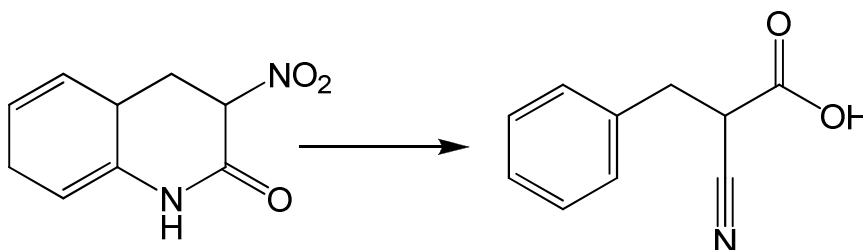


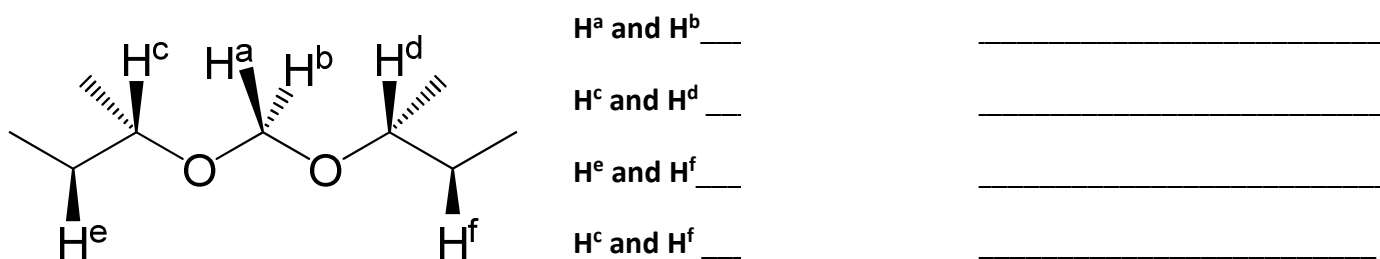
Fall 2016 (September 20th, 2016)

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)



Explain (3 pts)

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

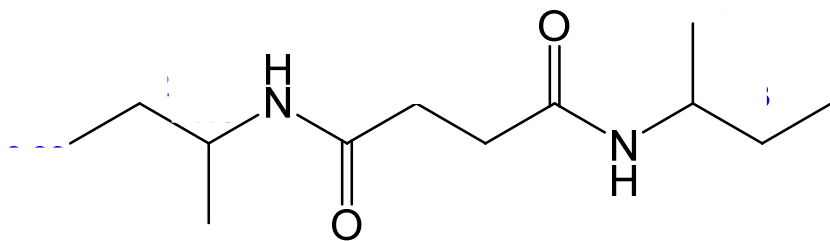


3. A 900 MHz spectrometer records protons that absorb at 7.84 ppm, 6.96 ppm, 5.54 ppm, 2.78 ppm and 1.15 ppm. (10 pts)

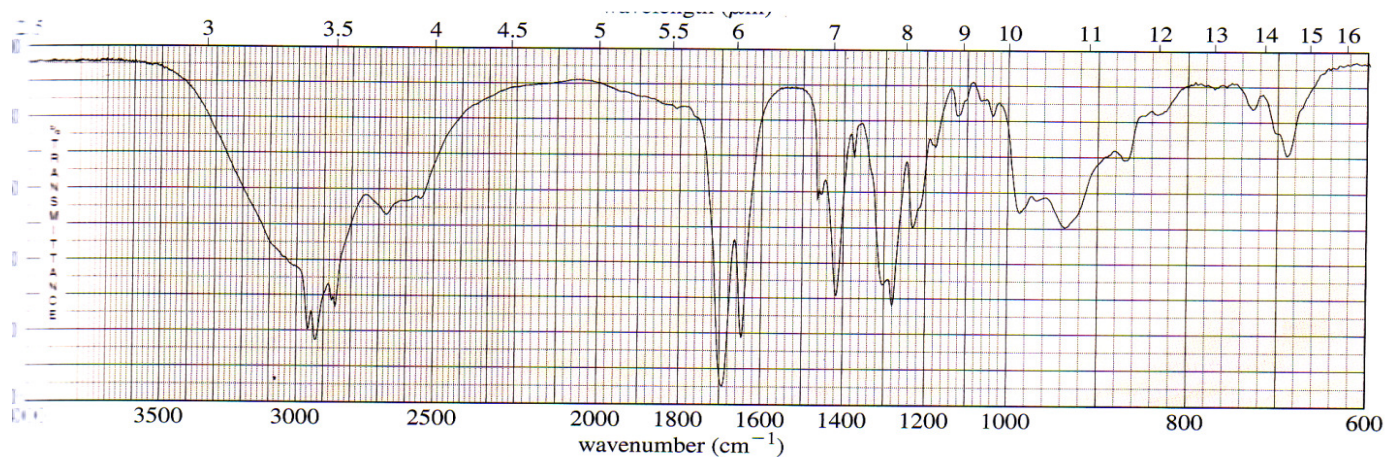
(a) How far downfield (in hertz) from TMS would these protons absorb? (5 pts)

(b) If the spectrum was recorded on a 400 MHz spectrometer, How far downfield (in hertz) from TMS would these protons absorb? (5 pts)

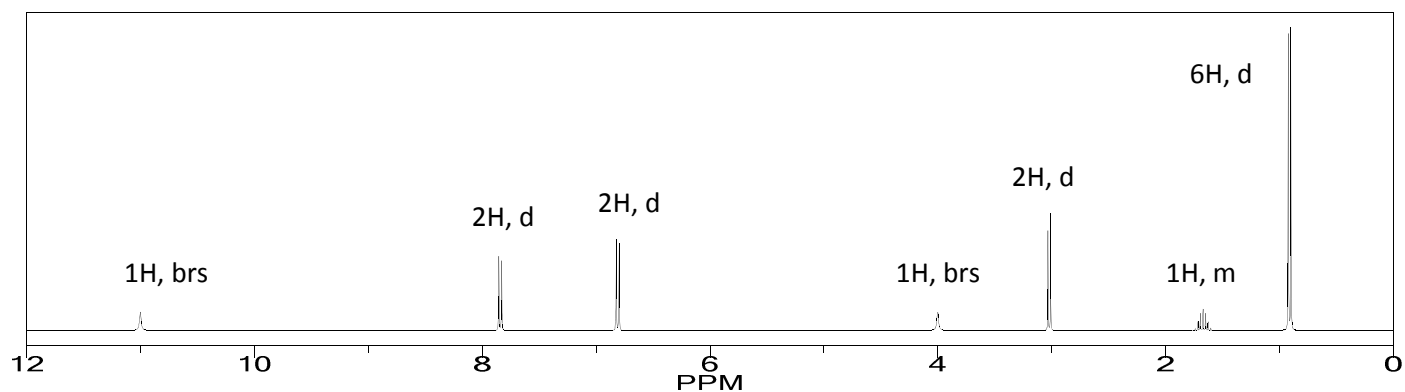
4. Predict the number of signals expected, their splitting, their relative area and their relative intensity in the ^1H -NMR spectrum of the following compound. (6 pts)



5. (a) Identify the major signals and the corresponding bonds vibration present in the compound having the following IR spectrum; Molecular formula **C₁₁H₁₅NO₂** (8 pts)



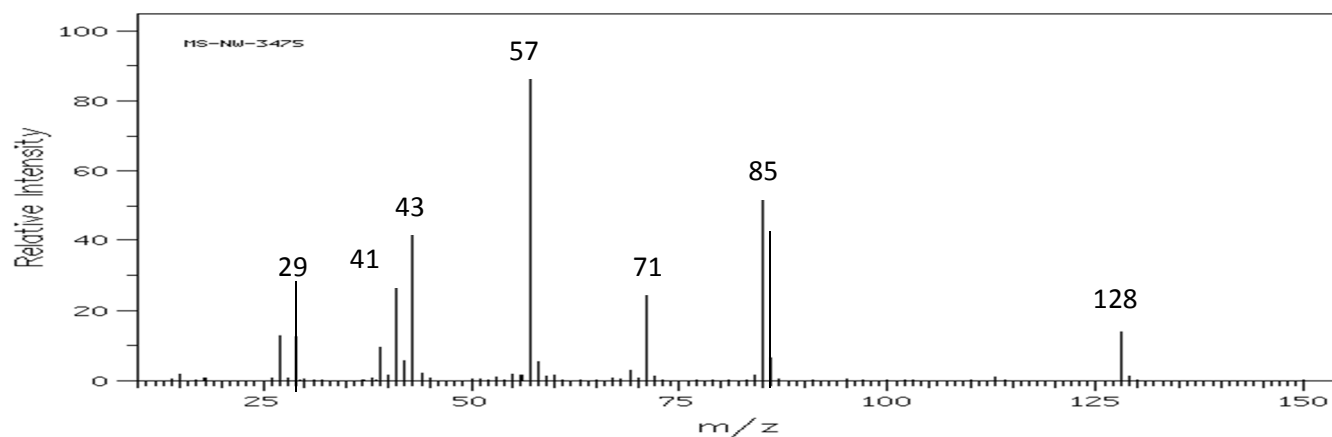
(b) The ¹H-NMR shown below is that of the same compound with the IR spectrum shown in (a). Determine its structure and explain your answer.



Structure (4 pts)

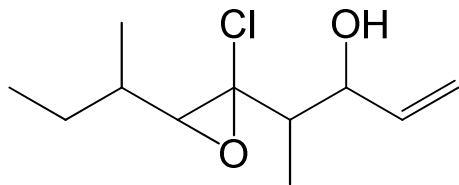
Explain (5 pts)

6. The mass spectrum showed below is that of octan-2-one (see structure). Provide a structure for each of the fragments corresponding to the peaks indicated by the m/z 128, 86, 85, 71, 57, 43, 41 and 29 (you must show the fragmentation pattern to receive full credit) (7 pts).

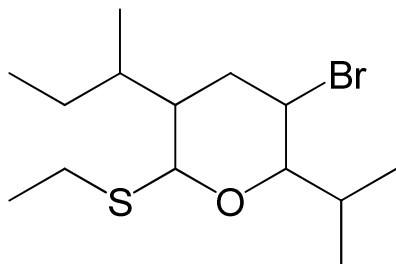


7. Name the following compounds (3 x 4 = 12 pts)

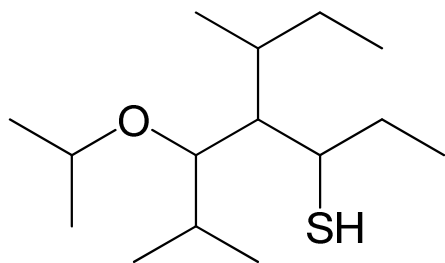
(a)



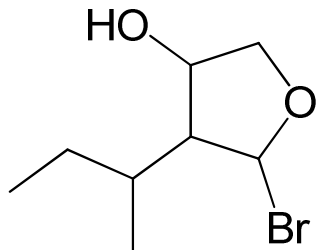
(b)



(c)

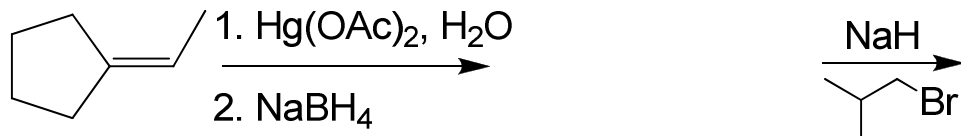


(d)

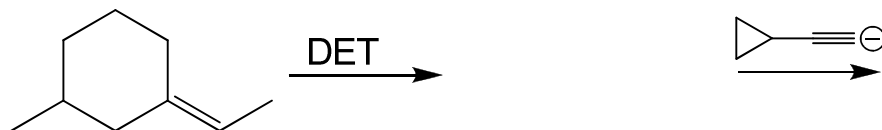


8. Predict the major product(s) expected from the following reaction sequences (3.5 x 6 = 21 pts)

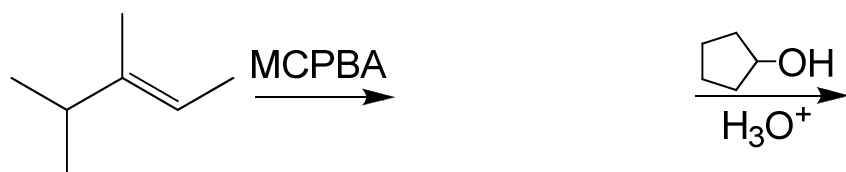
(a)



(b)



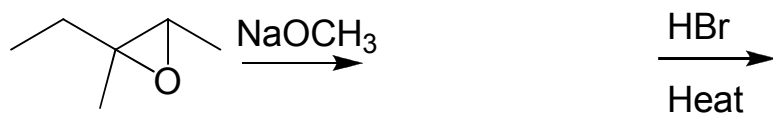
(c)



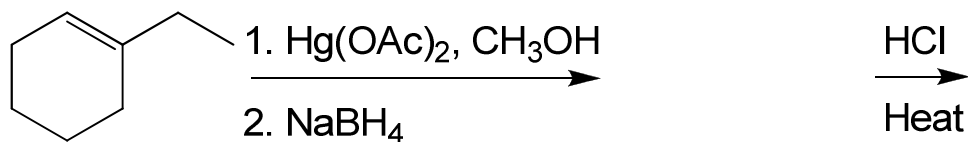
(d)



(e)

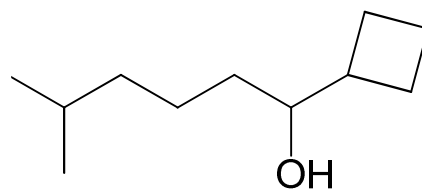
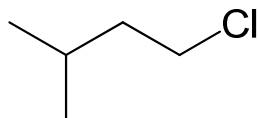


(f)

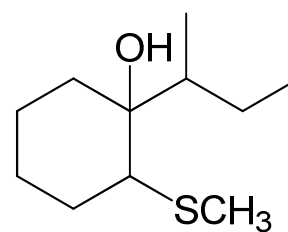
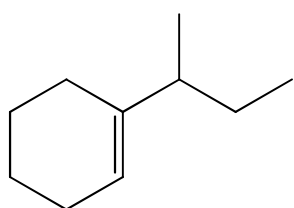


9. Show how you would synthesize each of the following compounds from the given starting material(s). You must draw key intermediates to receive full credit (3 x 3 = 9 pts).

(a)



(b)



(c)

