

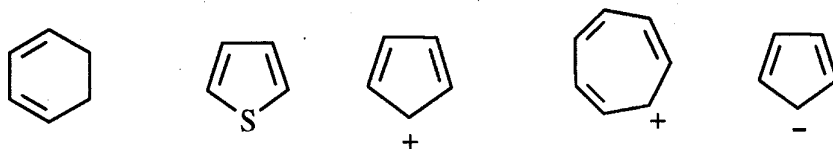
University of Windsor
Department of Chemistry and Biochemistry

Chemistry 59-235
Final Exam

Dec. 16, 1994
Time: 3 hours

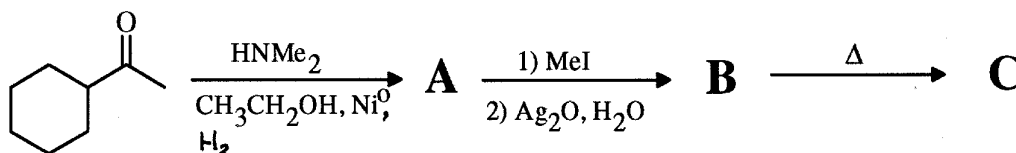
Use the following values for molecular weights: C, 12.011; H, 1.008; Cl, 35.453; O, 15.999; N, 14.007.

1. Which of the following compounds are aromatic? antiaromatic? neither? (5 marks)

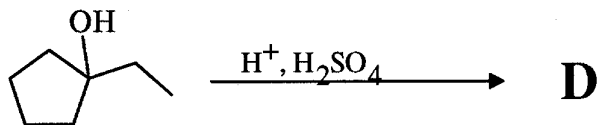


2. Predict the major products of the following transformations. Mechanisms are not necessary, but showing your work may be useful. (50 marks)

a)

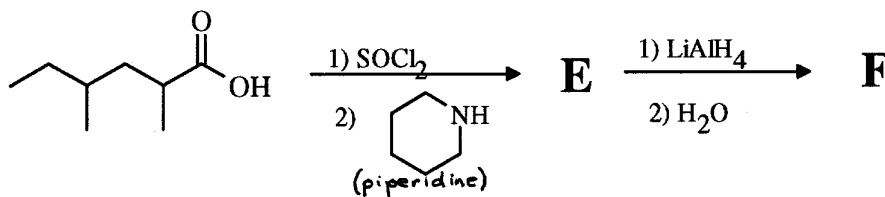


b)



What type of mechanism is this reaction following? What rule applies to the regiochemistry of this reaction?

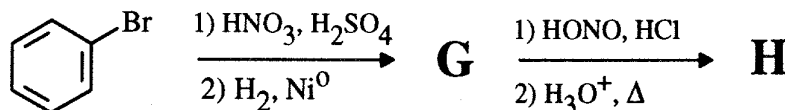
c)



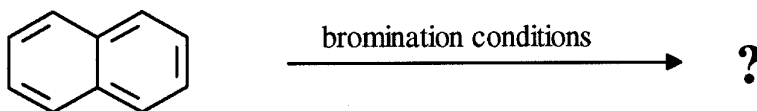
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STUDENTS
- WE DIDN'T
TAKE THIS ->

d) In the above transformation (the starting material in c) to **E**), the reaction was conducted so that at the end, there was a mixture of the starting material, the final reaction product, and the piperidine used in the reaction. Explain by use of a flowchart, or by use of text, the extraction techniques which you would use to separate the three compounds. Indicate in your answer where you would expect to find each of the compound.

e)

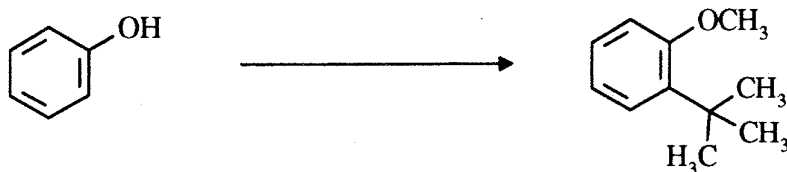


3. The electrophilic substitution of naphthalene has a preference for attack at one of the sites over the others. Using the electrophilic **bromination** of naphthalene, show by mechanism why this is the case and where the substitution occurs. Include the appropriate conditions for reaction. (10 marks)



4. Show by equation (in one or several steps) how you could prepare the products illustrated below from the given starting materials. You may use any other reagents you deem fit. Show all reagents, conditions, and isolable intermediates. Mechanisms are not necessary, but showing your work may be a help. **Do any three (30 marks).**

a)

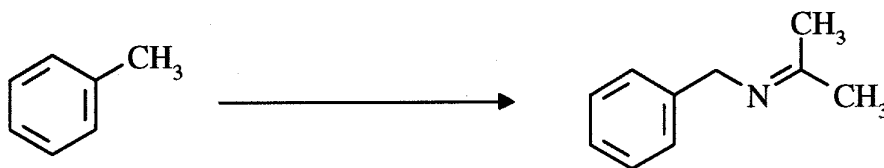


YOUR ANSWER SHOULD BE DESIGNED TO GET HIGHLY ORTHO-REGIOCHEMISTRY.

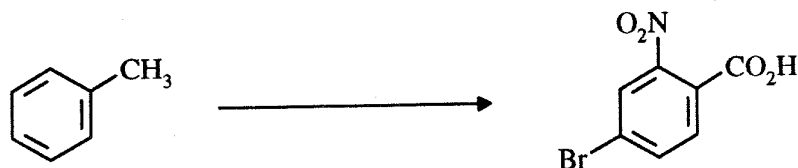
b)



c)

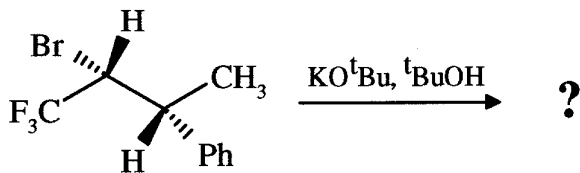


d)

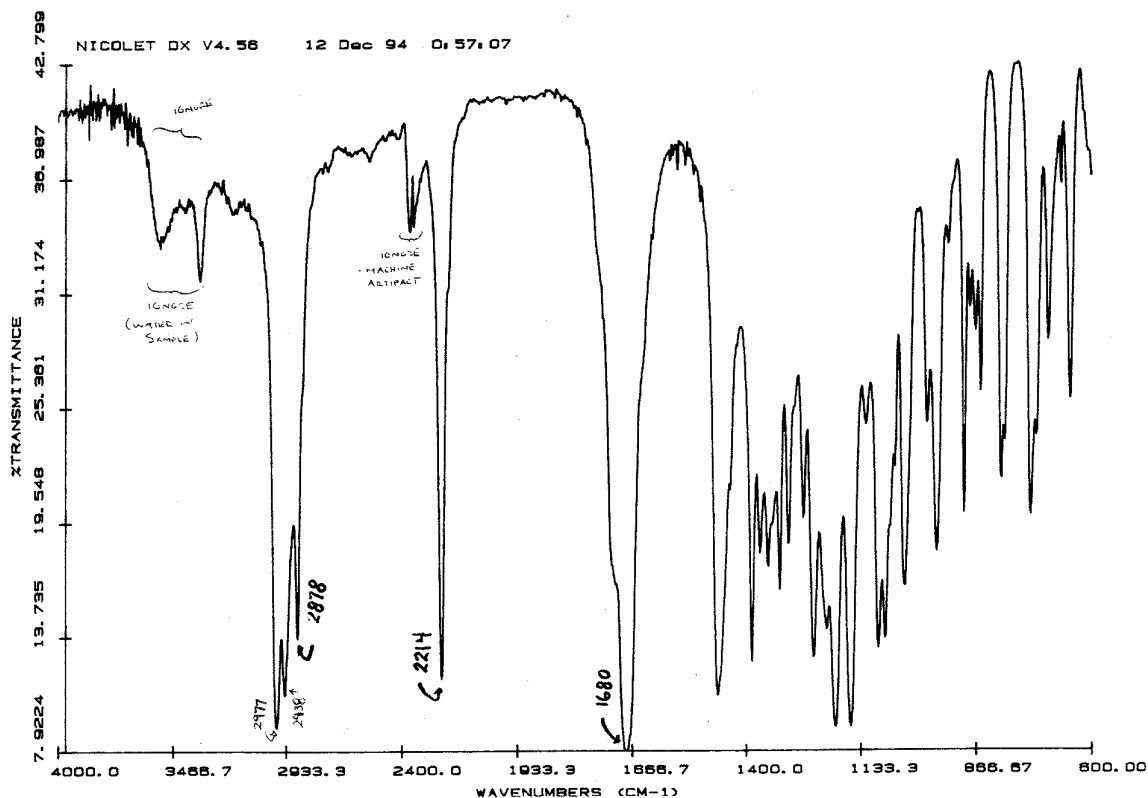
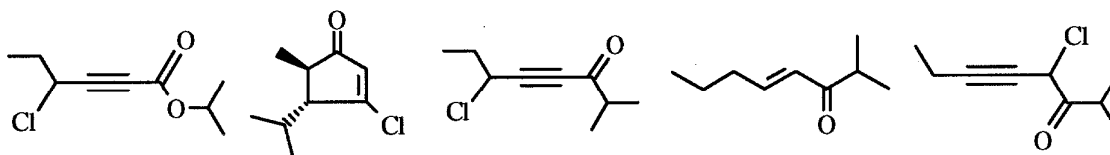


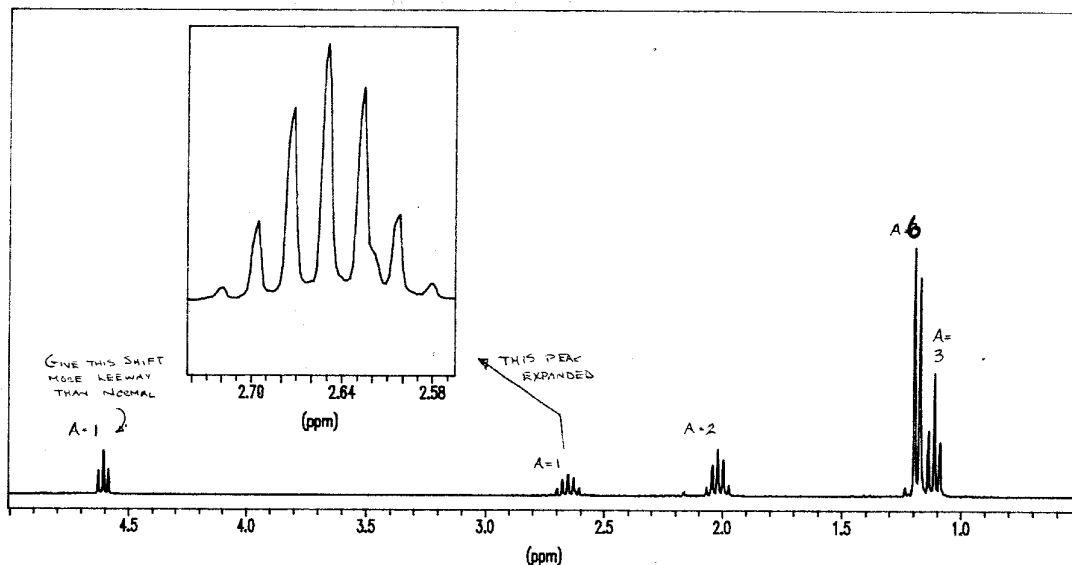
5. Explain the stereochemical outcome of the following reaction using Newman projections or any other drawings which effectively show the spatial relationship of the substituents during this reaction, and your knowledge of the reaction's characteristics. What type of mechanism is

this? (10 marks)



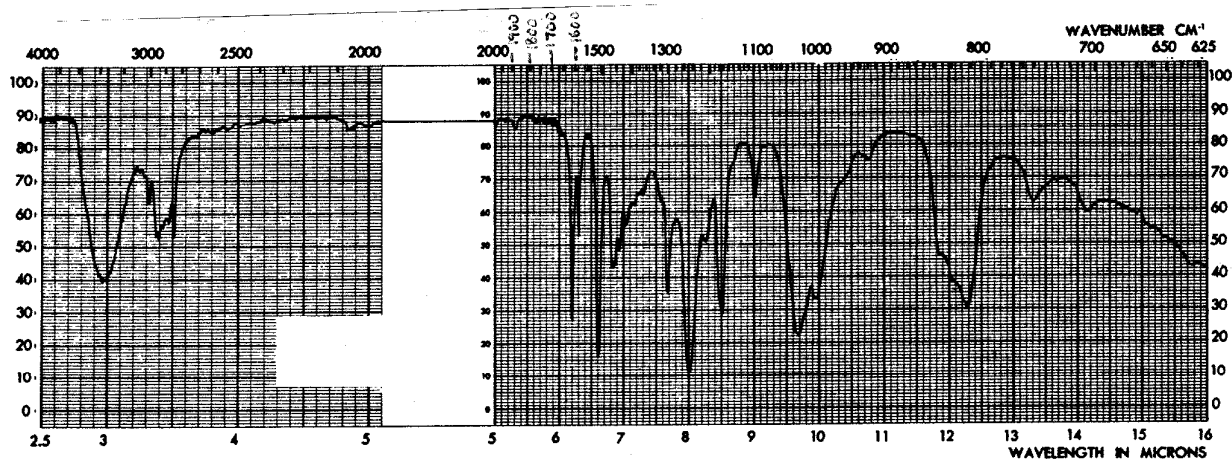
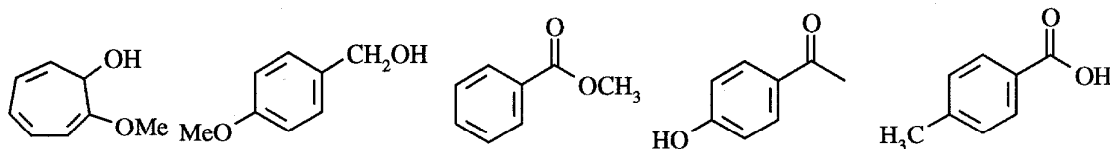
6.a) The following compound was analyzed, revealing C, 62.61%; H, 7.59%; Cl, 20.53%; O, 9.27%. The compound also gave infrared (IR) and ^1H NMR spectra as follows. Which of the following structures is the most reasonable candidate for the compound, and why? Assign the ^1H NMR spectrum, showing the comparison of the calculated chemical shifts with the observed ones. Your answer should also include the most important features in the IR spectrum, and what they mean. (15 marks)





b) The following compound was analyzed, revealing C, 69.55%; H, 7.30%; O, 23.16%. The Compound also gave infrared (IR) and ¹H NMR spectra as follows. Which of the following structures is the most reasonable candidate for the compound, and why? Assign the ¹H NMR spectrum, showing the comparison of the calculated chemical shifts with the observed ones. Your answer should also include the most important features in the IR spectrum, and what they mean. (15 marks)

Note: It may be a wise to consider **a multiple** of the simplest possible elemental formula which your calculations give.



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