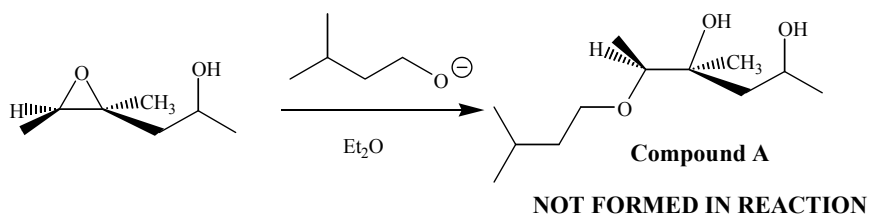


Organic Chemistry - CHEM 231A

Problem Set #5

Due December 10, 2001 @ 6:00pm

- The cyano group ($-\text{CN}$) can be hydrolyzed to a carboxylic acid group ($-\text{CO}_2\text{H}$). During this complex process, the steric size increases relative to that of the original cyano group. Any steric interaction of the cyano group with the rest of the molecule would tend to slow down its hydrolysis. Draw the most stable conformation for *cis*- and for *trans*-4-*t*-butyl-1-cyanocyclohexane and, on the basis of the above information, predict which isomer would hydrolyze most rapidly. Construct a reaction energy diagram that illustrates your analysis. Do Not worry about the reaction mechanism, but rather accept the provided information and explain it.
- When 2-phenyl-2-bromopropane is heated in water, a mixture of 2-phenyl-2-propanol and 2-phenylpropene is formed. When increasing amounts of NaCN are added to the solution, increasing amounts of 2-phenyl-2-cyanopropane are formed, at the expense of the alcohol and the alkene. In spite of this, the rate of disappearance of 2-phenyl-2-bromopropane is unchanged by the addition of NaCN.
 - Draw the two separate reactions that are occurring.
 - Explain the results from the two reactions.
 - Draw an energy diagram that supports the observed results upon addition of NaCN to 2-phenyl-2-bromopropane.
- Bob and Jane wanted to do the following reaction and predicted that they would observe compound A as the major product.



Instead of observing the formation of Compound A, a new compound, Compound B, was observed with molecular formula, $\text{C}_7\text{H}_{14}\text{O}_2$. It was also observed that the same starting material upon treatment with sulfuric acid in water yield the same product, Compound B:

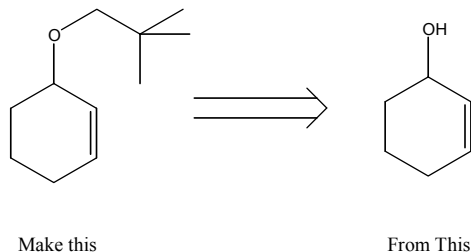


The compound had the following spectral data:

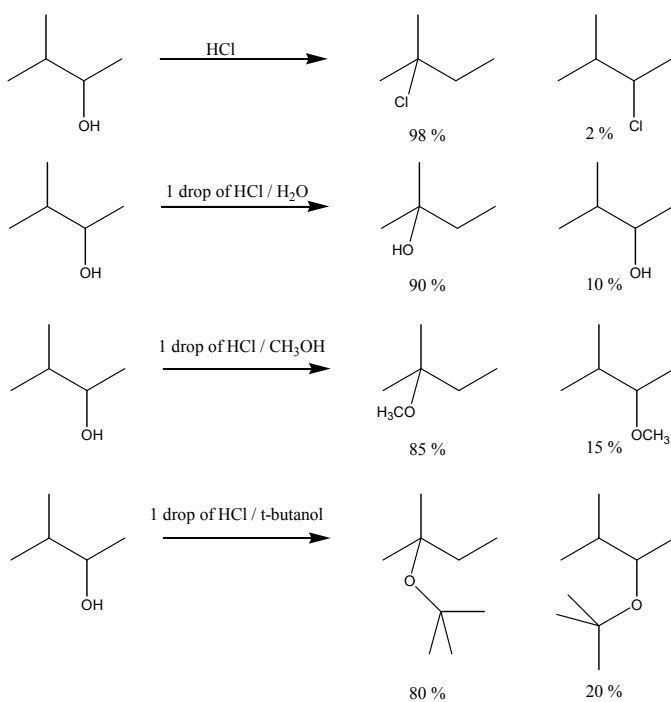
NMR Spectral Data for Compound B

Frequency (ppm, δ)	Integration (cm)	Coupling	Frequency (ppm, δ)	Integration (cm)	Coupling
1.18	5.41	Doublet	1.52	3.41	Doublet
1.21	5.36	Doublet	3.65	1.85	Sextet
1.25	5.52	Singlet	3.76	1.73	Quartet

- 3a. What is the structure of the product?
 3b. Why did the reaction fail to produce the predicted product, Compound A?
 3c. What is the mechanism for formation of the observed product via either the 1st or 2nd reaction conditions, Compound B? (Write only one mechanism)
4. Perform a retrosynthetic analysis and synthesis for the following compound:



5. Consider the following four reactions:



- 5a. Chose two of the reactions and provide a mechanism that accounts for the formation of the observed regiochemical products.
 5b. Explain why the different reaction conditions yield different amounts of the observed regiochemical products.
 5c. Why is only one drop of HCl needed for all but the first reaction?
6. Study from your old tests as well. Any subject or concept covered on your old tests is fair game for the exam. I will not, however, test you on information that was not covered in some form or another on one of the previous tests.