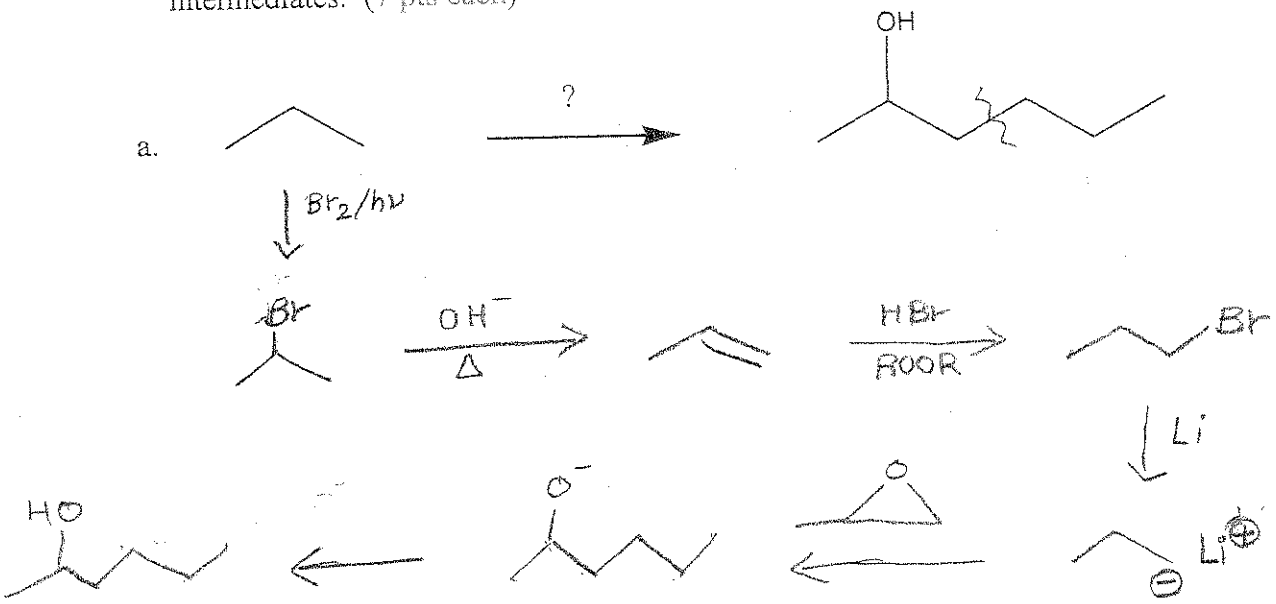
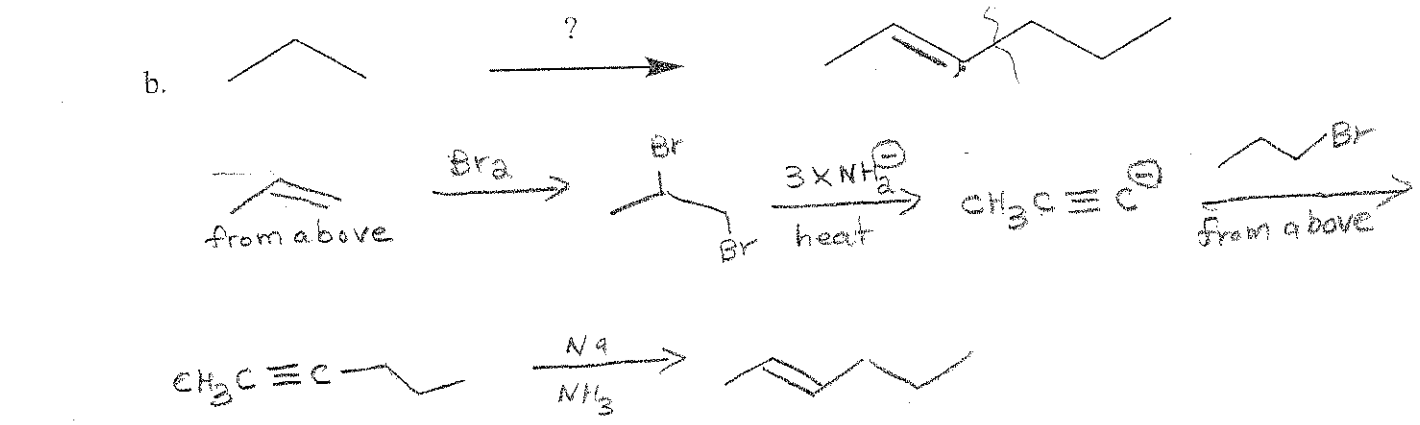
1. For each of the following problems, give a step by step scheme showing how you would accomplish each synthetic transformation. You may use any sources of carbon that you wish, but **you must use propane in each synthesis**. You must show all reagents and intermediates. (7 pts each)

a.

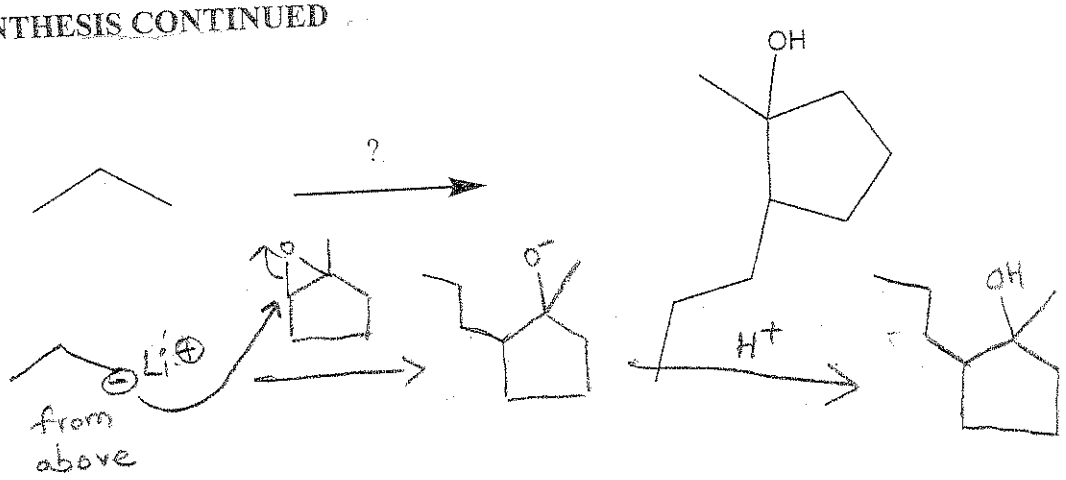


b.

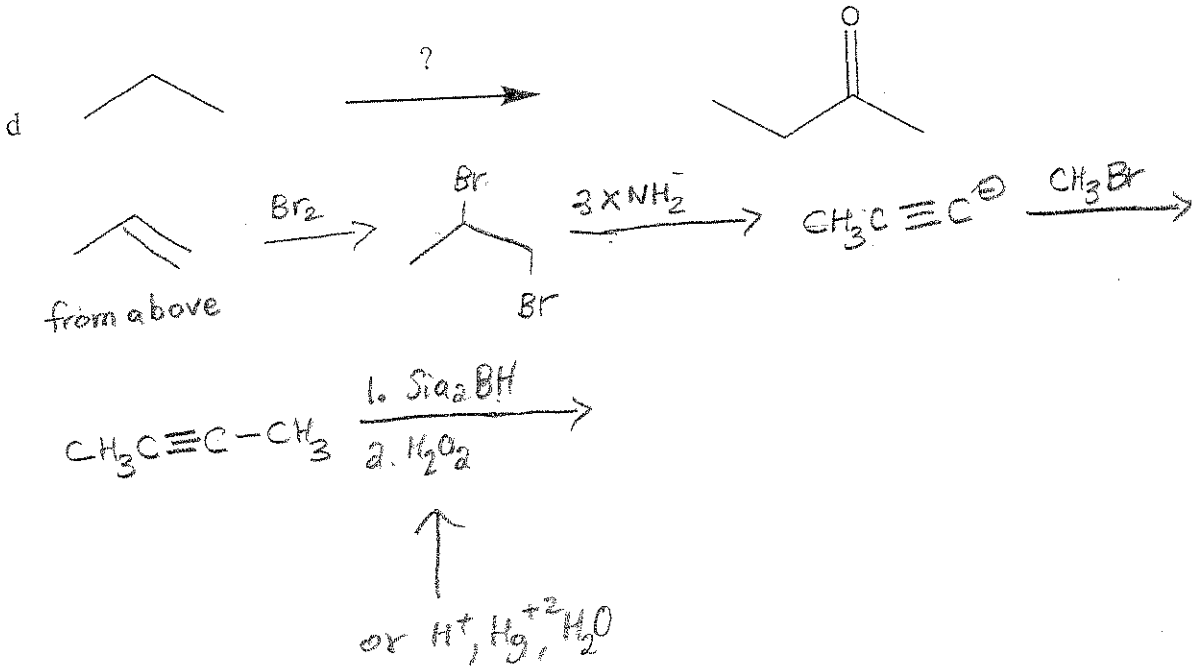


SYNTHESIS CONTINUED

c.

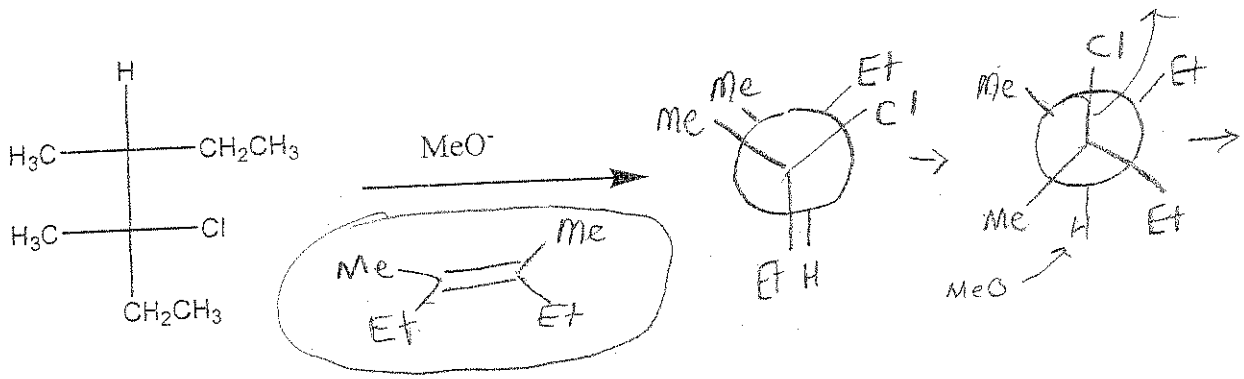


d

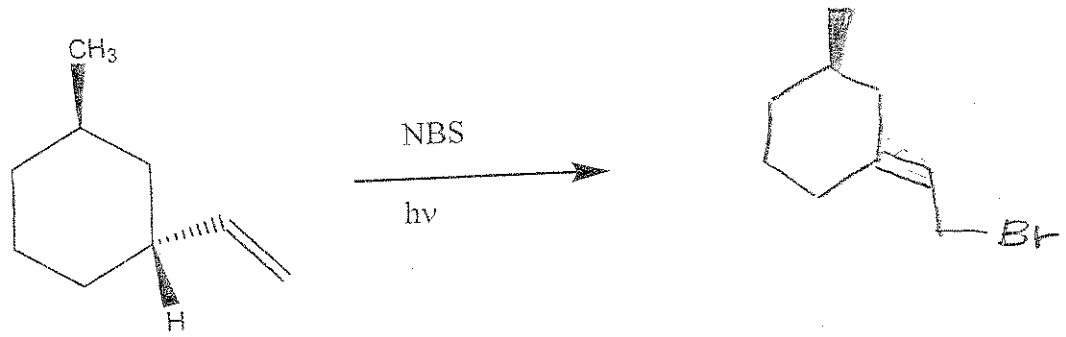


2. Show the **major** product or products in each of the following reactions. Do not show minor products. Be sure to show proper stereochemistry. (4 pts each)

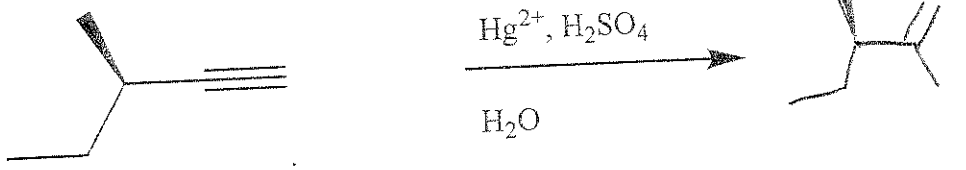
a.



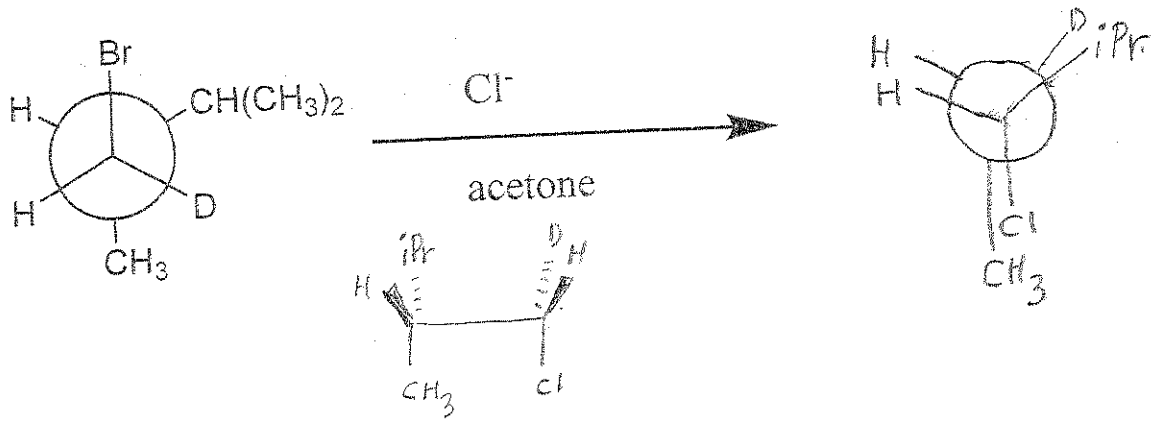
b.



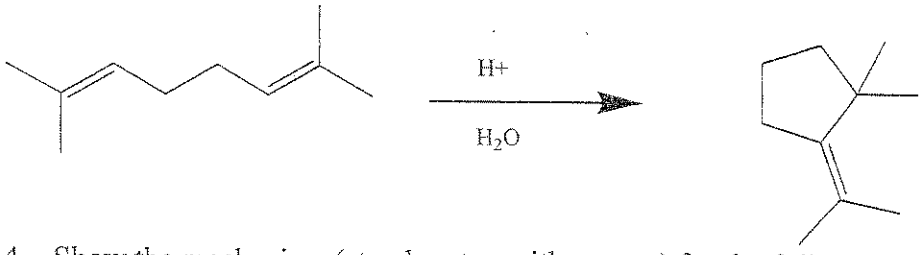
c.



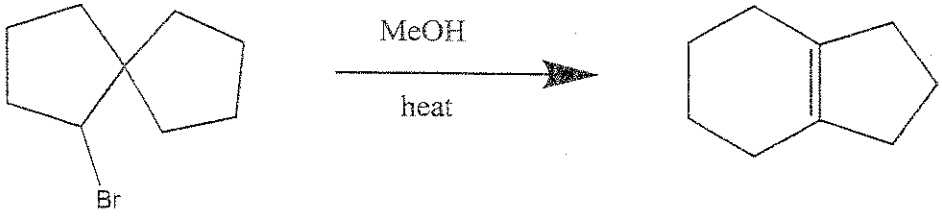
d.



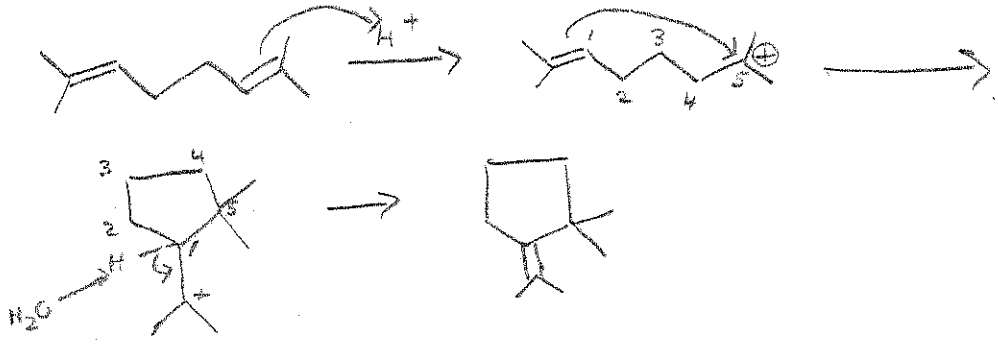
3. Show the mechanism (step by step with arrows) for the following reaction. (7 pts)



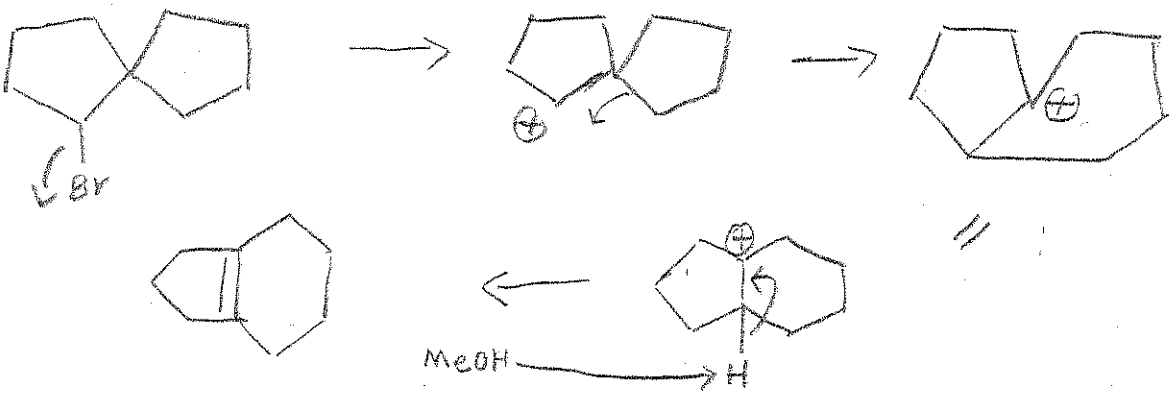
4. Show the mechanism (step by step with arrows) for the following reaction. (7 pts)



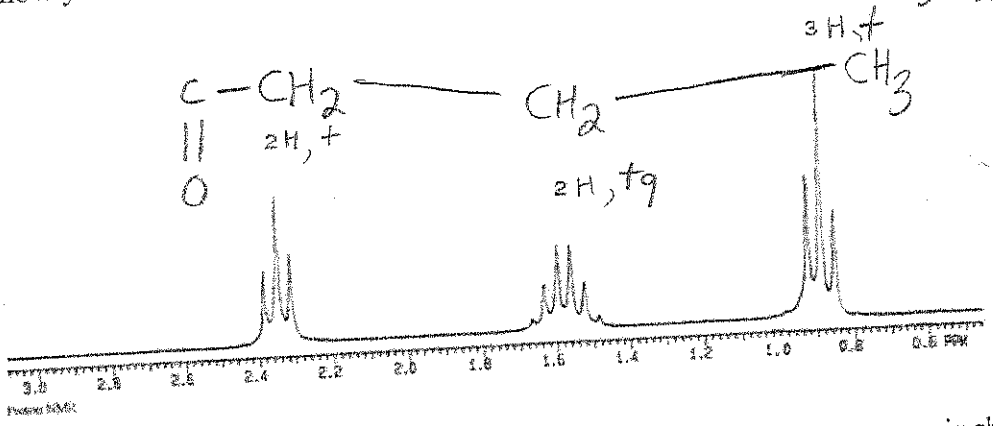
3.



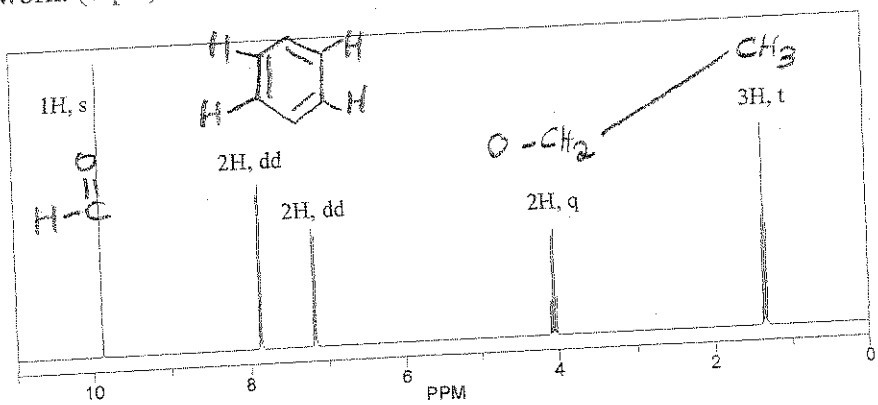
4.



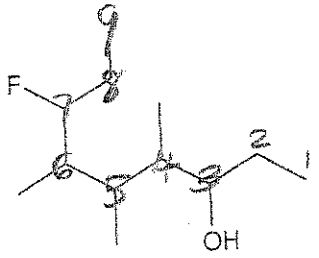
5. Determine the structure of compound $C_7H_{14}O$ whose ^1H NMR spectrum is shown below. Show your work. (7 pts)



6. Determine the structure of compound $C_9H_{10}O_2$ whose ^1H NMR spectrum is shown below. Show your work. (7 pts)



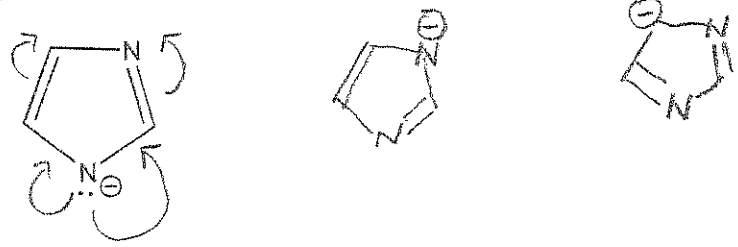
7. Give the IUPAC name of the following molecule. (4 pts)



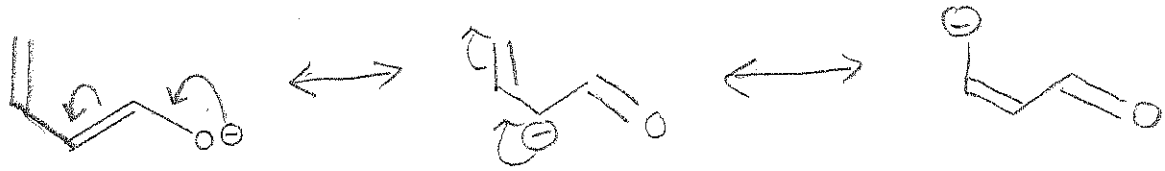
7-fluoro-
4,5,6-trimethyl-
3-nonanol

8. Draw two resonance structures for each of the molecules shown below. Make sure your resonance structures are *major* contributors. Use arrows to show how each of your resonance structures can be generated from the structures given. (6 pts each)

a.

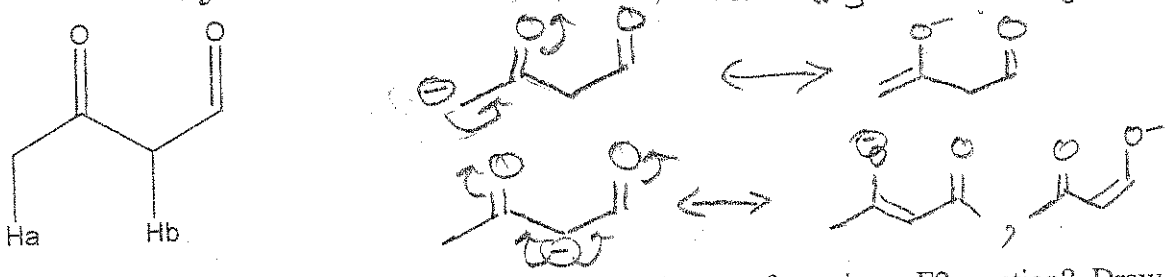


b.

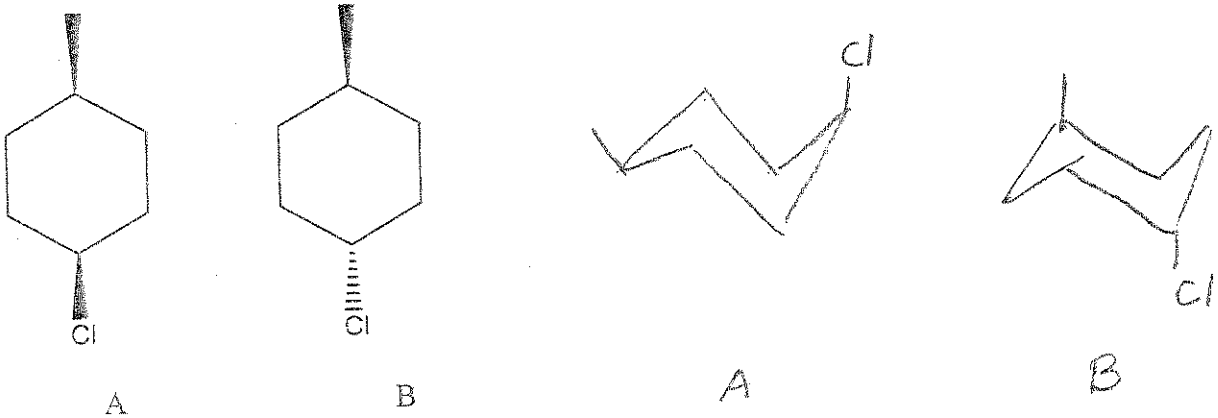


9. Which of the two labelled H's (a or b) is more acidic? Use resonance to justify your answer. (6 pts)

H_b is more acidic. Conjugate base of "H_a" has 2 resonance structures, but conjugate base of "H_b" has 3



10. Which of the following two molecules (A or B) reacts faster in an E2 reaction? Draw chair conformers to justify your answer. (6 pts)



A reacts faster because B requires a higher activation energy to put the Cl in the axial position