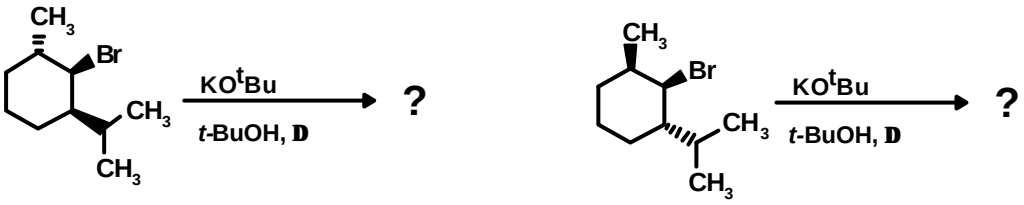
**UNIVERSITY OF WINDSOR**
**Chemistry and Biochemistry**

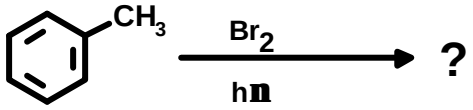
**Chemistry 59-235** **Apr. 24, 2000**
**Final Exam** **Time: 3 hours**

Answer all questions in the exam booklet(s). 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.** One of the following reactions proceeds more slowly than the other. Indicate which of the reactions is faster (or slower), and clearly explain the reasons why this is the case. Include the structure of both reaction products in your answer. Note: Isopropyl is a somewhat larger than methyl, and bromine acts as if it's not very large at all. (**10 marks**)

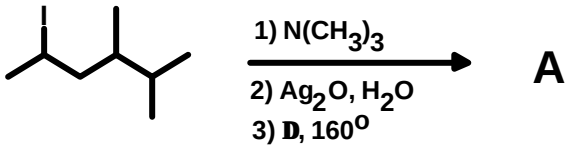



**2.** Show the complete mechanism for the following transformation. Classify each of the steps as either initiation, propagation, or termination. I only need *one* reasonable termination step. Be sure the product structure is included. (**10 marks**).



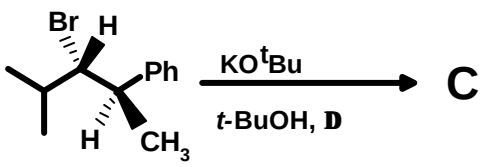

**3.** Predict the major products of the following transformations. Mechanisms are not necessary, but showing your work may be useful (**5 marks each, 50 total**).

**a)**

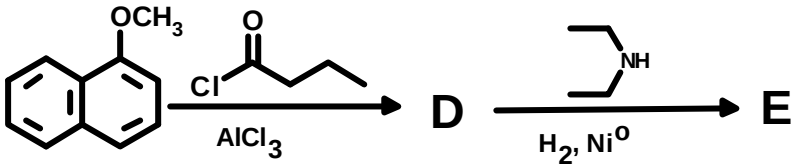



What would happen to the final products if $N(CH_2CH_3)_3$ was used instead in step 1)? Call these products **B**.

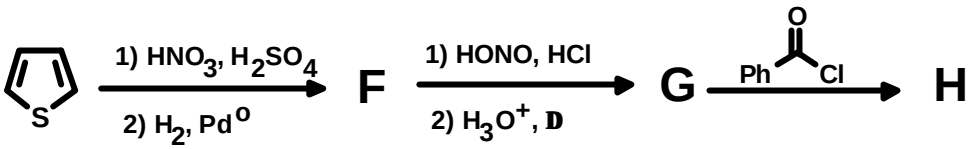
**b)**



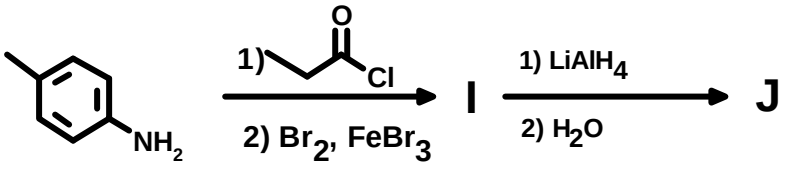
**c)**




**d)**

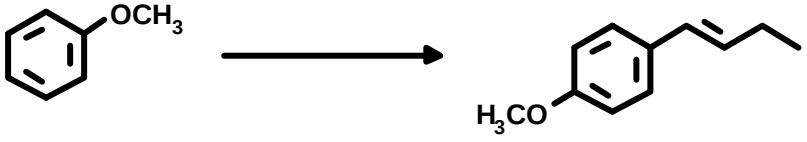



**e)**

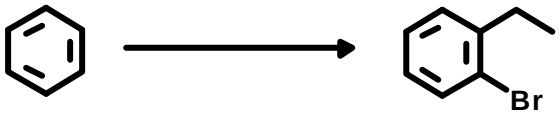



**4.** Show by equation (in one or several steps) how you could prepare the products illustrated below from the given starting materials. You may use any other reagents you deem fit. Show all reagents, conditions, and isolable intermediates. Mechanisms are not necessary, but showing your work may be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

**a)**




**b)**

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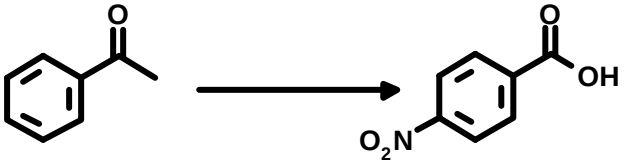
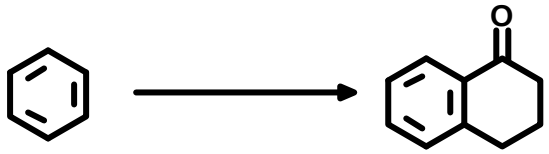
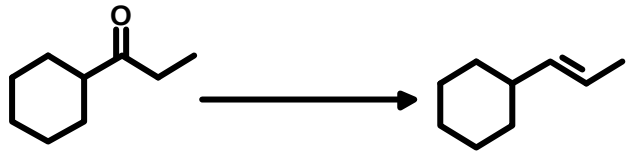
**c)**



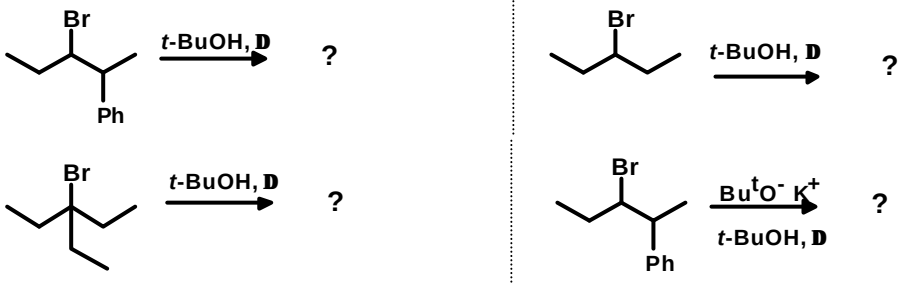
**d)**



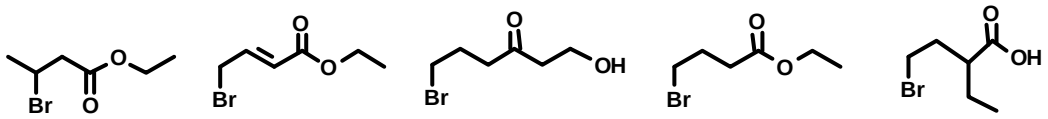
**e)**

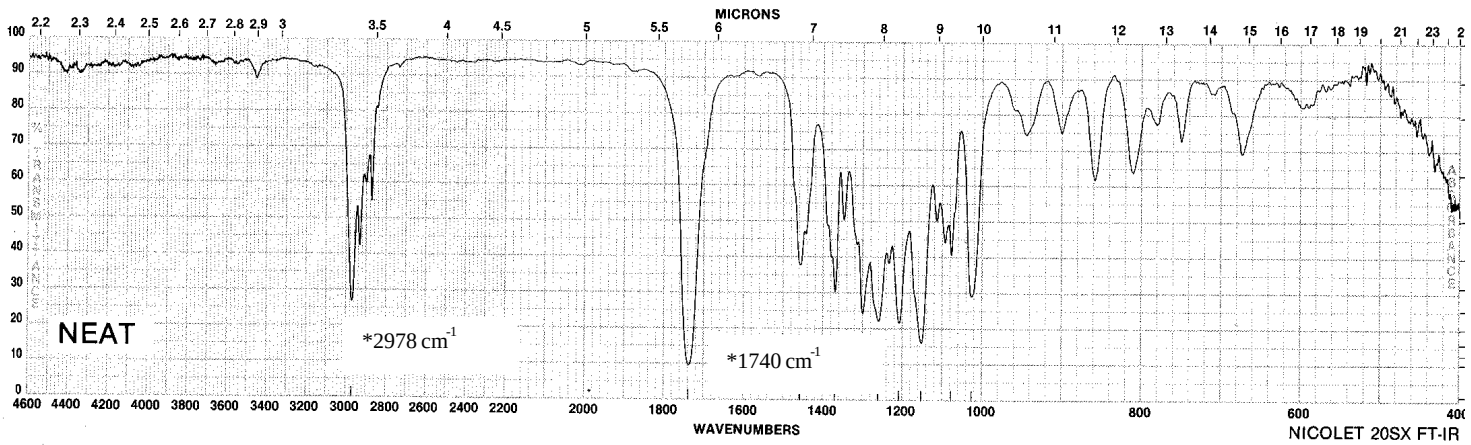


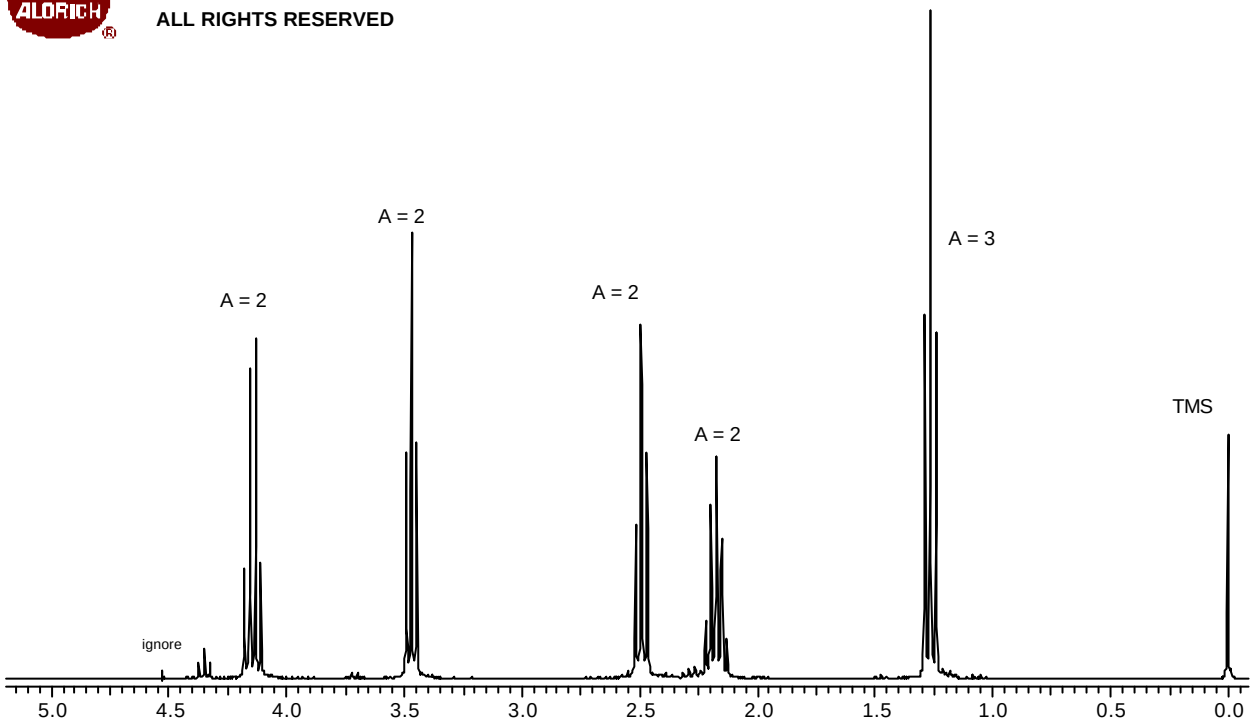
**5.** Rank *all four* of the following reactions in their *relative* ability to undergo E2 elimination as opposed to an E1 elimination. Include the reasons for your ordering and the product structures. (**10 marks**).




**6.** The following compound has been analyzed, revealing a composition of C, 36.95%, H, 5.68%, Br, 40.97, O, 16.40%. 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 NMR spectrum, showing the comparison of your calculated chemical shifts with the observed ones. Your answer should include the assignment of the most important features (i.e., the starred ones) of the IR spectrum. (**15 marks**)






**Bonus:** Arenes can be reduced by $H_2$ and a transition metal catalyst, but it is not often a practical, as it only occurs under unusually forcing conditions, and pretty much everything else is reduced more easily. There *is* a convenient way to reduce benzenes, using sodium (or lithium) in liquid ammonia. What is the mechanism of the following reduction, and what is the product?