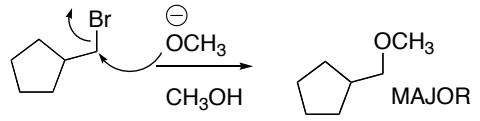
CHE 171
Fall, 2005
Exam 3

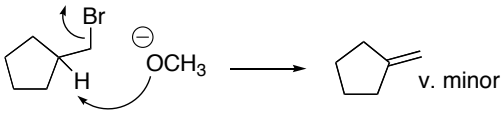
Name: _____
Section: 101 102 103
(*circle one*)

1. Show a full mechanism and predict the product(s) for the following reactions. When more than one organic product is formed, specify which is major and which is/are minor. (30 pts)

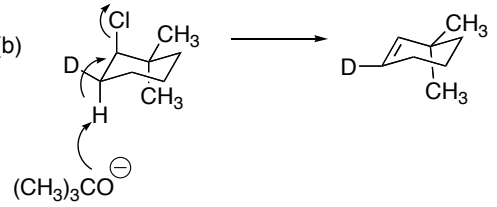
(a)



Analysis: 1° alkyl halide, strong base => S_N2

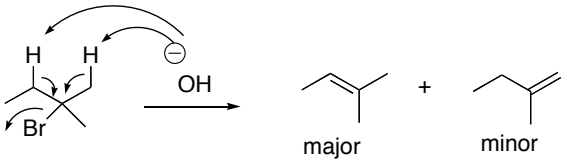


(b)



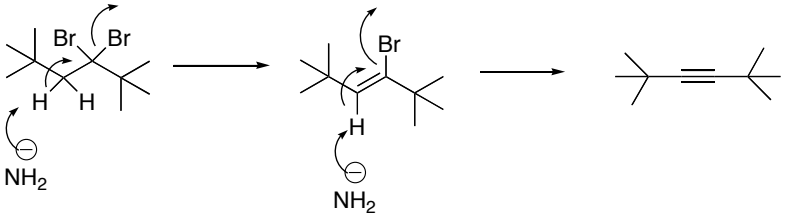
Analysis: 2° alkyl halide, non-nucleophilic, strong base => anti-periplanar E2

(c)



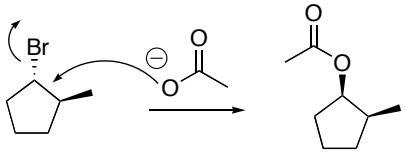
Analysis: 3° alkyl halide, strong base => E2 w/Zaitsev regioselectivity

(d)



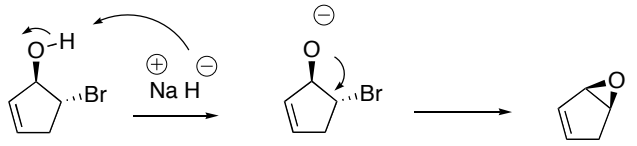
Analysis: Alkyne formation via two successive E2 reactions

(e)



Analysis: 2° alkyl halide, weak base, good nucleophile => S_N2

2. Show a mechanism and the product that forms from the reaction shown below (hint: this is a two-step mechanism where the second step is intramolecular): (12 pts)

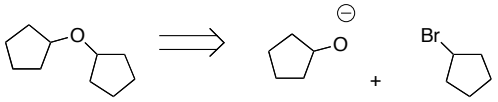


acid-base reaction

intramolecular Williamson, epoxide formation

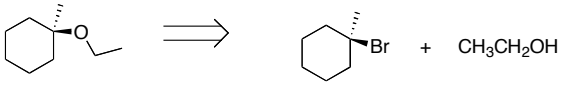
3. Name each of the following ethers (either a common name or the IUPAC name is fine) and show how you could synthesize each: (18 pts)

(a)



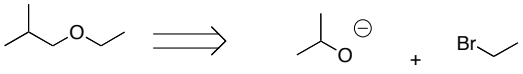
dicyclopentyl ether
or cyclopentoxycyclopentane

(b)



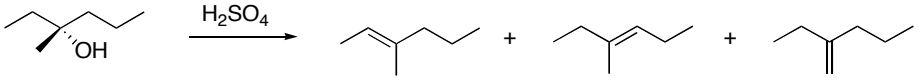
ehtyl-1-methylcyclohexyl ether
or 1-ethoxy-1-methylcyclohexane

(c)



ethyl isobutyl ether
or 1-ethoxy-2-methylpropane

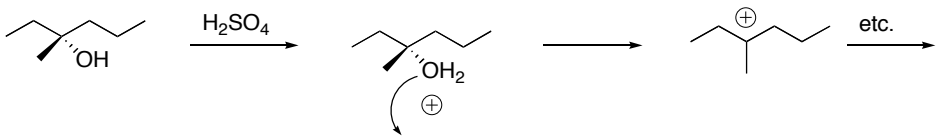
4. Show the products that would form from the acid-catalyzed dehydration of (*R*)-3-methyl-3-hexanol. (10 pts)



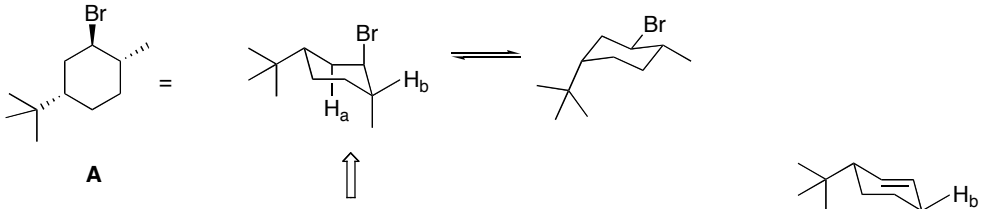
major *minor*

5. Explain and illustrate with an example why elimination reactions with alcohols (or dehydration reactions) must be catalyzed with an acid.(10 pts)

Hydroxide ion is not a good leaving group (it's a strong base), but water is a good leaving group (it's a weak base). Protonation of the hydroxyl group of an alcohol with an acid catalyst allows the elimination to occur because water can be kicked out as the leaving group, or can leave on its own to form a carbocation intermediate (as shown below) from which β-protons may be abstracted.

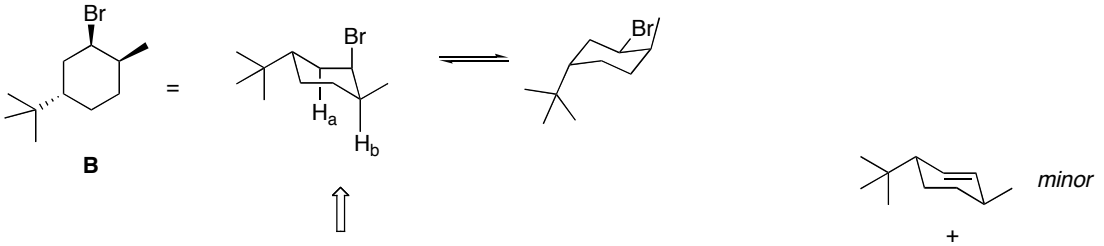


6. Diastereomers **A** and **B** undergo E2 elimination upon treatment with sodium hydroxide. One diasteromer gives only one alkene product, but the other gives two (a major and minor). Explain this difference in reactivity by showing two chair conformations for each diastereomer (**A** and **B**) and taking into account the anti-periplanar geometry required for the transition state of an E2 reaction. (20 pts)



A

This is the reactive conformer with Br in the axial position.
There is only one trans-axial β proton to abstract, so E2 yields only one product:



B

This is the reactive conformer with Br in the axial position.
There are two trans-axial β protons to abstract, so E2 yields two products: