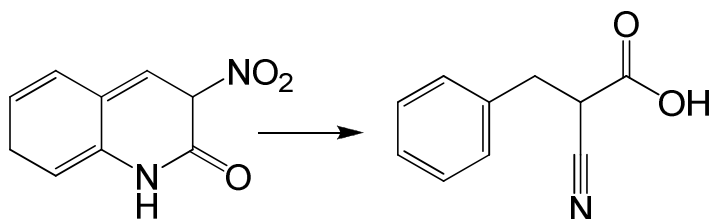


Spring 2018 (February 28th, 2018)

1. You have just performed the following transformation in the lab; predict the type of bonds corresponding to the major signals found in the IR spectra of both the product and the reactant. Explain how IR spectroscopy could be used to check if the transformation is successful. (7 pts)

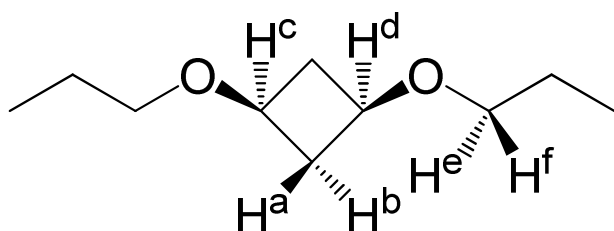


Reactant

Product

Explain (3 pts)

2. State the relationship between the labeled protons in the structure below (as: homotopic, enantiotopic, diastereotopic, or unrelated). (2 x 4 = 8 pts)

H^a and H^b _____H^c and H^d _____H^e and H^f _____H^c and H^f _____

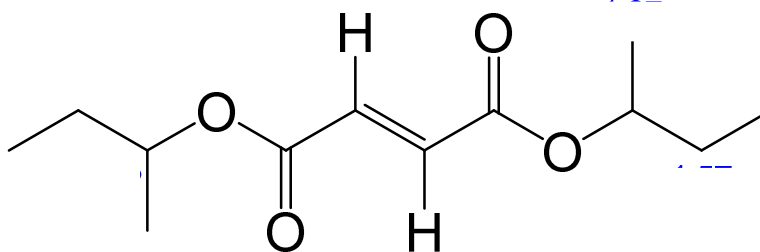
3. A 600 MHz spectrometer records protons that absorb at 8.02 ppm, 6.87 ppm, 5.33 ppm and 3.78 ppm. (10 pts)

(a) How far downfield (in hertz) from TMS would these protons absorb? (4 pts)

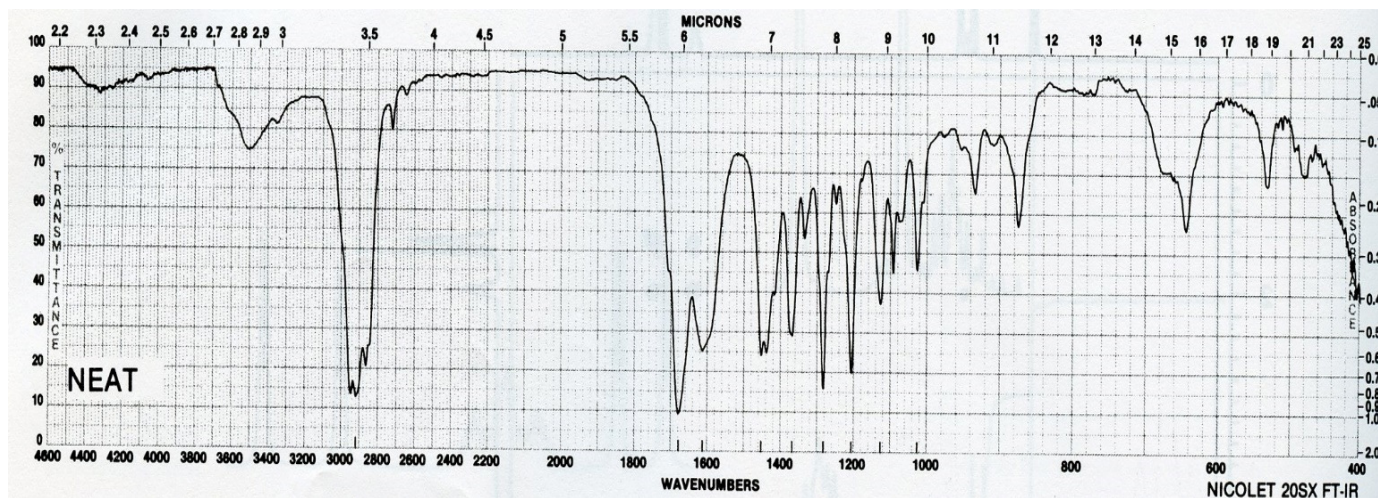
(b) If the spectrum was recorded on a 200 MHz spectrometer, what will be the chemical shifts (in ppm) for the signal above listed (question a)? (2 pts)

(c) At 200 MHz, how far downfield (in hertz) from TMS would these protons absorb? (4 pts)

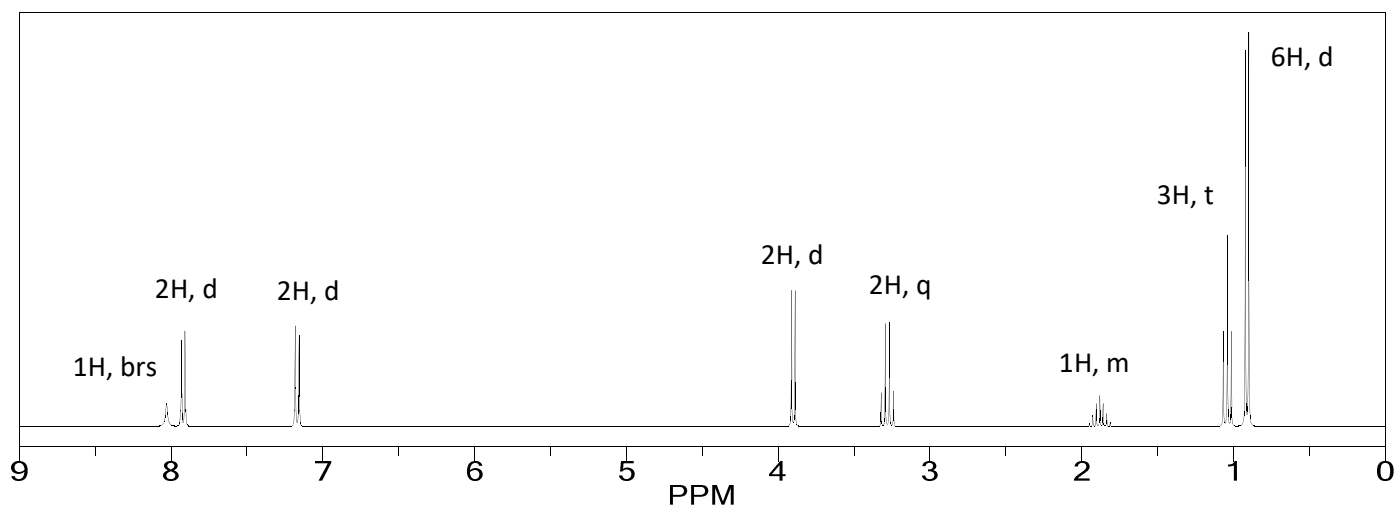
4. Predict the signals expected, their chemical shifts, their splitting, and their relative intensity in the ^1H -NMR spectrum of the following compound. (5 pts)



5. (a) Identify the major signals and the corresponding bonds vibration present in the compound having the following IR spectrum; Molecular formula $\text{C}_{13}\text{H}_{19}\text{NO}_2$ (8 pts)



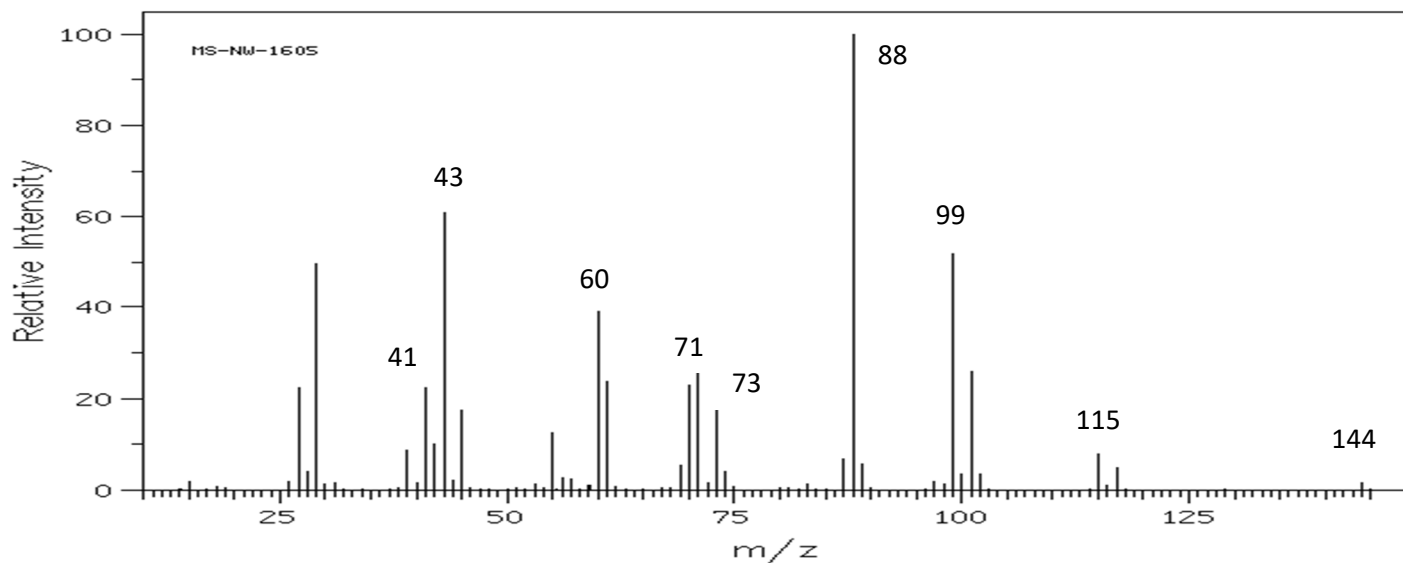
(b) The ^1H -NMR shown below is that of the same compound with the IR spectrum shown in (a). Determine its structure and explain your answer.



Structure (4 pts)

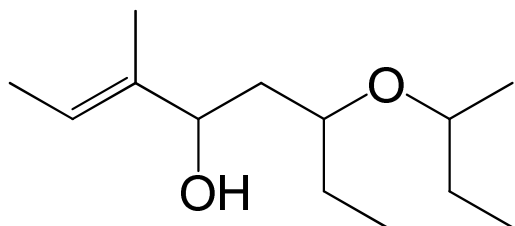
Explain (4 pts)

6. The mass spectrum showed below is that of ethyl hexanoate (see structure). Provide a structure for each of the fragments corresponding to the peaks indicated by the m/z 144, 115, 99, 88, 73, 71, 60, 43 and 41 (you must show the fragmentation pattern to receive full credit) (8 pts).

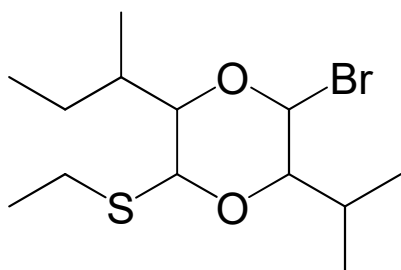


7. Name the following compounds (3 x 4 = 12 pts)

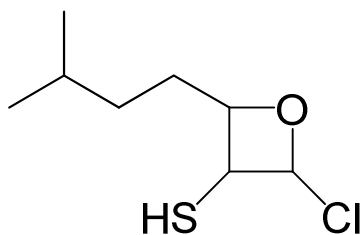
(a)



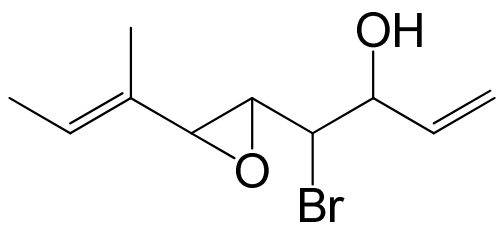
(b)



(c)

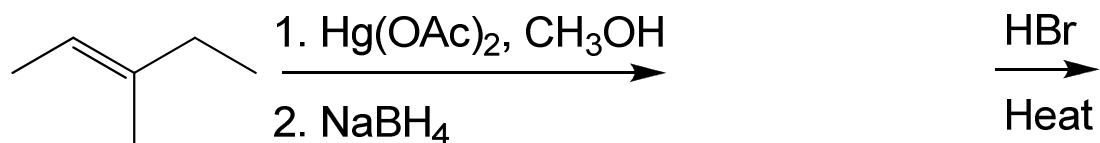


(d)

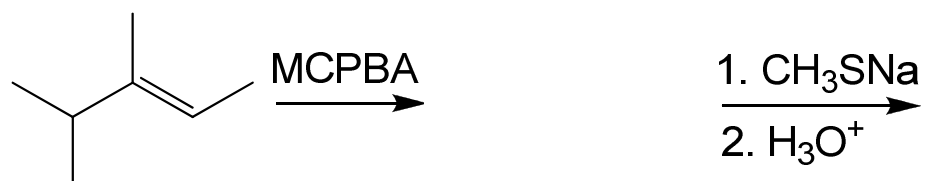


8. Predict the major product(s) expected from the following reaction sequences (3 x 6 = 18 pts)

(a)



(b)



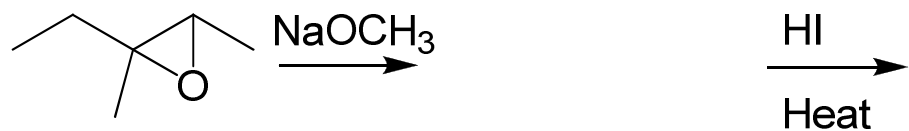
(c)



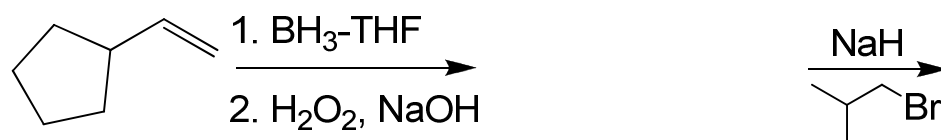
(d)



(e)

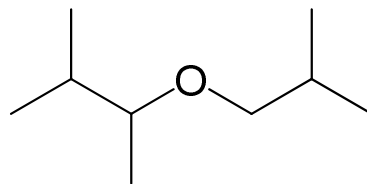
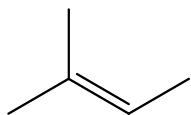


(f)

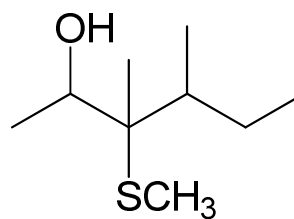
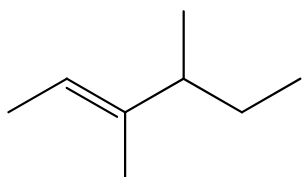


9. Show how you would synthesize each of the following compounds from the given starting material(s). **You must show all the intermediates to receive full credit** (3 x 3 = 9 pts)

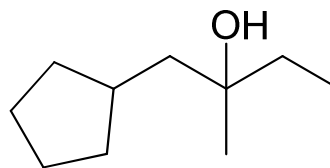
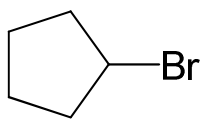
(a)



(b)



(c)



10. Propose a mechanism consistent with the following reaction (**you must show all the intermediates, and arrows indicating the electron flow to receive full credit**) (4 pts)