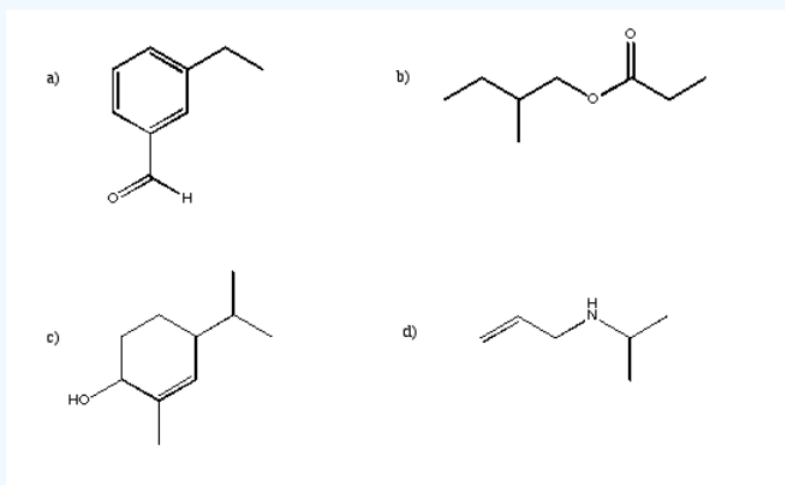


4.16: More Practice

? Exercise 4.16.1

For each of the following structures, indicate how many peaks would be found in the ^{13}C spectrum.



? Exercise 4.16.2

Sketch the expected ^{13}C spectrum for each of the structures in the previous question.

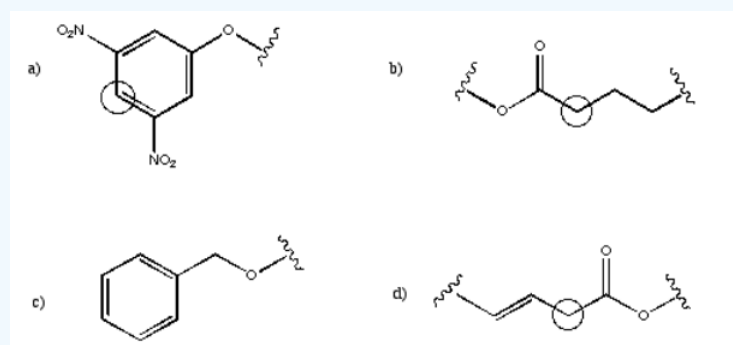
? Exercise 4.16.3

Suggest possible assignments for peaks found at the following positions in the ^{13}C NMR spectrum.

a) 63 ppm b) 114 ppm c) 205 ppm d) 35 ppm e) 165 ppm f) 175 ppm

? Exercise 4.16.4

Suggest the approximate chemical shift for the circled carbons in the following partial structures.



? Exercise 4.16.5

Explain why, in the following cases, chemical shift is slightly different from the normal range described.

- a) chloroform (CHCl_3): H on sp^3 carbon; normally 0-5 but here at 7.27 ppm.
- b) vinyl ether ($\text{CH}_2=\text{CHOCH}=\text{CH}_2$): H on sp^2 carbon normally 5-7 but here at 4.5 ppm.
- c) nitrobenzene ($\text{C}_6\text{H}_5\text{NO}_2$): H on sp^2 , aromatic carbon normally 7-8 but here 8.5 ppm

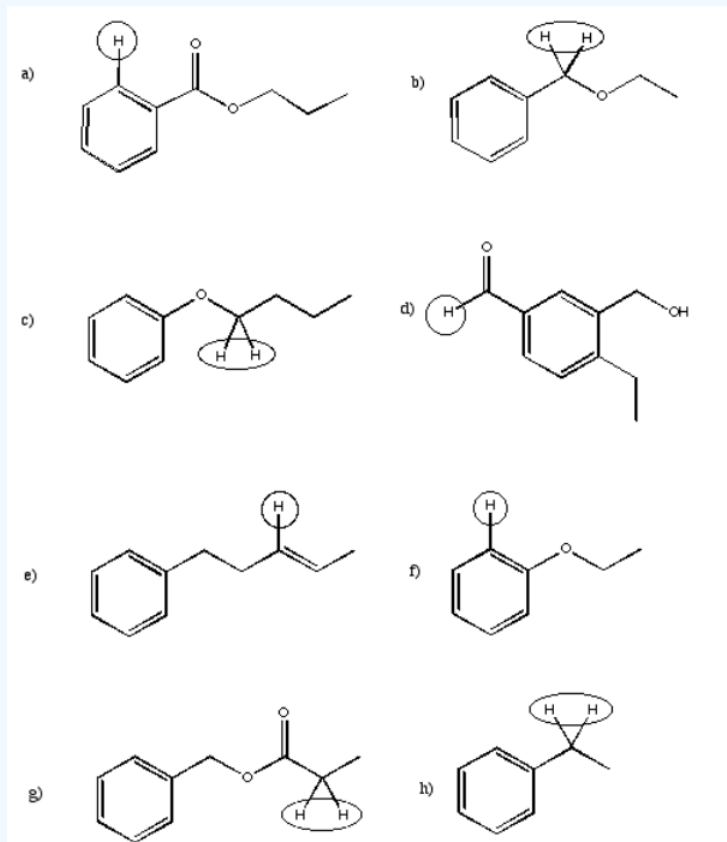
? Exercise 4.16.6

Suggest possible assignments for peaks found at the following positions in the ^1H NMR spectrum.

a) 7.4 ppm b) 12.1 ppm c) 3.6 ppm d) 10.1 ppm e) 8.2 ppm f) 2.1 ppm g) 5.8 ppm

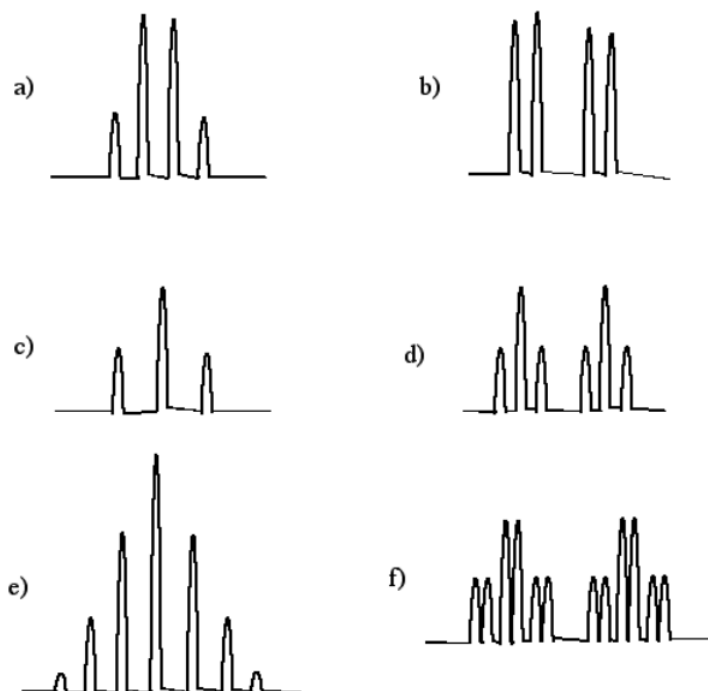
? Exercise 4.16.7

Suggest the approximate chemical shift for the circled protons in the following partial structures.



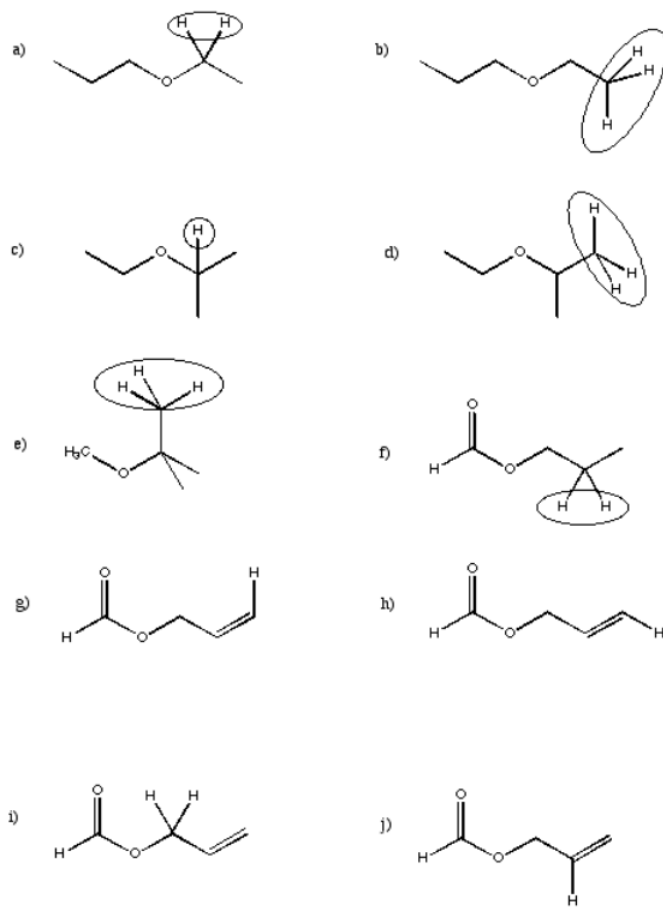
? Exercise 4.16.8

Suggest the arrangement of neighbouring hydrogens for the following peaks in the ^1H NMR spectrum and draw a partial structure.



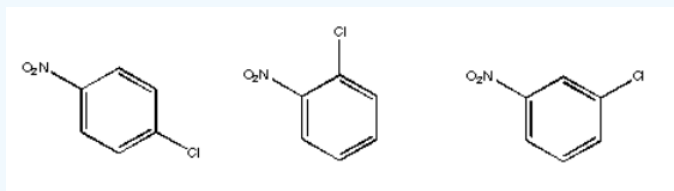
? Exercise 4.16.9

Sketch peak shapes for the circled protons in the following partial structures.



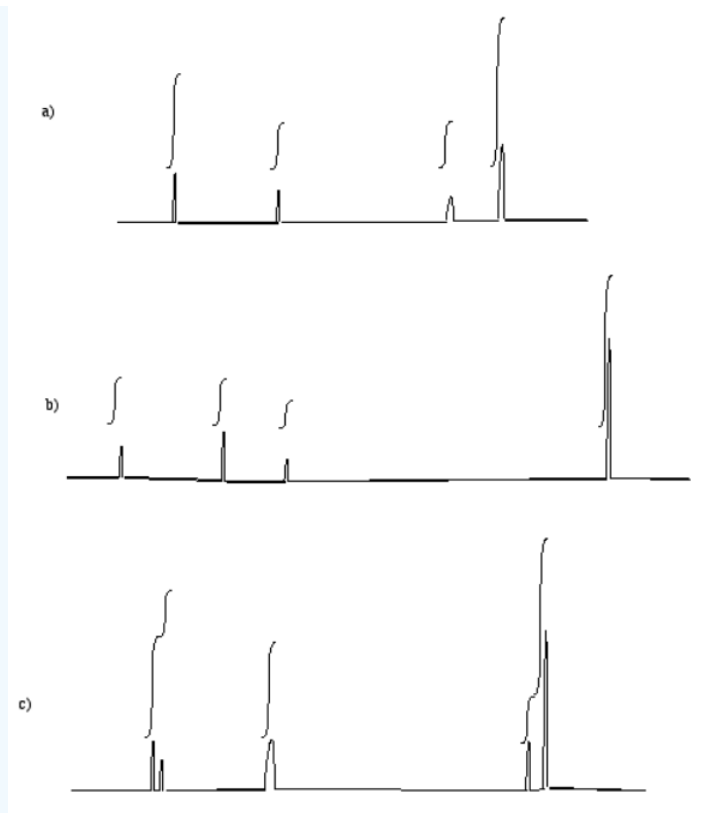
? Exercise 4.16.10

Describe the different coupling patterns in the aromatic region of the ^1H NMR spectra of the following isomers.



? Exercise 4.16.11

Assign the relative number of protons at each position based on the integral lines shown.



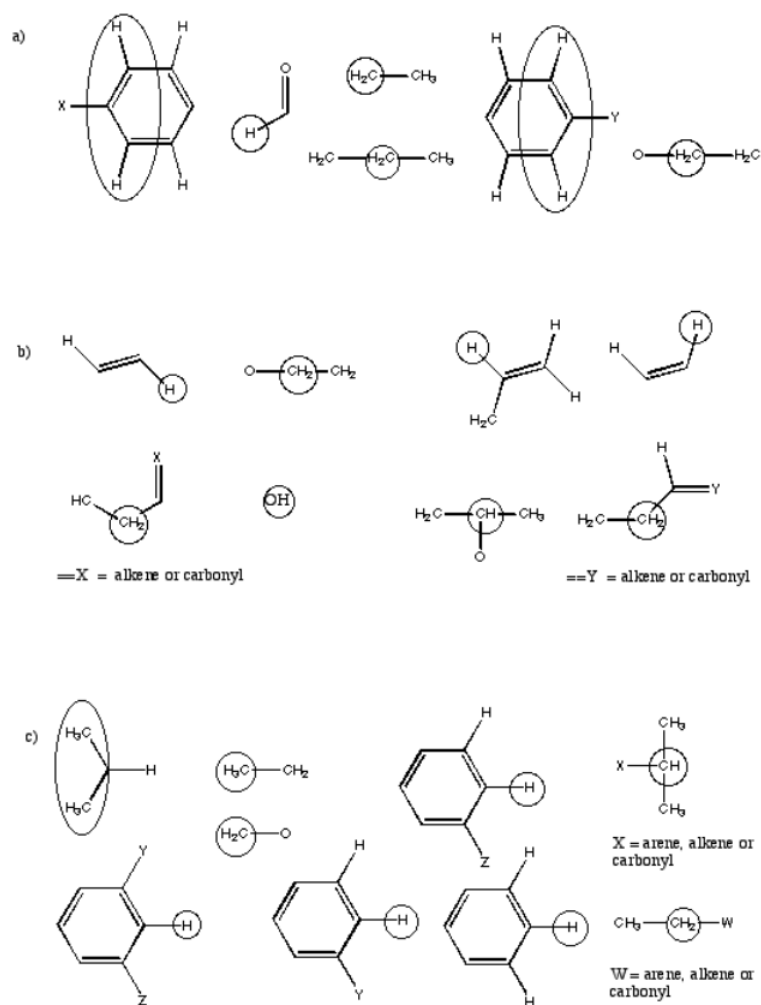
? Exercise 4.16.12

Suggest partial structures for the following data, given in string form.

- a) 8.05 ppm (doublet, 2H) b) 3.25 ppm (septet, 1H) c) 2.65 ppm (nonet, 1H)
 d) 6.55 ppm (broad singlet, 1H) e) 0.94 ppm (triplet, 3H) f) 2.33 ppm (broad singlet, 2H)
 g) 8.65 ppm (singlet, 1H) h) 2.05 ppm (quartet, 2H) i) 6.21 ppm (doublet of doublets, 1H)

? Exercise 4.16.13

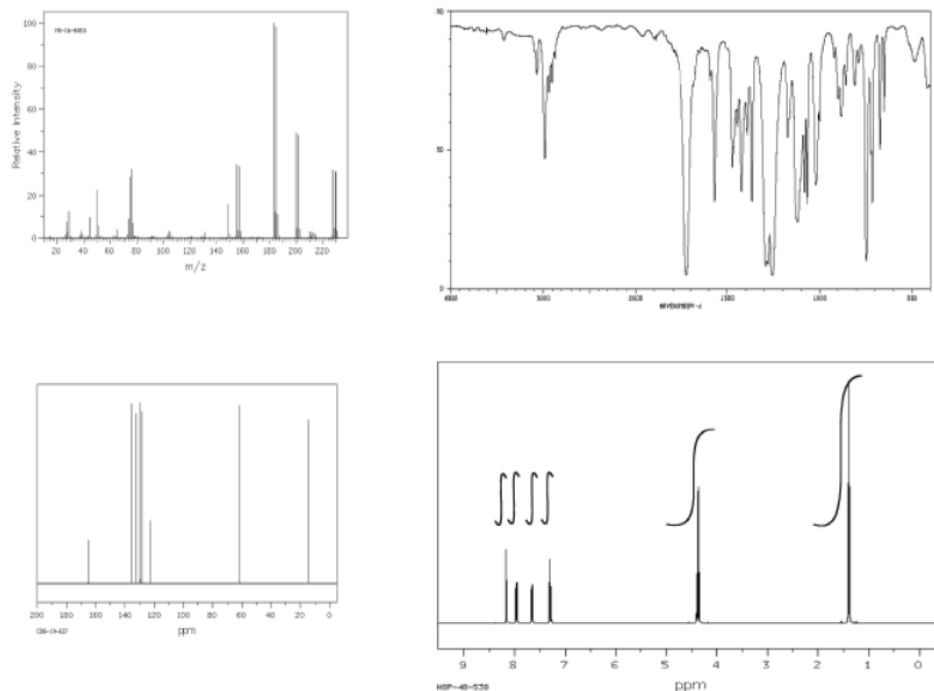
Suggest complete structures from the following sets of partial structures.



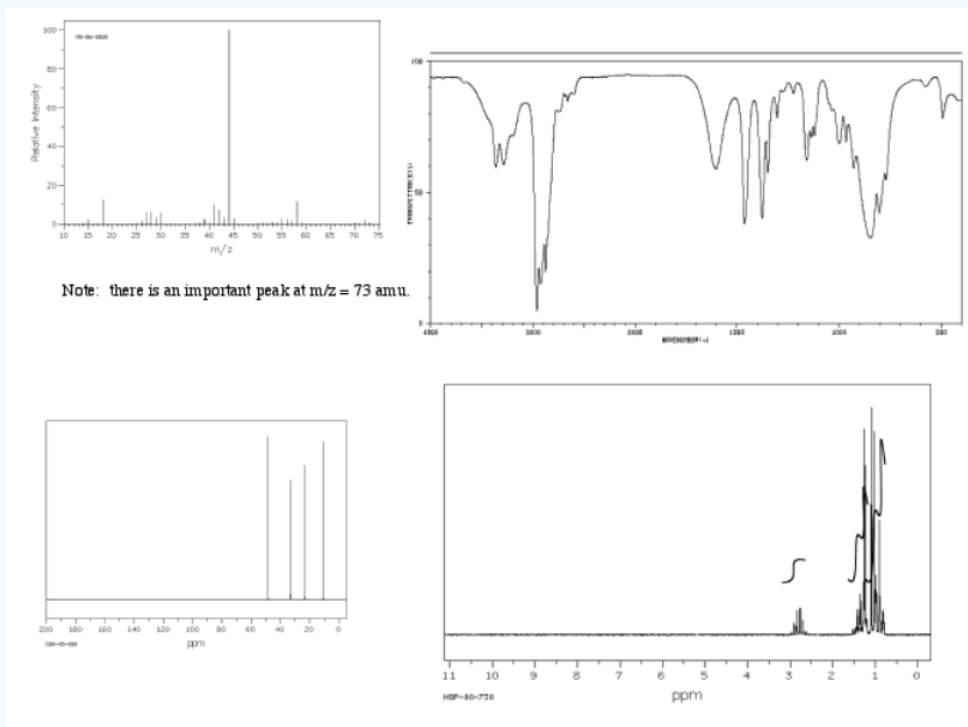
? Exercise 4.16.14

Show complete analysis of the following spectral data and propose a structure in each case.

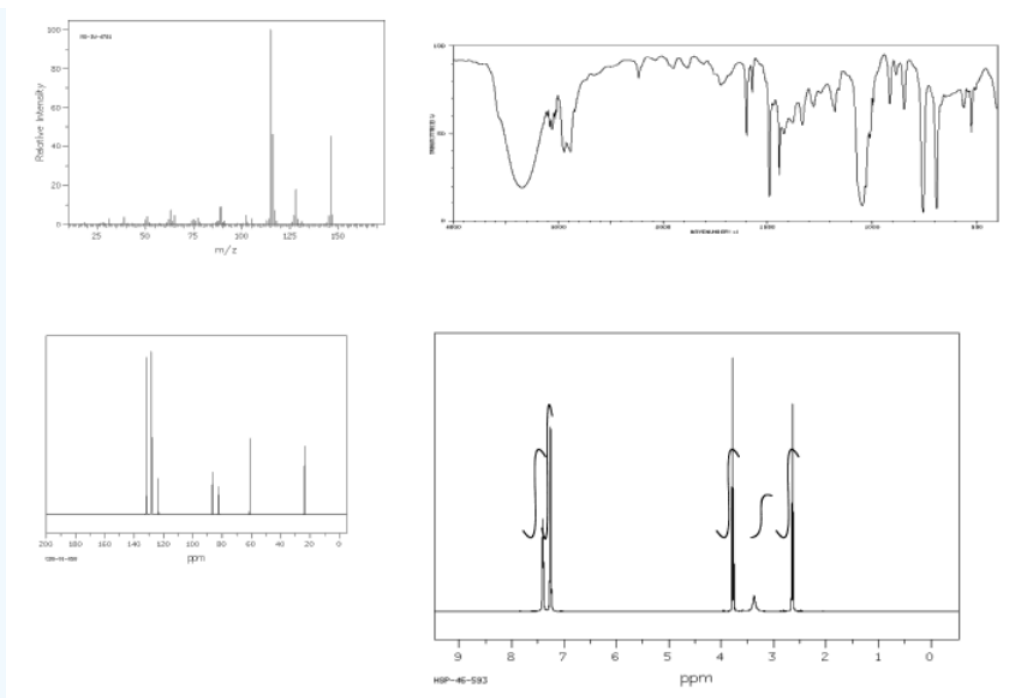
a)



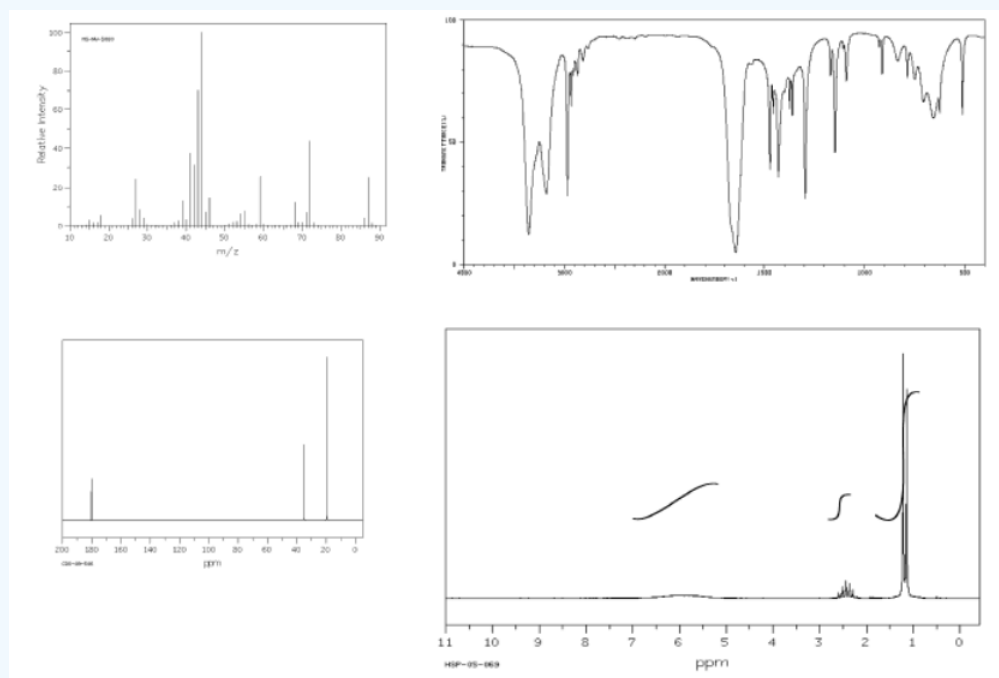
b)



c)

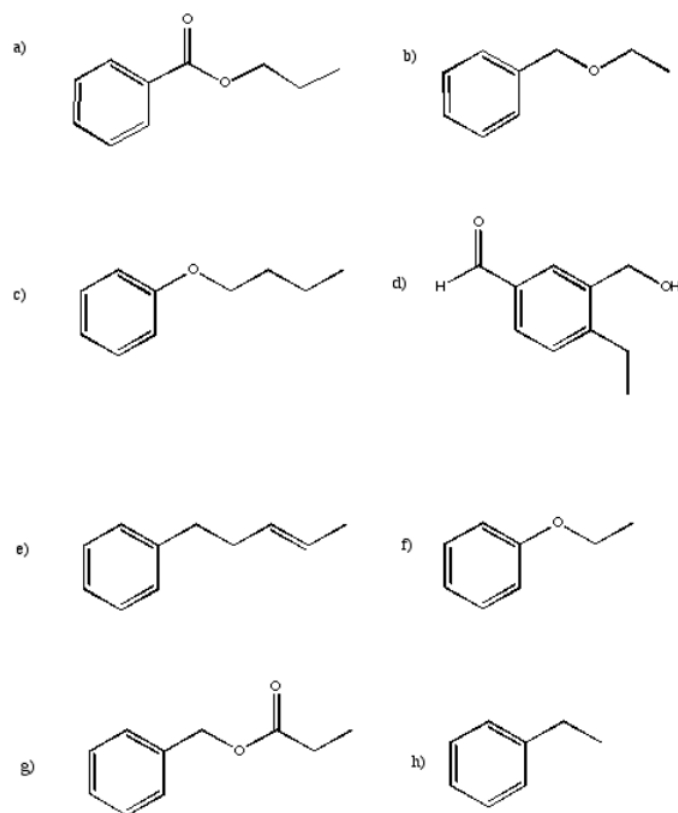


d)



? Exercise 4.16.15

Sketch the expected ^1H spectrum for each of the following structures.

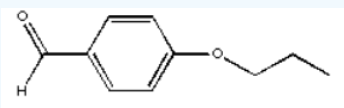


? Exercise 4.16.16

Draw what the NMR spectrum of ethylbenzene, $\text{CH}_3\text{CH}_2\text{C}_6\text{H}_5$, would look like if it was contaminated with an equal amount of tert-butyl methyl ether, $(\text{CH}_3)_3\text{COCH}_3$

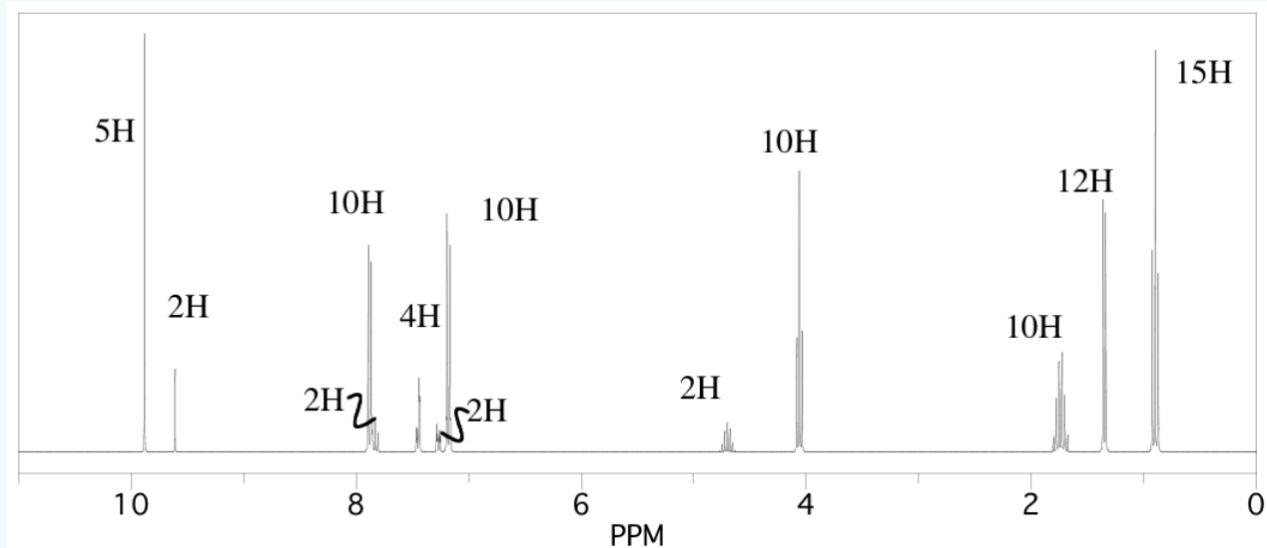
? Exercise 4.16.17

The following NMR spectrum, of the aldehyde shown, is contaminated with another isomer.



- Identify the peaks corresponding to each isomer.
- Identify which peaks correspond to which proton in each isomer.

c. Identify the ratio of isomers in the sample.



This page titled [4.16: More Practice](#) is shared under a [CC BY-NC 3.0](#) license and was authored, remixed, and/or curated by [Chris Schaller](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.