

Sample Final (Chapters 8 – 15)

Recommended time is 120 minutes; there are 105 points possible, but the exam is scored out of 100 (consider the extra five points to be “extra credit”). The exam is closed books (textbooks and other books) and websites, but open notes, class handouts, lab notebooks, homework and exercises. There is to be no collaboration.

1. A compound called Frank with the molecular formula C_9H_{10} reacts with bromine in carbon tetrachloride. Frank gives an IR spectrum:

Wave-number (cm^{-1})	3035	3020	2925	2853	1640	990	915	740	695
Peak strength	Med.	Med.	Med.	Weak	Med.	Strong	Strong	Strong	strong

The proton NMR spectrum of Frank is:

Chemical shift	splitting	integration
3.1	Doublet	2
4.8	multiplet	1
5.1	multiplet	1
5.8	multiplet	1
7.1	multiplet	5

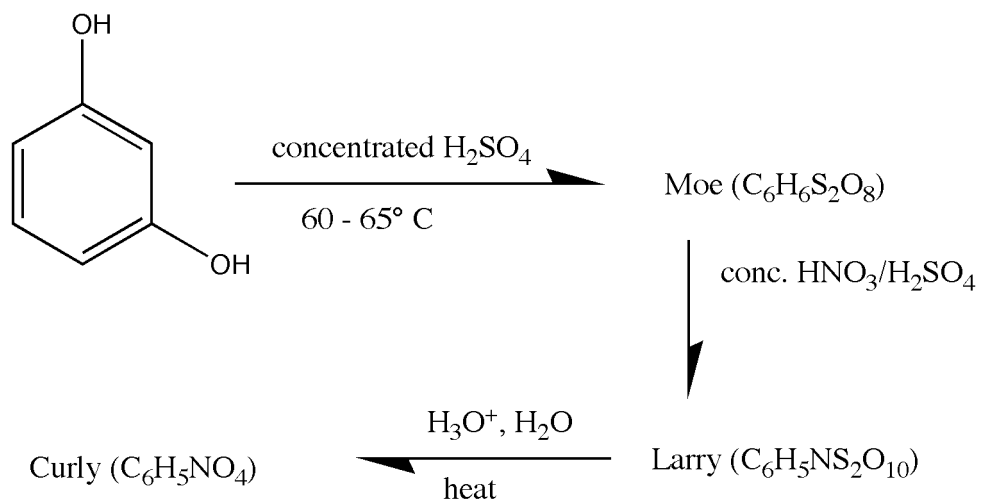
“Multiplet” refers to peaks that have been split and resplit such that no simple splitting pattern can be found.

a. (5 points) Write the **structural formula** of Frank (i.e., draw its structure).

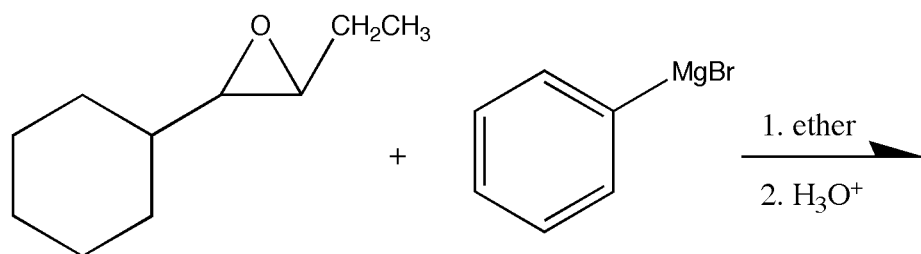
b. (10 points) Write the structural formula of the bromine product and assign four (you pick them) IR peaks to particular bonds.

c. (5 points) Assign the peaks of the NMR spectrum to protons in the structural formula.

2. (15 points) Propose structures for the molecules called Moe, Larry and Curly below:

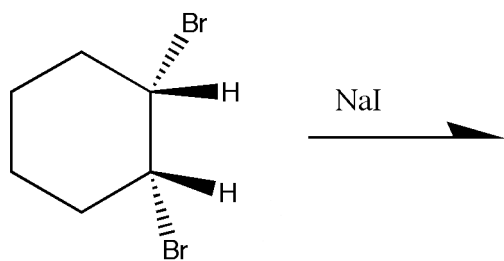
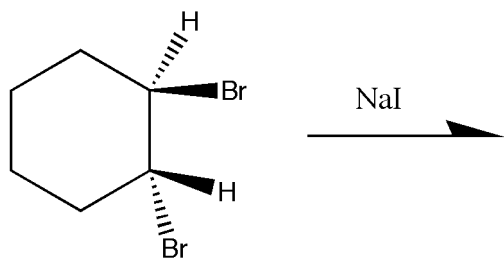


3. a. (5 points) Predict the product:

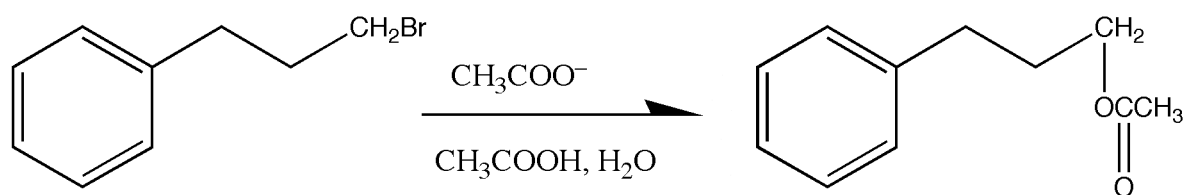
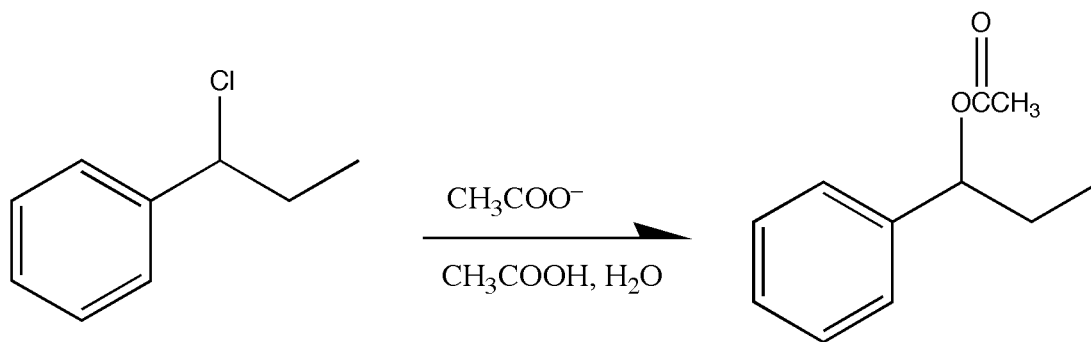


b. (10 points) Write a plausible mechanism; it is okay to abbreviate the phenyl ring as "Ph" and the cyclohexyl ring as "Ch".

4. (10 points) Under E2 conditions, are the products the same or different in the following two reactions? Justify your answer by citing a mechanism, or at least a portion of a mechanism!

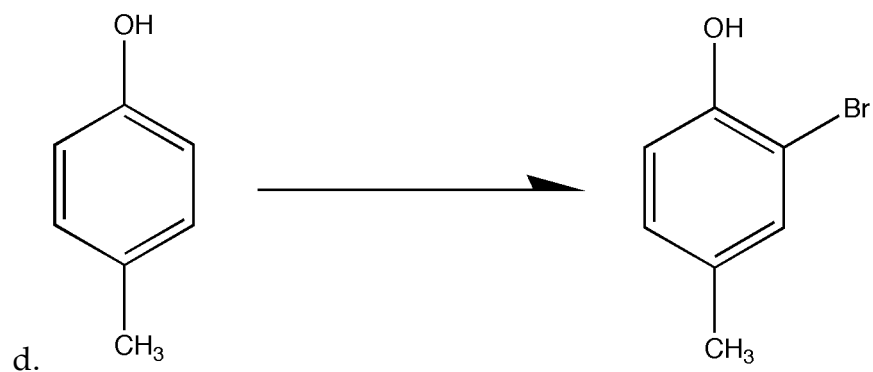
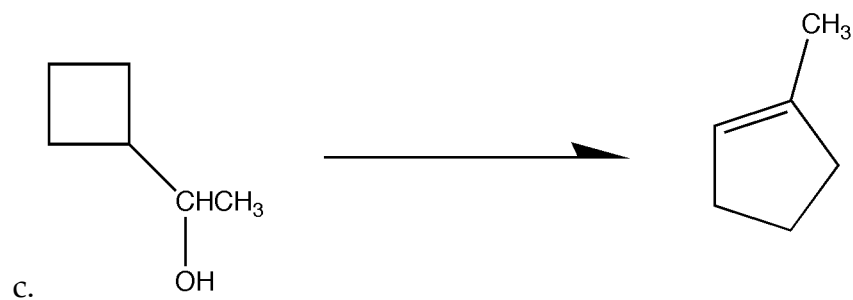
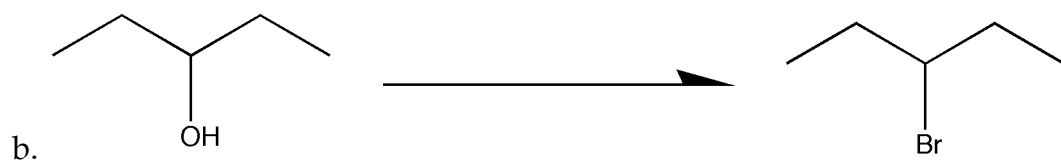
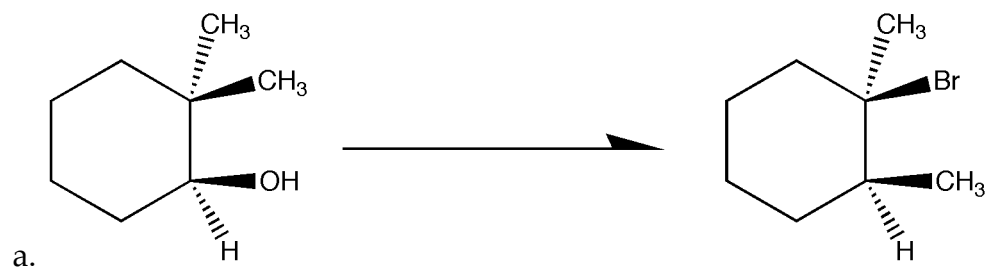


5. (10 points) Predict whether each of the following substitution reactions is likely to be S_N1 or S_N2 :

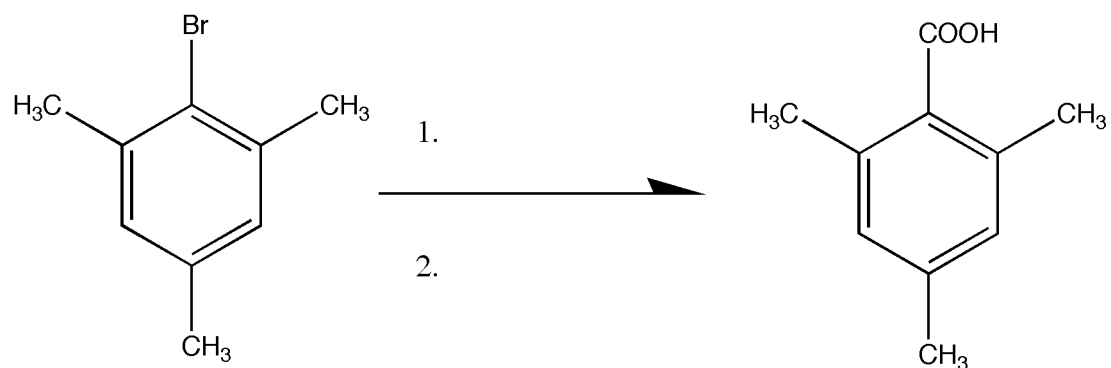


Please justify your choices.

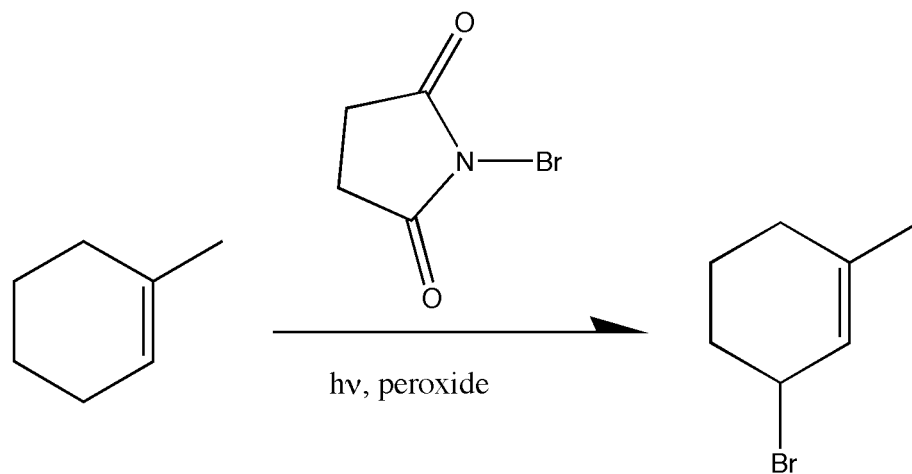
6. (15 points) Give the other reactants and any appropriate conditions for the following reactions:



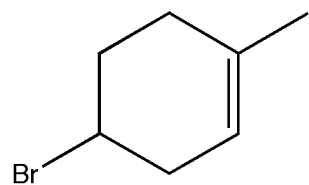
e. (note that there are two steps required)



7. a. (5 points) Did you really think you could get through this exam without a radical question? (That was not really a question). Write the mechanism for the following reaction:



b. (10 points) In the reaction on the previous page, why is the product the one given and not:



Hint: resonance of the intermediate...