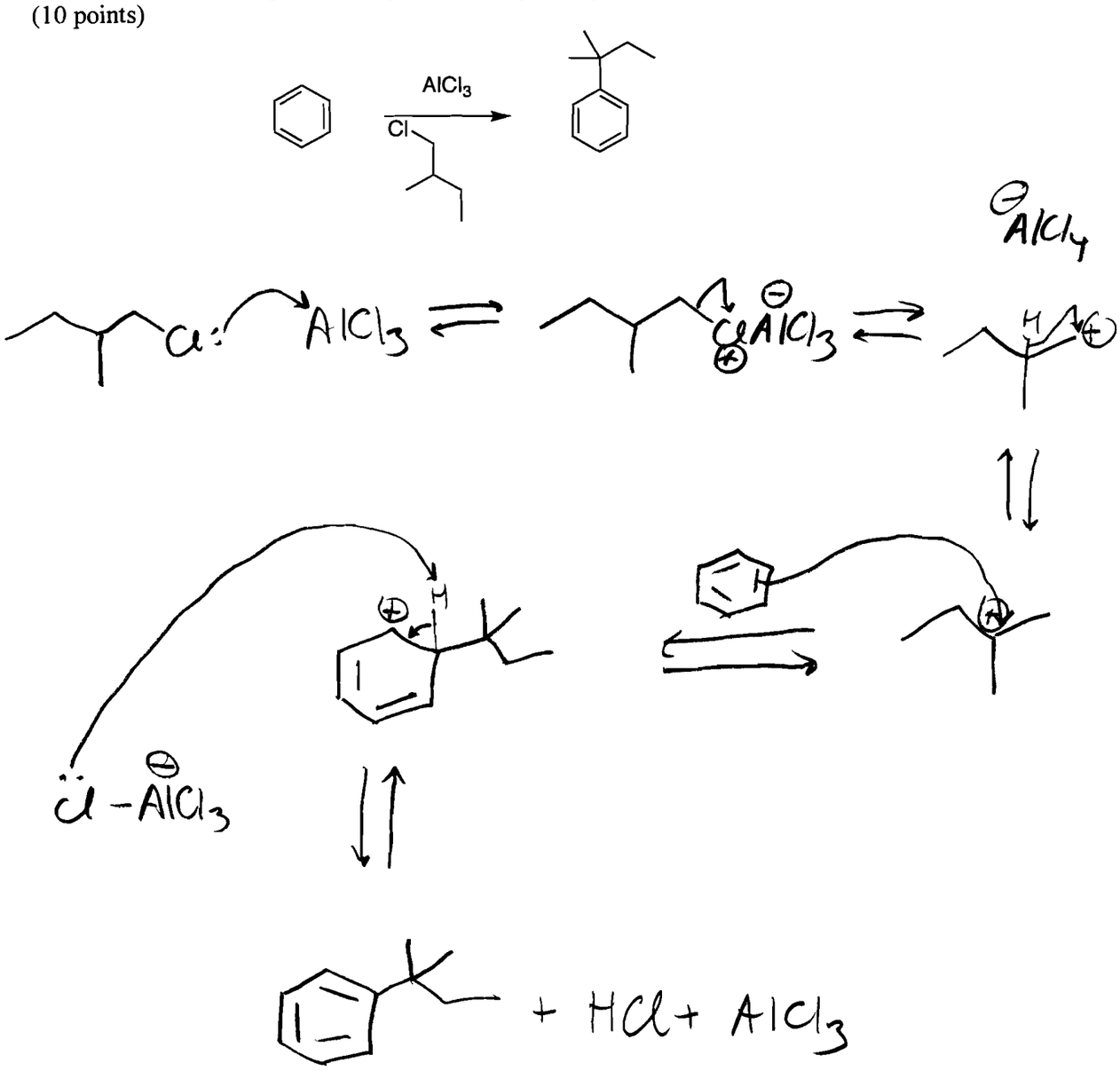


Ortho/para position have more resonance structures possible than meta, which makes addition at these positions more favorable. Also, the 4th resonance structure drawn for ortho/para has an octet on every atom (more stabilizing).

11. Please show how you would synthesize the following compound from benzene and any reagent containing 4 carbons or less. (8 points)



12. Draw the mechanism for the following reaction, including all participating lone pairs, applicable formal charges, and required arrow pushing to indicate flow of electrons. (10 points)



BONUS: What does Dr. Anslyn feel is the best part of his job as professor?

No boss