Please print:

Last name:_____

First name: _____

Chem 2061 Exam 3

Fall 2005

Andy Aspaas, Instructor

Monday, November 7, 2005

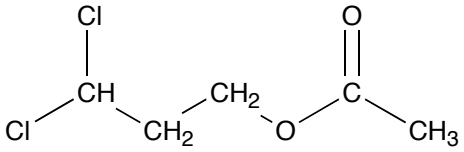
Instructions:

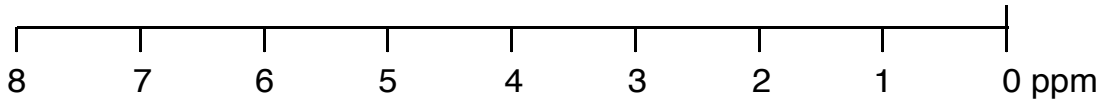
You have 55 minutes to complete this exam.

I, _____ have read and understand the directions given above, and pledge that I will follow all regulations with regard to Academic Dishonesty as outlined by this college when taking this exam.

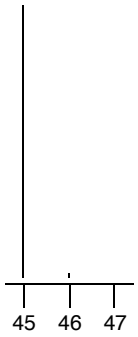
Signature _____ Date and Time _____

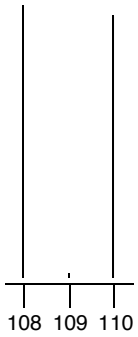
1. Using the scale below, sketch the ^{1}H NMR spectrum for the following compound. Present the peaks with correct splitting patterns and at the approximate chemical shift (± 0.5 ppm). Just above each peak, indicate the relative integration value (e.g. "2H"). *(16 pts)*





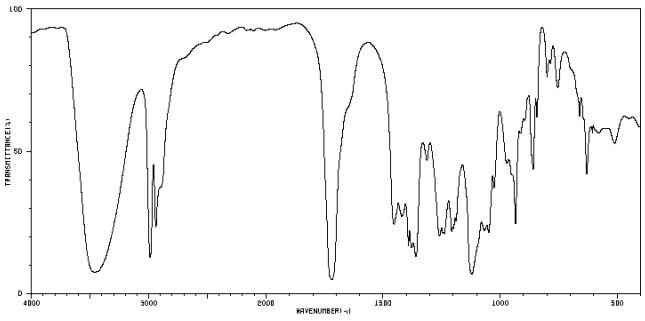
2. Below are molecular ion peaks from the mass spectra of two different compounds. Describe the recognizable traits of these peaks, and what those traits represent. *(8 pts)*

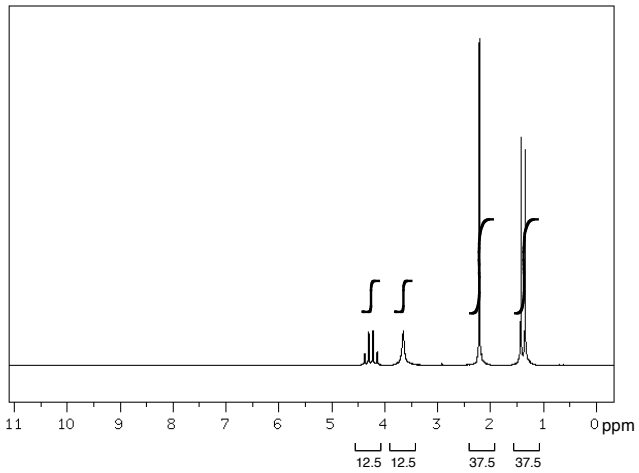




The molecular ion on the left comes from a compound with 7 hydrogens in its formula, and the one on the right comes from a compound with 5 hydrogens in its formula. Draw a structure that is consistent with one of these two molecular ions. *(6 pts)*

3. Draw the structure of the molecule with the formula $C_4H_8O_2$ and the following IR and NMR spectra. Show all your work. *(20 pts)*





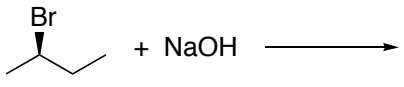
4. For the following pairs of reaction conditions, circle the conditions that would react faster in an S_N2 reaction, and briefly explain why (just a few words). *(12 pts)*

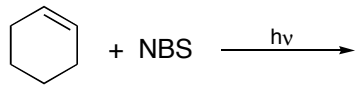
   a. SH^- + CH_3CH_2Cl vs. OH^- + CH_3CH_2Cl

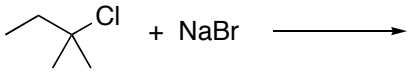
   b. NaBr + CH_3CH_2OH vs HBr + CH_3CH_2OH

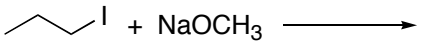
   c. OH^- + CH_3CH_2Cl vs. OH^- + $(CH_3)_2CHCl$

5. Predict the major organic product of the following reactions. Show the proper stereochemistry where appropriate. *(16 pts)*

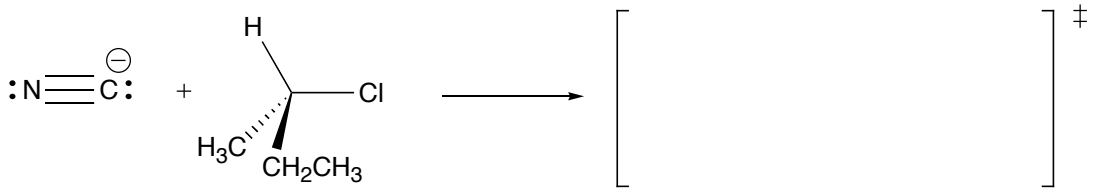
a. 

b. 

c. 

d. 

6. a. The reactants shown below will undergo an S_N2 reaction. *(10 pts)*
   - Draw the appropriate curved mechanism arrows for this reaction.
   - Label the nucleophile and substrate.
   - Draw the transition state of the reaction, with correct geometry.



b. Draw the products of this reaction, with correct stereochemistry. Label the organic product and leaving group. *(10 pts)*

IR Stretching frequencies (cm^{-1})

3300	alcohol O–H (broad) amine N–H (broad with spikes) alkyne sp^3 C–H
3000	alkene sp^2 C–H (just above 3000) alkane sp^3 C–H (just below 3000) acid O–H (broad)
2200	nitrile C≡N (just above 2200) alkyne C≡C (just below 2200)
1710	carbonyl C=O (esters higher, conjugated and amides lower)
1660	alkene C=C (conjugated lower, aromatic lower yet)

NMR Chemical Shifts (ppm)