13.39 How could you use IR spectroscopy to help you distinguish between the two compounds shown in Problem 13.38?

13.40 The compound whose $^1$H NMR spectrum is shown here has the molecular formula $C_8H_6Br_2$. Propose a plausible structure.

```
\begin{center}
\includegraphics[width=0.5\textwidth]{image1.png}
\end{center}
```

13.41 Propose structures for compounds that fit the following $^1$H NMR data:

(a) $C_6H_{10}O$

- 6 H doublet at 0.95 δ, $J = 7$ Hz
- 3 H singlet at 2.10 δ
- 1 H multiplet at 2.43 δ

(b) $C_9H_8Br$

- 3 H singlet at 2.32 δ
- 1 H broad singlet at 5.35 δ
- 1 H broad singlet at 5.54 δ

13.42 The compound whose $^1$H NMR spectrum is shown has the molecular formula $C_4H_7O_2Cl$ and shows an infrared absorption peak at 1740 cm$^{-1}$. Propose a plausible structure.

```
\begin{center}
\includegraphics[width=0.5\textwidth]{image2.png}
\end{center}
```

13.43 Propose structures for compounds that fit the following $^1$H NMR data:

(a) $C_6H_6Cl_2$

- 3 H singlet at 2.18 δ
- 2 H doublet at 4.16 δ, $J = 7$ Hz
- 1 H triplet at 5.71 δ, $J = 7$ Hz

(b) $C_{12}H_{14}$

- 9 H singlet at 1.30 δ
- 5 H singlet at 7.30 δ
13.44 How might you use NMR (either $^1$H or $^{13}$C) to differentiate between the following two isomeric structures?

![Structures](image)

(You might want to build molecular models to help you examine the two structures more closely.)

13.45 Propose plausible structures for the two compounds whose $^1$H NMR spectra are shown.

(a) $\text{C}_4\text{H}_8\text{Br}$

(b) $\text{C}_4\text{H}_8\text{Cl}_2$

13.46 We saw earlier that long-range coupling between protons more than two carbon atoms apart is sometimes observed when π bonds intervene. One example of long-
The $^1$H and $^{13}$C NMR spectra of compound A, C$_6$H$_5$Br, are shown. Propose a possible structure for A, and assign peaks in the spectra to your structure.

13.49 Propose plausible structures for the three compounds whose $^1$H NMR spectra are shown.

(a) C$_4$H$_{10}$O$_2$
Figure 19.5. Nmr spectra for Problem 30, p. 653.

30, p. 653.