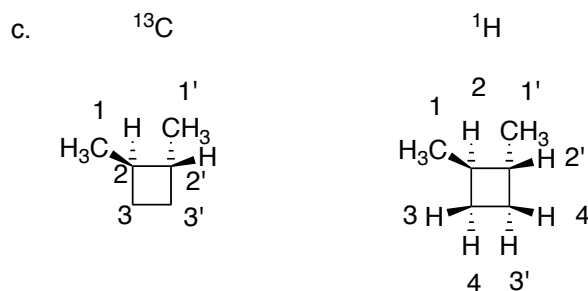
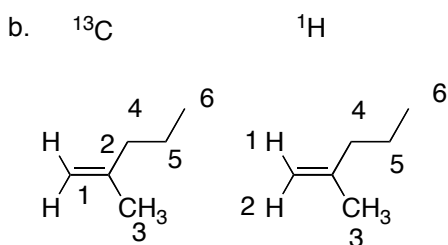
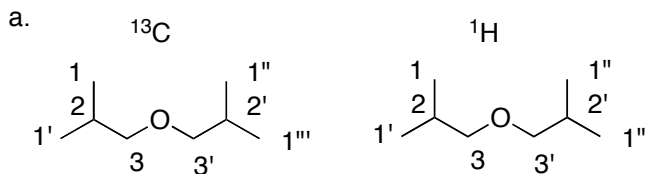
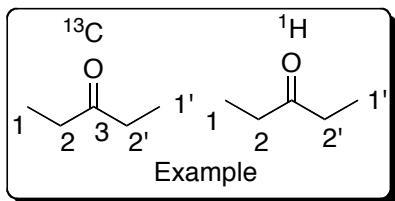
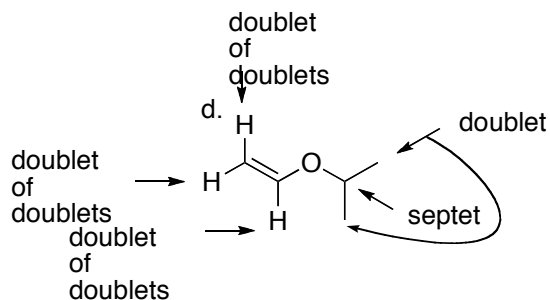
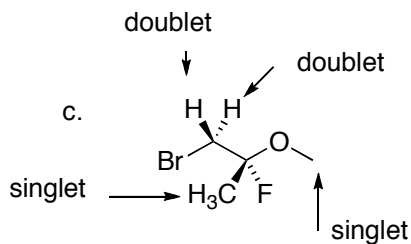
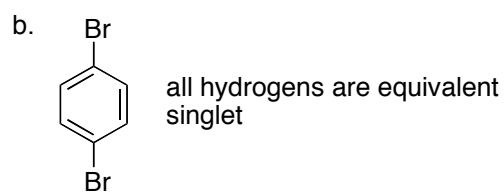
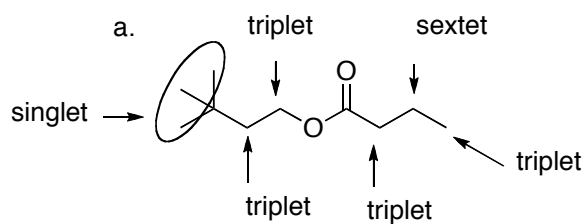


2. For each molecule below, indicate the number of peaks that would be seen in their  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectra. Number each unique type of carbon and hydrogen.

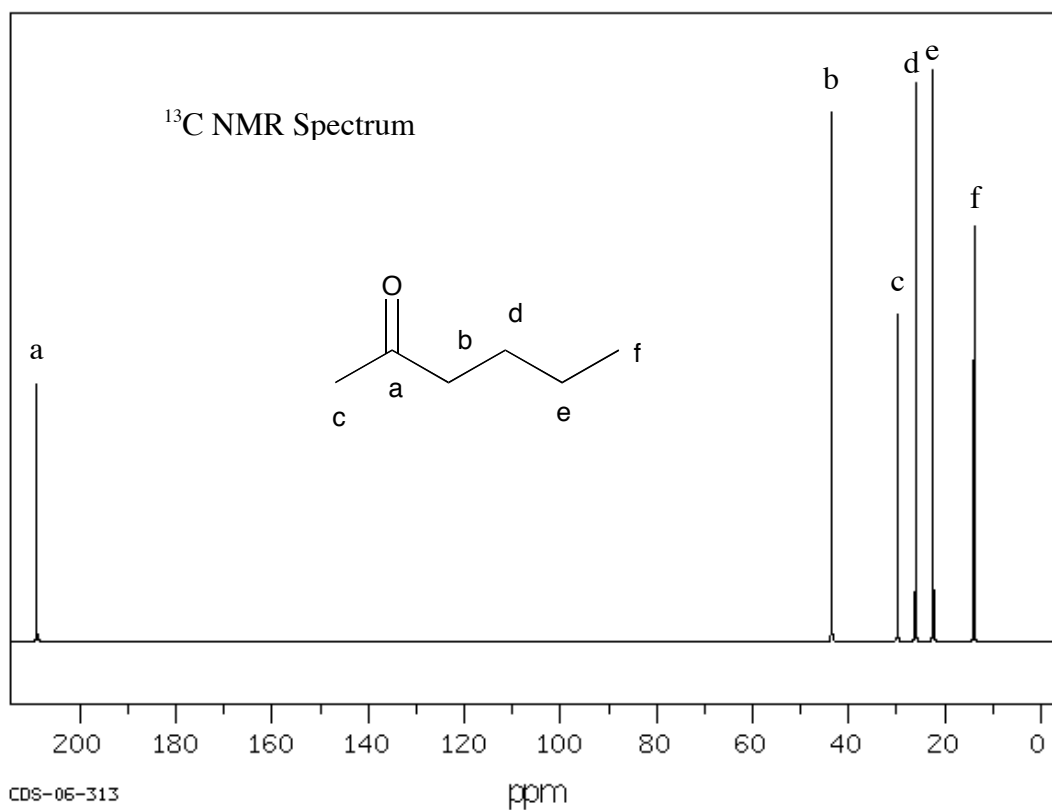
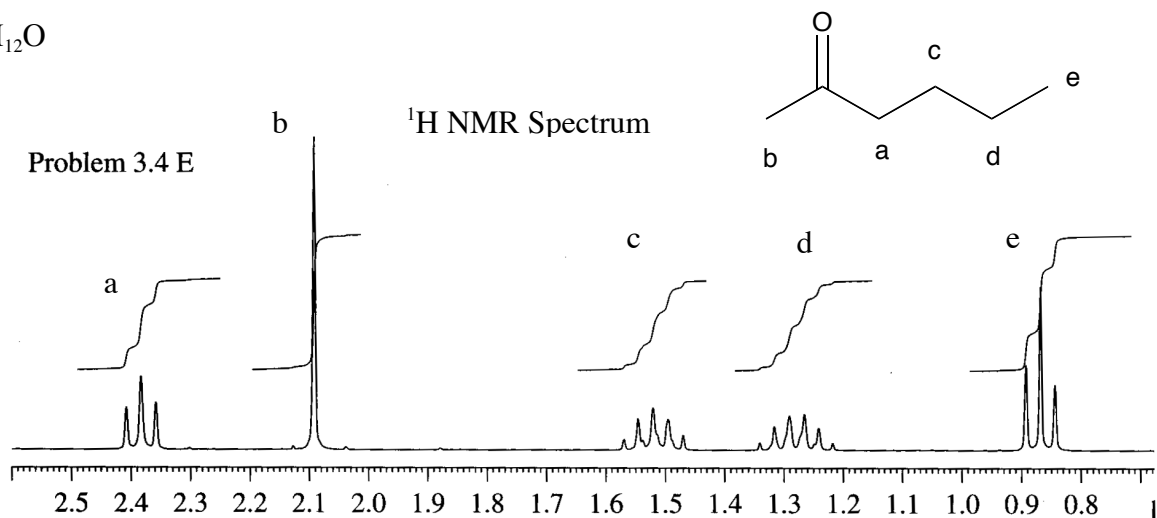


3. For each compound below, predict the splitting pattern that would be observed for each type of hydrogen.

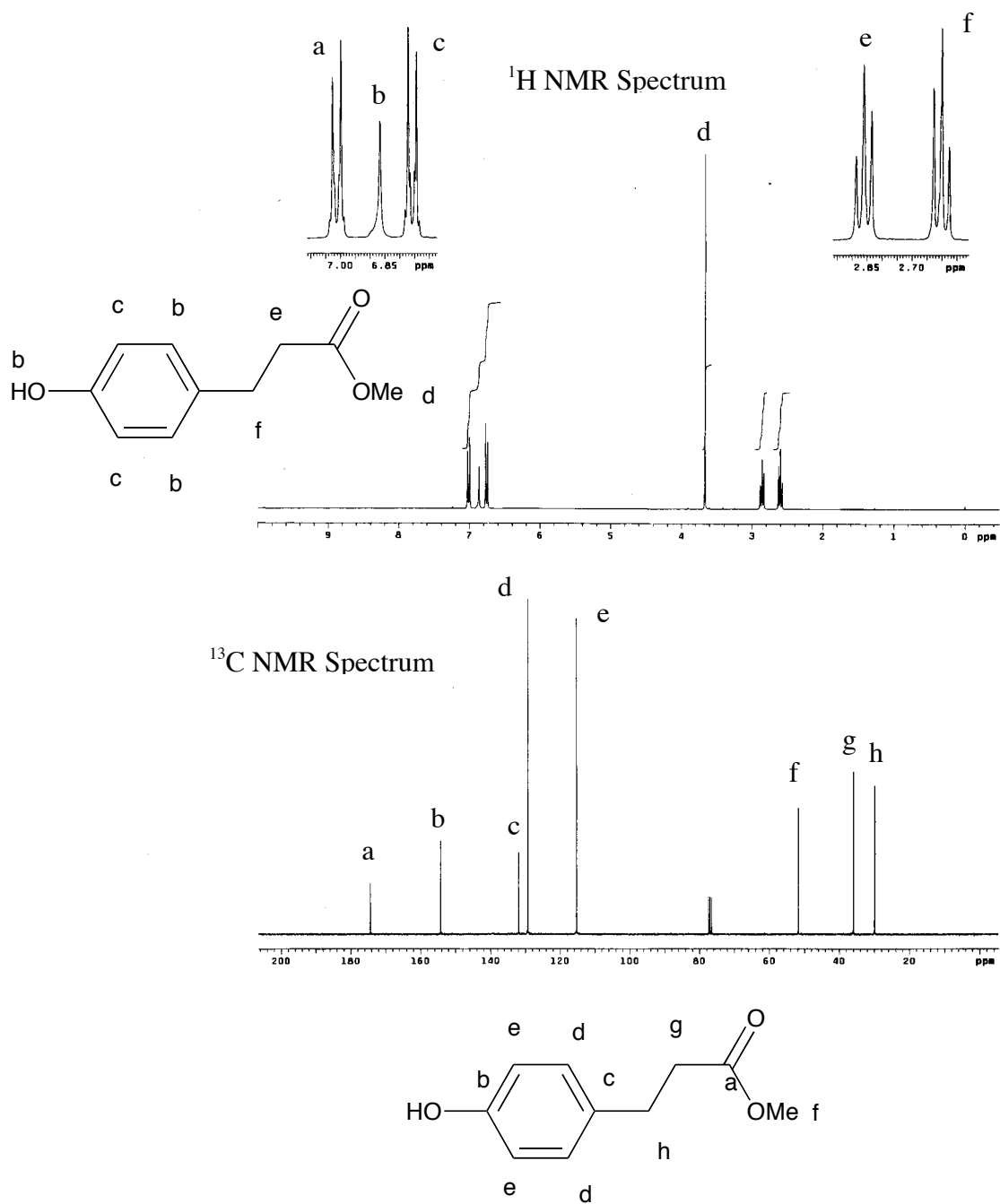


4. For each set of NMR spectrum below, provide the correct structure for the molecule. Label the peaks and indicate which peak goes with each unique H or C.

a.  $C_6H_{12}O$

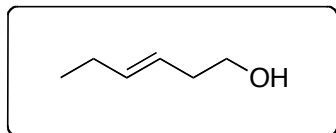


- b.  $C_{10}H_{12}O_3$ : The peak at 6.87 ppm disappears upon treatment with  $D_2O$ , which indicates that it is an alcohol (OH) proton. The three peak pattern in the  $^{13}C$  NMR is due to the solvent ( $CDCl_3$ ) and can be ignored.

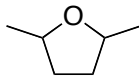


5.  $^{13}\text{C}$  NMR spectroscopy (10 points)

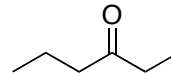
- a. For each structure, indicate how many carbon peaks you would expect to observe in a  $^{13}\text{C}$  NMR spectrum of the compound.



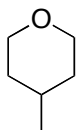
6 carbons



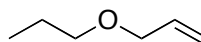
3 carbons



6 carbons

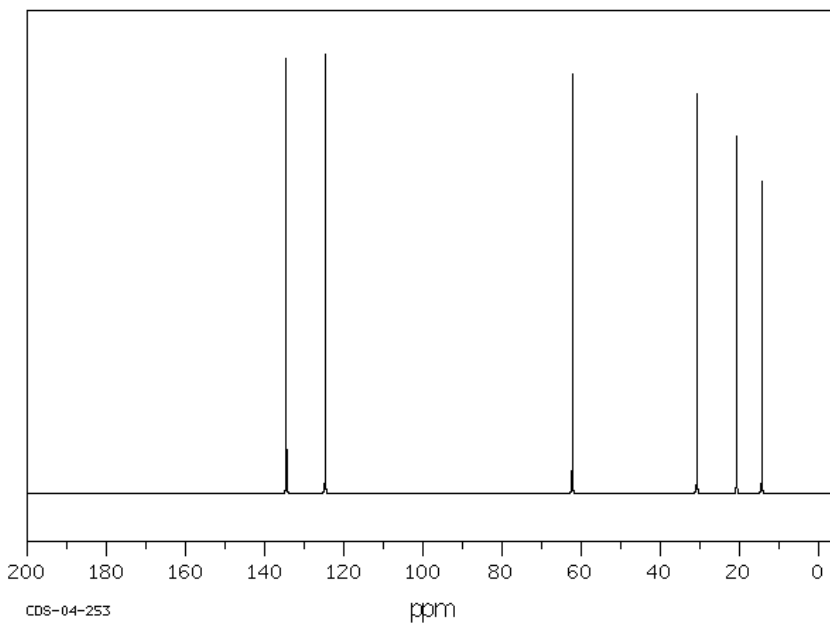


4 carbons



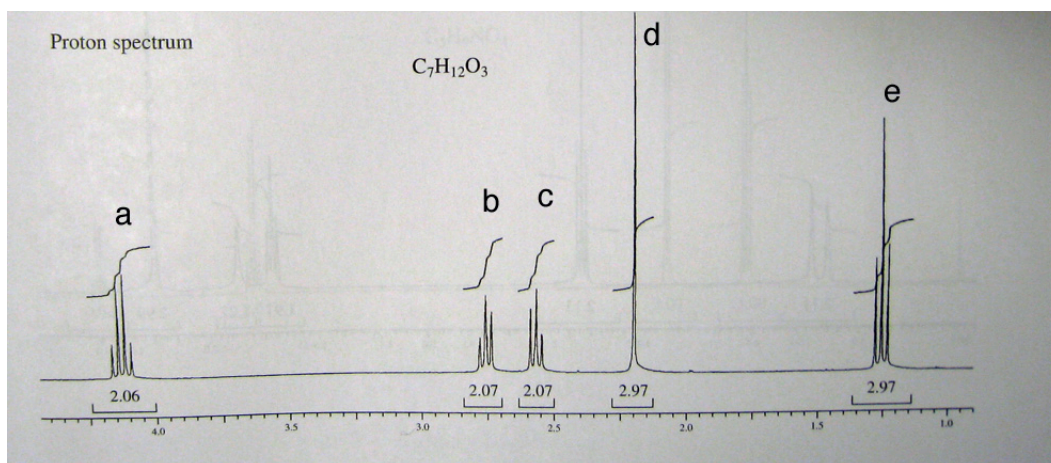
6 carbons

- b. Circle the structure above that is most consistent with the  $^{13}\text{C}$  NMR spectrum. Briefly explain your choice.



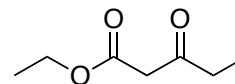
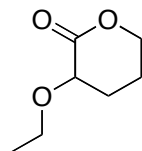
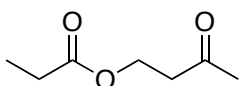
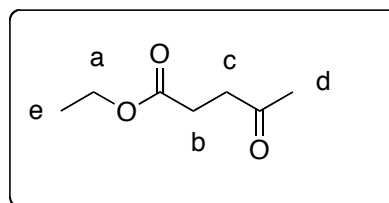
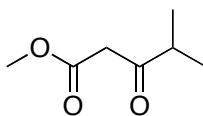
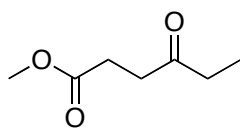
The spectrum shows 6 types of carbons, with two  $\text{sp}^2$  carbons and 4  $\text{sp}^3$  carbons. Only one of the  $\text{sp}^3$  carbons is near the oxygen. The only possible answer is 3-hexen-1-ol.

8. Spectral data for a compound with molecular formula of  $C_7H_{12}O_3$  is shown below. The NMR spectrum is shown. The numbers below the peaks provide the integration values (these can be rounded to the nearest integer). Also provided is the  $^{13}C$  NMR data along with the DEPT-135 and DEPT-90 results. Finally, an IR spectrum of this compound shows strong absorbances at  $1720$  and  $1738\text{ cm}^{-1}$ . (16 points)



Peak	$^{13}C$ NMR (ppm)	DEPT-135	DEPT-90
1	14	+	0
2	28	-	0
3	30	+	0
4	38	-	0
5	61	-	0
6	173	0	0
7	207	0	0

+ = positive peak; - = negative peak, 0 = no peak



- a. Circle the compound above that is most consistent with the spectroscopic data provided.
- b. Label the compound you chose to show which  $^1H$  NMR peaks correspond with each set of hydrogens in the structure.