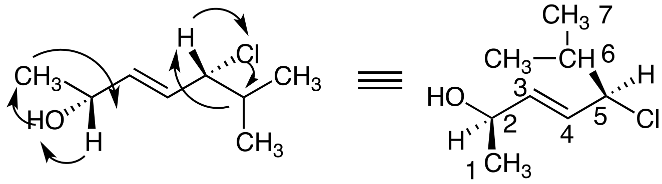
Final Exam - Long Island University

Chem. 121, Sect, 009, 010, 012 Fall, 2012, 250 points

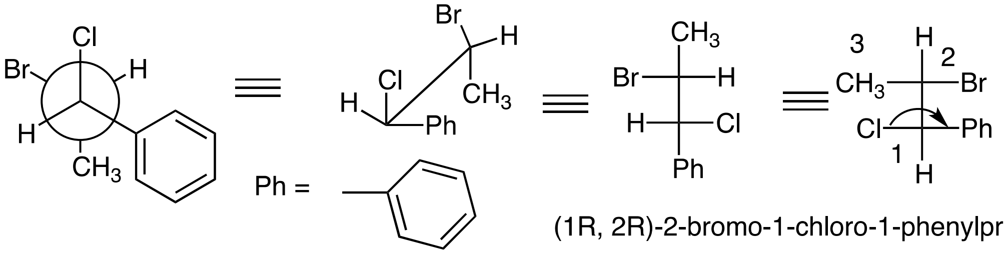
1. Name the following molecules and assign the absolute configuration (R or S) to each chirality center and also specify E or Z where appropriate. (20 pts)

(a)



(E, 2R, 5R)-5-chloro-6-methyl-3-hepten-2-ol

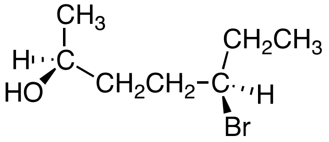
(b)



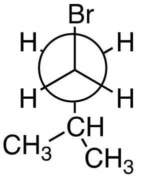
(1R, 2R)-2-bromo-1-chloro-1-phenylpropane

2. Draw the following molecules (a) (2S, 5R)-5-bromo-2-heptanol and (b) the low energy Newman projection looking down the C1-C2 bond for 1-bromo-3-methylbutane. (20 pts)

(a)

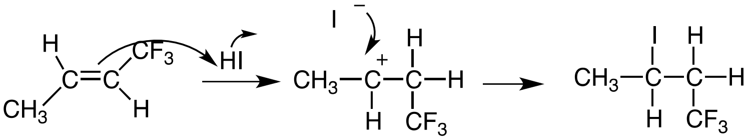


(b)



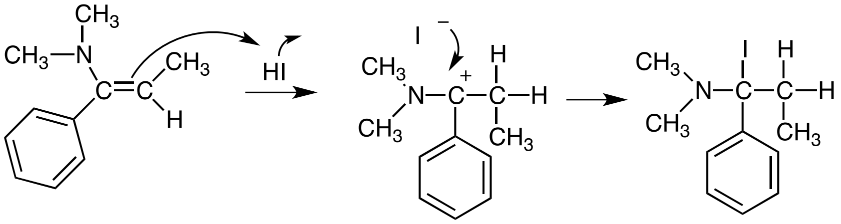
3. Which alkene would react faster with HI? Explain your answer briefly and show the product for each reaction and the full reaction mechanism in each case. Pay attention to the regiochemistry. (30 pts)

A



Reacts much more slowly since the -CF_3 group is a strong EWG and deactivates the double bond.

B

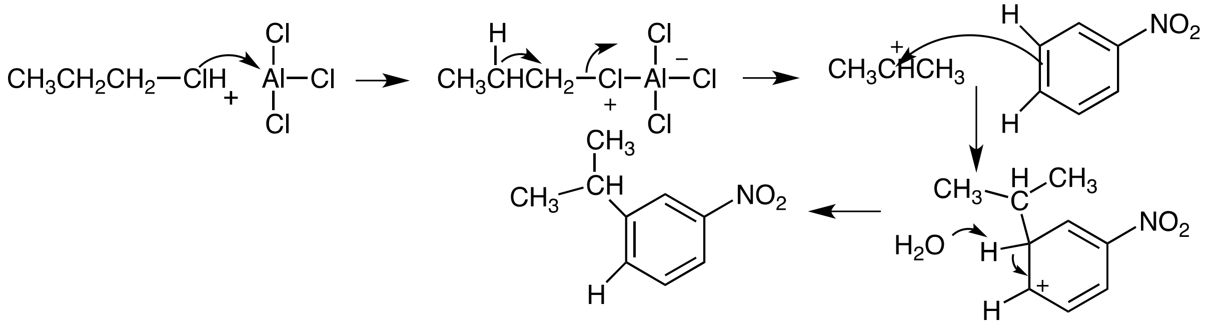


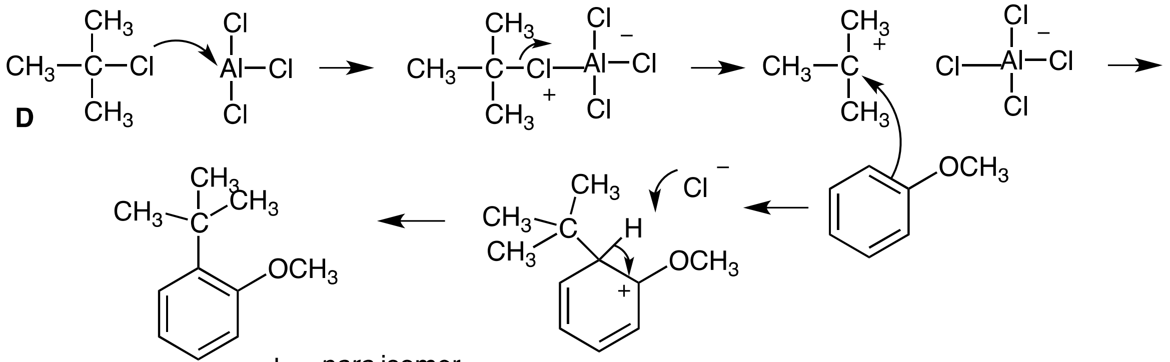
Reacts much faster since the carbocation is stabilized by resoance donation by the benzene ring and by the amino group, which is a strong electron donating group.

4. Which of the following reactions would be faster? Explain your answer briefly and show the product for each reaction and the full reaction mechanism in each case. Pay attention to both the benzene substrate and the alkane electrophile and to the regiochemistry of the products. (30 pts)

Reaction **D** is much faster for two reasons: (1) there is a strong electron donating group on the benzene ring that makes the ring much more electron rich and therefore a much better nucleophile. (2) The *t*-butyl chloride electrophile will form a much more stable tertiary carbocation than the 1-chloropropene and therefore the carbocation will form faster.

C

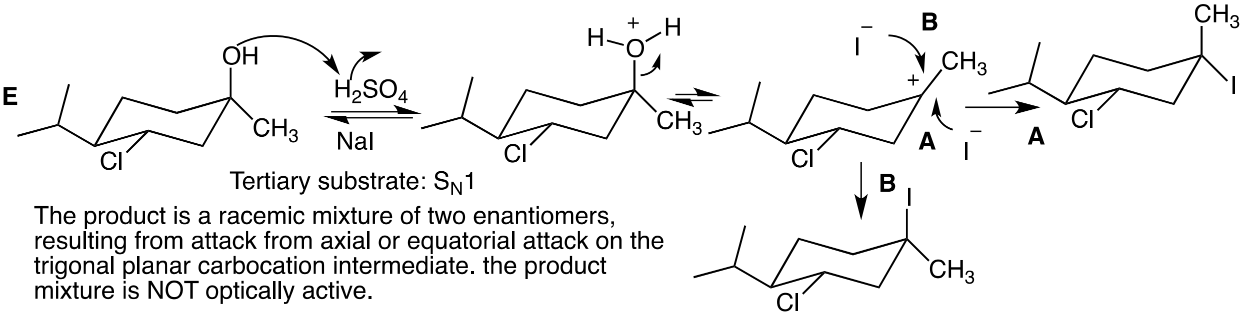




+ *para* isomer

5. In the following two reactions, both of the starting materials are optically active. Give the product of each reaction, showing the full reaction mechanism, and in each case determine whether the product is optically active. (30 pts)

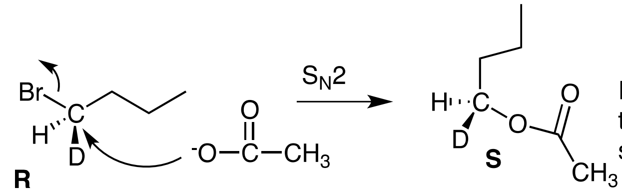
E



Tertiary substrate: S_N1

The product is a racemic mixture of two enantiomers, resulting from attack from axial or equatorial attack on the trigonal planar carbocation intermediate. the product mixture is NOT optically active.

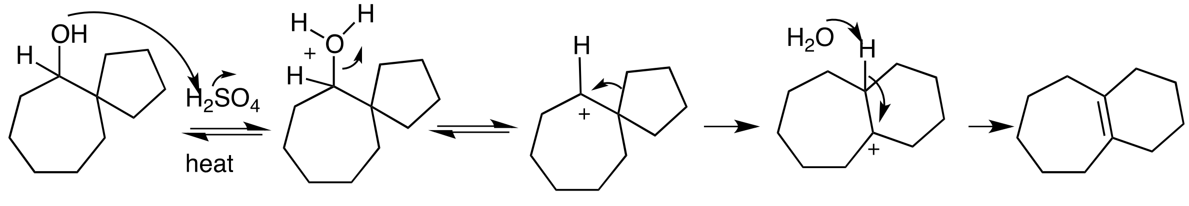
F



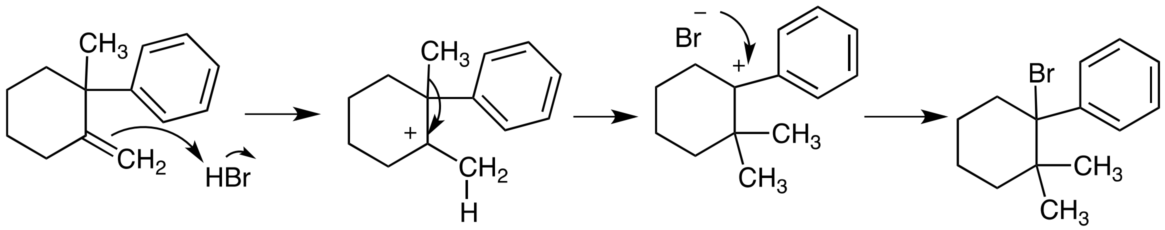
Reaction **E** proceeds by an S_N2 mechanism in which there is complete inversion; therefore, the product is still optically active.

6. Show how the following reactions occur, giving a detailed mechanism in each case, showing all intermediates. No other reagents are needed except those given over the arrow. (45 pts)

(a)



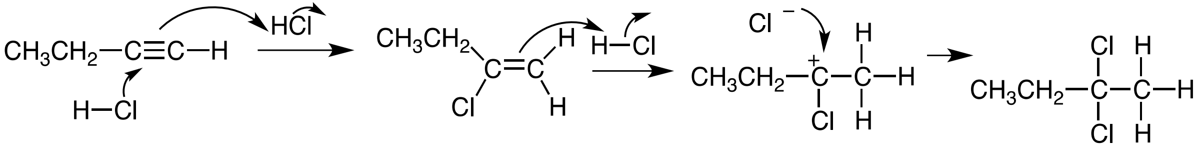
(b)



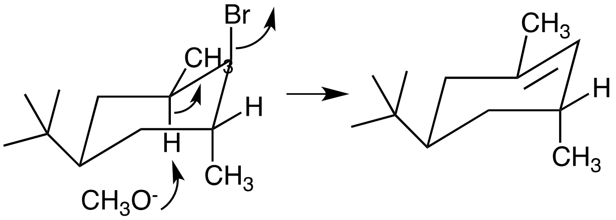
Secondary carbocation; we see rearrangement to the much more stable tertiary benzylic carbocation.

7. Give the product and show the complete reaction mechanism in each case. (45 pts)

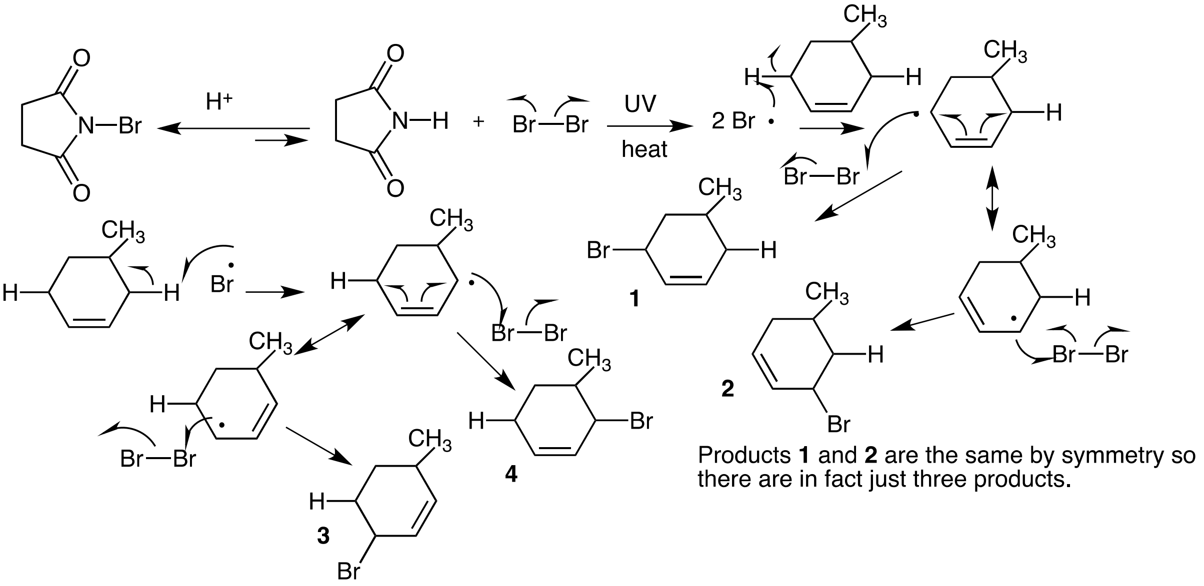
(a)



(b)

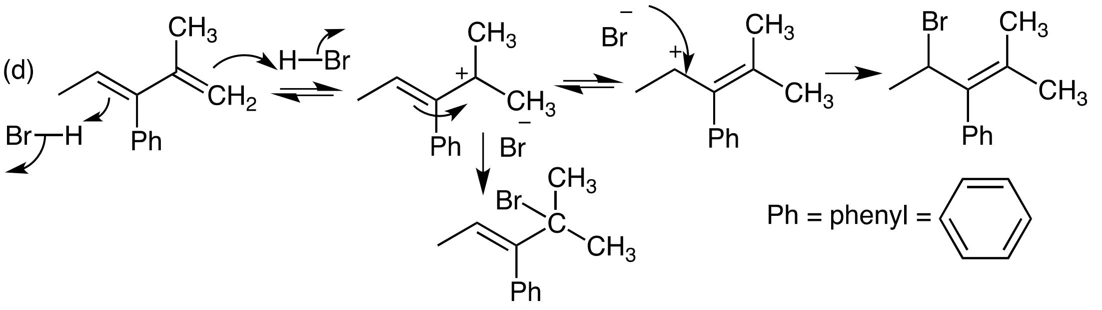


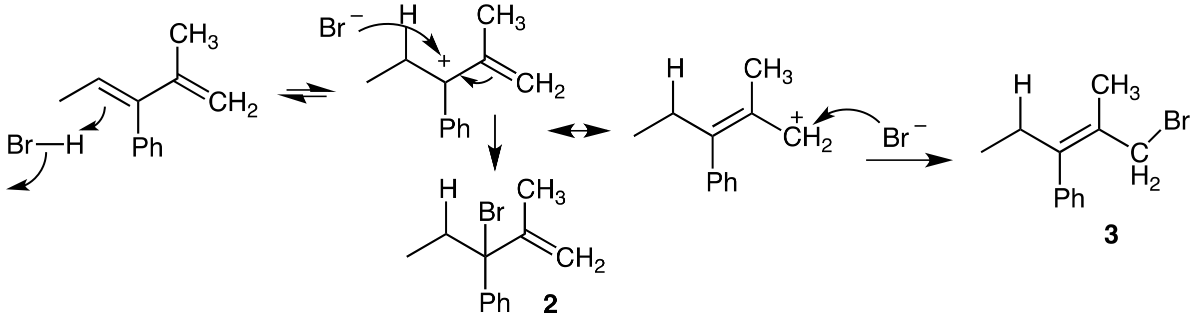
(c)



Products **1** and **2** are the same by symmetry so there are in fact just three products.

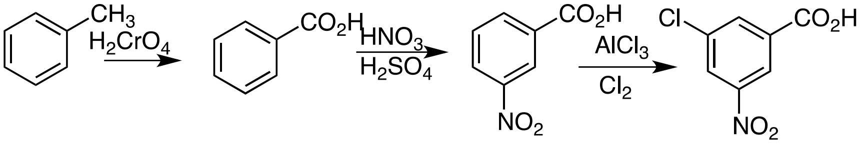
(d)

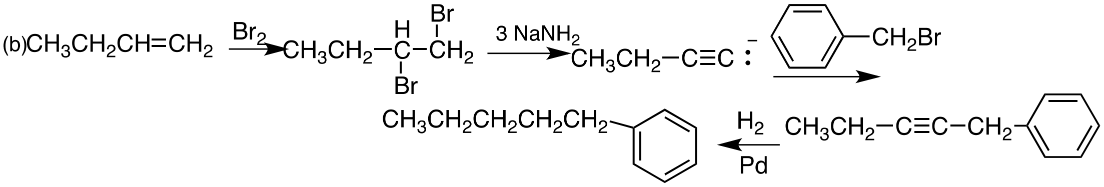




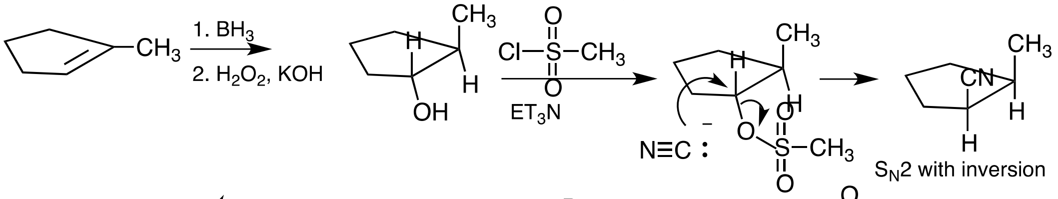
8. Synthesize **three** of the following molecules from the starting materials shown on the left. There may be more than one step involved. You do not need to show the reaction mechanisms. Do all four for extra credit. (30 pts)

(a)





(c)



(d)