CHEM 3311/Summer 2011/T. Minger
Practice Exam #4

This is a bit longer than a 1.5-hour exam, so maybe more like a problem set. Try doing as many of these problems as you can without consulting textbook or notes. If you'd like to use this as a timed practice exam, do #1-7.

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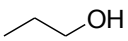
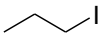
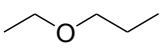
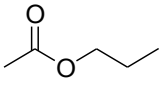
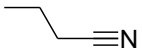
1) Using 1-bromopropane as your starting material, draw the structure of the nucleophile you would use to make each of the following products.



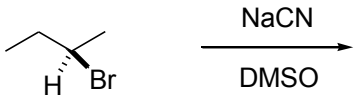


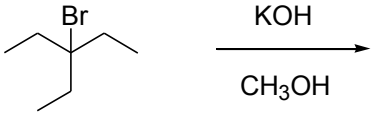


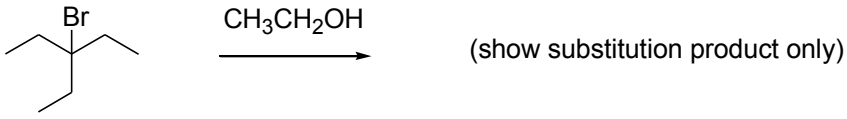


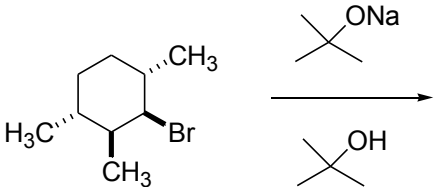


2) Predict the products of each of the following reactions. Show stereochemistry where necessary.

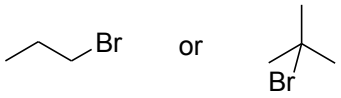


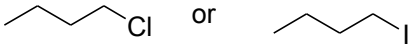


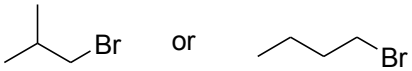




3) In each of the following pairs, which molecule would react *faster* in an S_N2 reaction?







In each of the following pairs, which molecule is the *better* nucleophile?

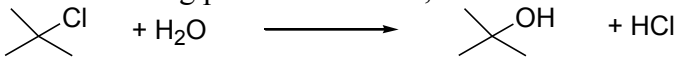
$CH_3NH^{\ominus}$ or CH_3NH_2

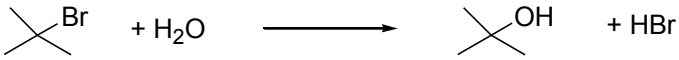
$CH_3O^{\ominus}$ or CH_3OH

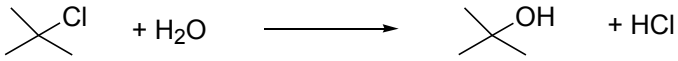
CH_3SH or CH_3OH

H_2O or $H_3O^{\oplus}$

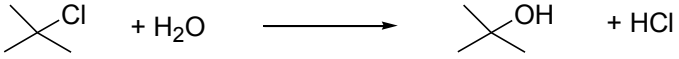
In each of the following pairs of reactions, which would be the *faster* S_N1 reaction?

A 

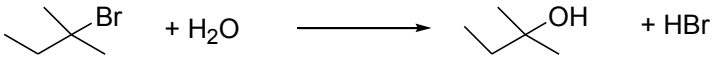
B 

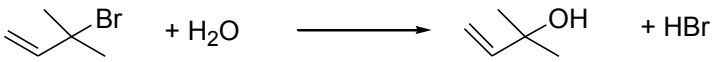
A 

1.0 M

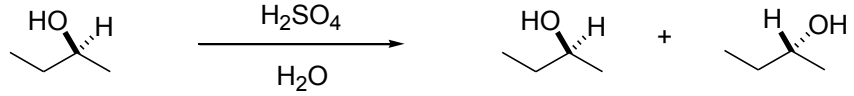
B 

2.0 M

A 

B 

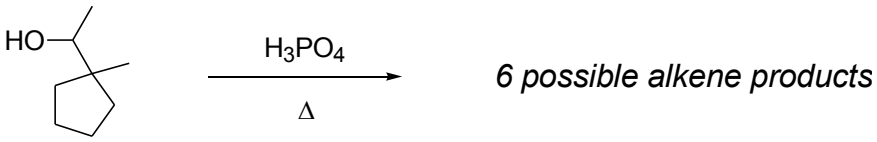
4) When *S*-2-butanol is allowed to stand in dilute sulfuric acid for several days, it slowly forms a racemic mixture:



S-2-butanol | *S*-2-butanol (50%) | *R*-2-butanol (50%)

Why does this happen? Draw mechanisms to support your explanation.

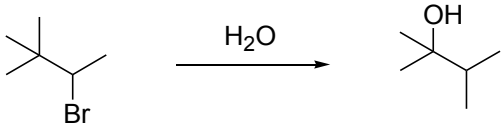
5) Under dehydrating conditions, the alcohol starting material shown below can form up to six (6) different alkene products.



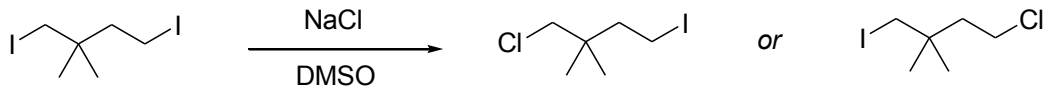
a. Provide the structures of 3 of these possible alkene products.

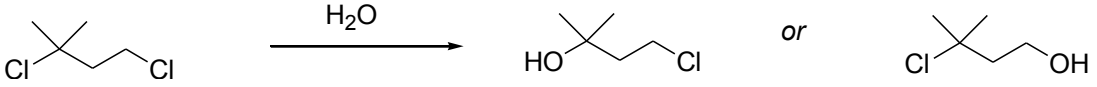
b. Draw an arrow-pushing mechanism to show the formation of **one** of your alkene products. Include all curved arrows, lone pairs of electrons, and formal charges for full credit.

6) Provide an arrow-pushing mechanism that shows the transformation of the starting material to the indicated product. Include all lone pairs of electrons, curved arrows and formal charges.

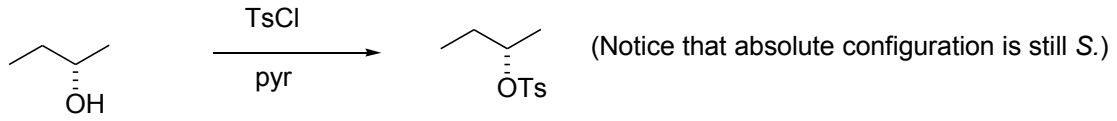


7) For each of the following reactions, only one of the products shown actually forms. Which is it, and why?





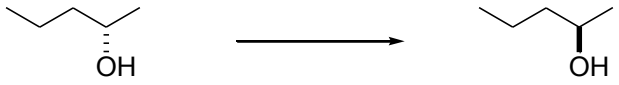
8) The hydroxyl group is typically a poor leaving group in an S_N2 reaction. But by converting an alcohol to a tosylate ester (see Loudon text, section 10.3A), a hydroxyl group can be converted to an excellent leaving group:



(Notice that absolute configuration is still *S*.)

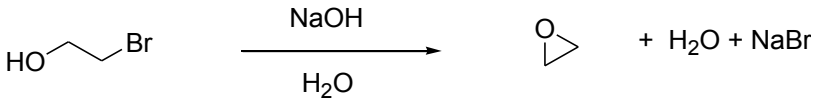
S-2-butanol

Using this information, propose a sequence of reactions to convert *S*-2-pentanol to *R*-2-pentanol.

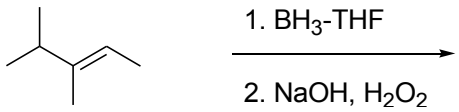


S-2-pentanol *R*-2-pentanol

9) Propose a mechanism for the following transformation. Include all curved arrows, lone pairs of electrons, and formal charges for full credit.



10) Predict the major organic products of the following reaction, including stereochemistry. State the stereochemical relationship of the products to each other (i.e., enantiomers, diastereomers) and their relative amounts.



11) Predict the major organic products of the following reaction, including stereochemistry. State the stereochemical relationship of the products to each other (i.e., enantiomers, diastereomers) and their relative amounts.