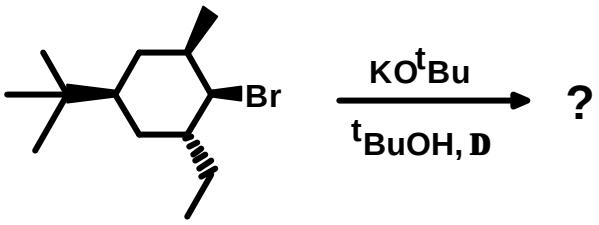
University of Windsor
Department of Chemistry and Biochemistry

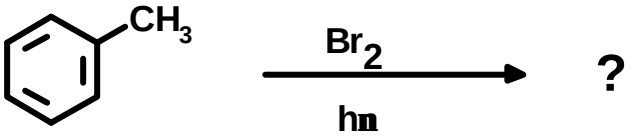
Chemistry 59-235 Apr. 12, 1999
Final Exam Time: 3 hours

Answer all questions in the exam booklet(s) provided. Use the following values for molecular weights: C, 12.011; H, 1.008; Br, 79.904; Cl, 35.453; O, 15.999; N, 14.007.

1. Show the product of the following reaction. Explain clearly, in terms of the conformations available and the hydrogen atoms available, the reasoning behind your choice of reaction pathways, and the name of the mechanism this reaction is occurring under. Include the appropriate stereochemistry in your product. (**10 marks**)

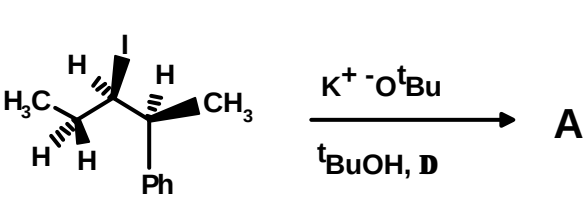


2. Give the complete mechanism for the radical bromination of toluene. Include the important initiation and propagation steps, and one reasonable termination step. Any small molecules given off should also be included, as should the product structure. (**10 marks**)

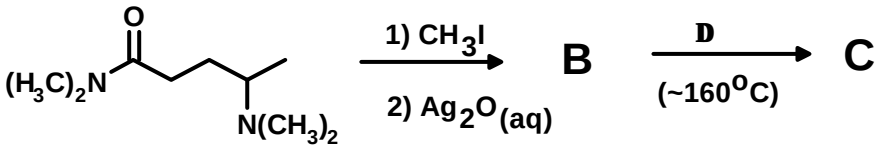


3. Predict the major products of the following transformations. Mechanisms are not necessary, but showing your work may be useful If there's a major and minor product, show them both and take the major one on to any subsequent step.. (**5 marks each letter, 50 marks total**)

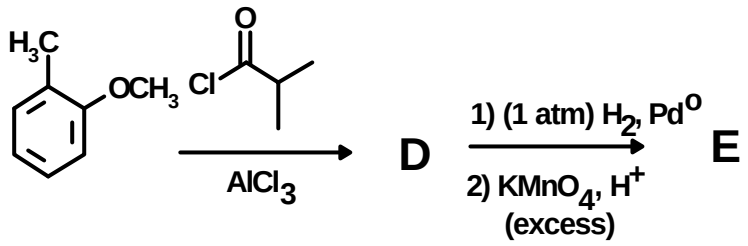
a)



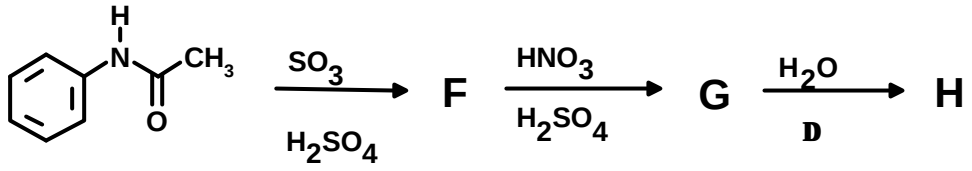
b)



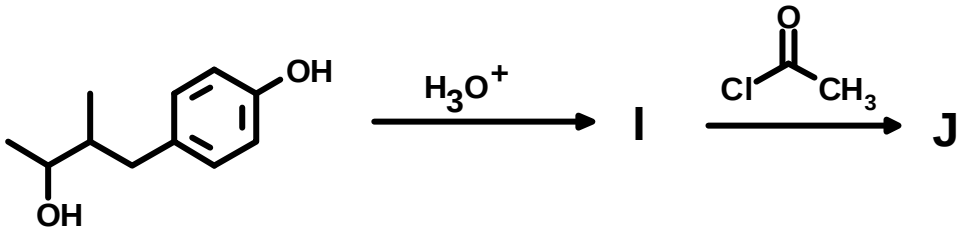
c)



d)

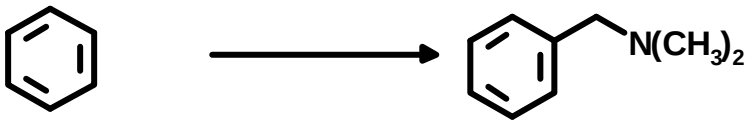


e)

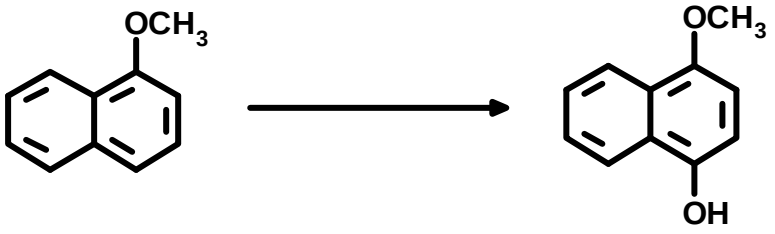


4. Show by equation (in one or several steps) how you could prepare the products illustrated below from the given starting materials. You may use any other reagents you deem fit. Show all reagents, conditions, and isolable intermediates. Mechanisms are not necessary, but showing your work may be a help. **Do any four** (**40 marks**).

a)

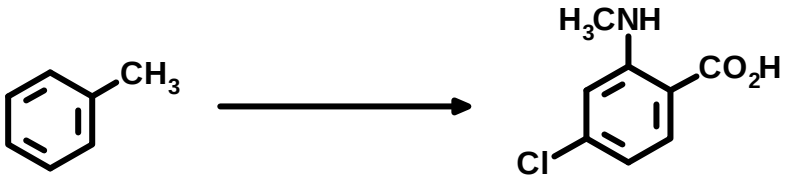


b)

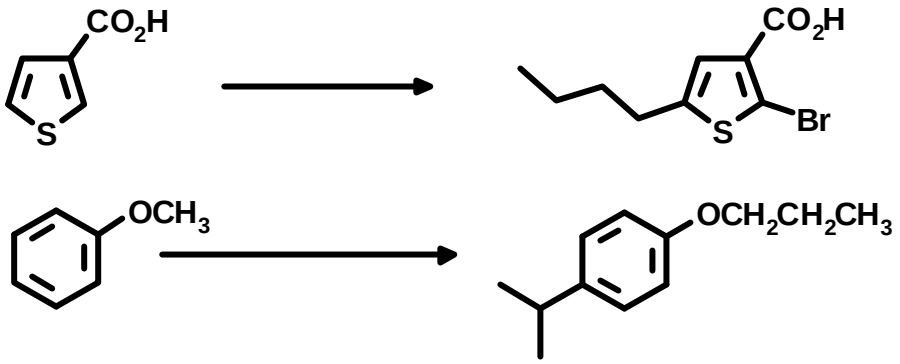


c)

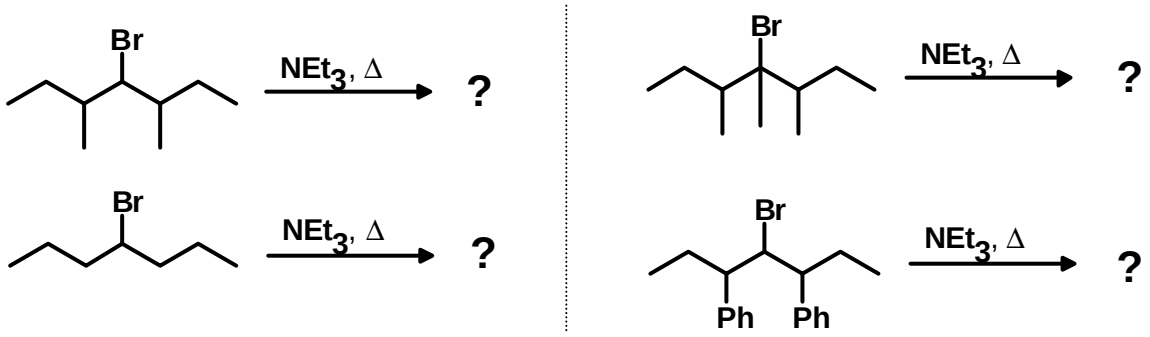
d)



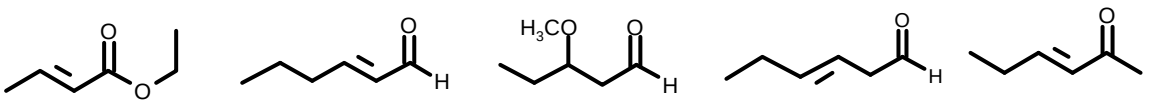
e)

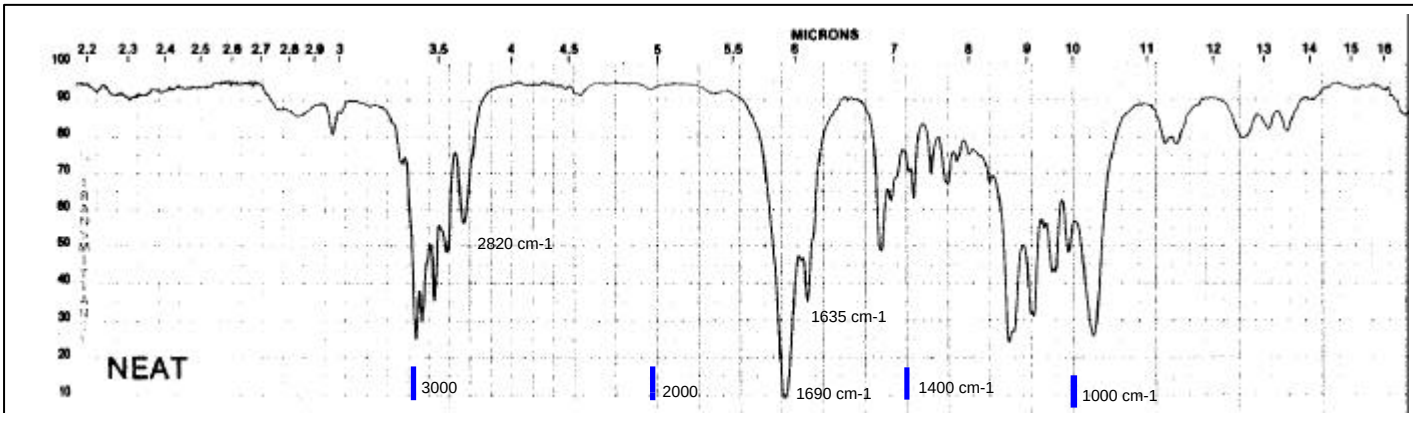


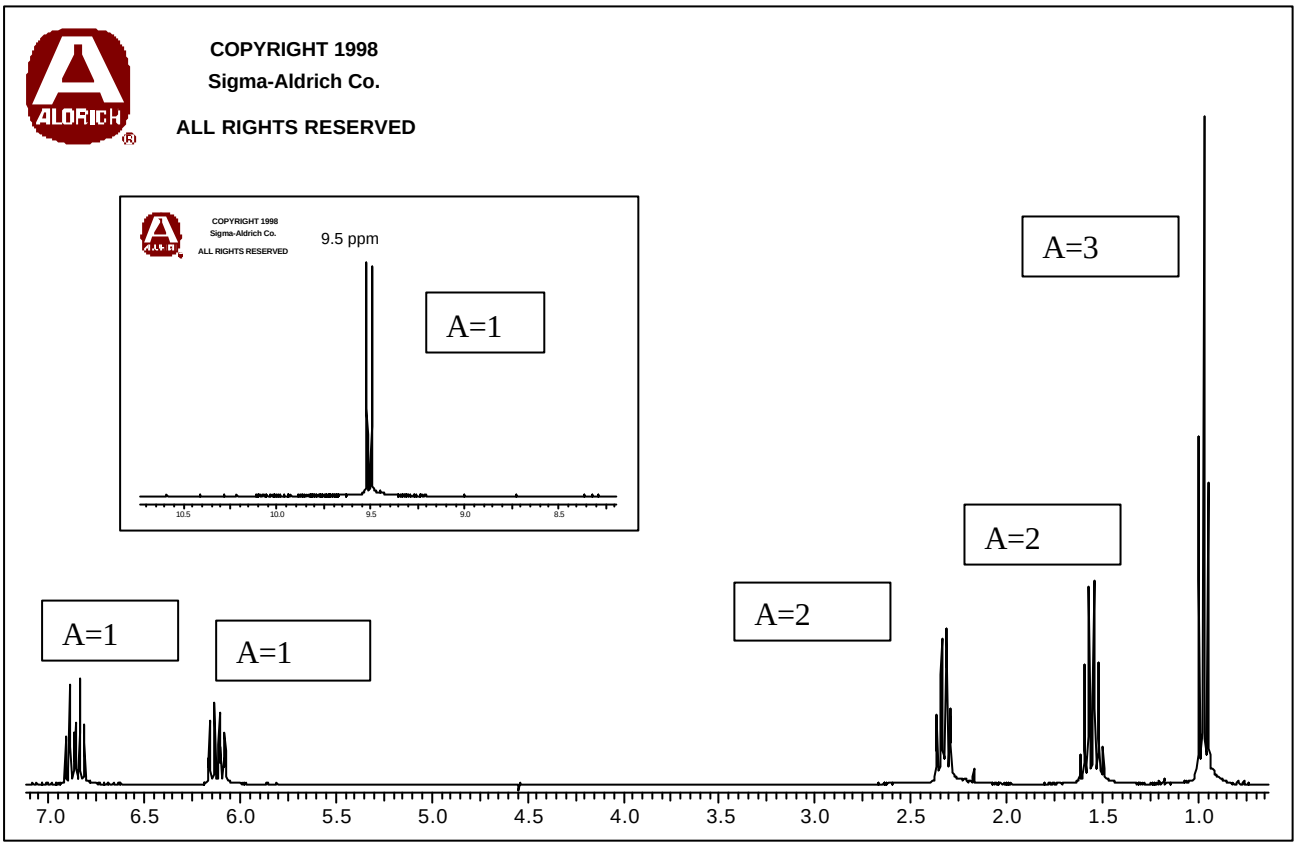
5. Rank the following reactions in their relative ability to undergo an E2 elimination as opposed to an E1 elimination. Include the reasons for your ordering *and* the product structures. Stereochemistry can be ignored, though. (**10 marks**).



6. The following compound has been analyzed, revealing a composition of C, 73.43%, H, 10.27%, O, 16.30%. The IR (infrared) and ^{1}H NMR spectra are also included below. Which of the following structures is the most reasonable candidate for the compound in question, and why? Assign the ^{1}H NMR spectrum, showing the comparison of your calculated chemical shifts with the observed ones. Your answer should also include the assignment of the most important features (i.e., the starred ones) of the IR spectrum. (**15 marks**)







Bonus:

One of the olefin polymerization catalysts is the following chloride. Give a plausible mechanism for how it causes polymerization of the indicated alkene. There should be initiation, propagation, and termination steps.