Key

Chemistry 344
Spectroscopy Part II
Problem Set

I. For each of the following structures, label the equivalent sets of hydrogens as a, b, c, etc. and sketch the $^1$H NMR spectrum on one of the attached blanks. Show each NMR signal at the correct chemical shift (approximate, use correlation table attached to this problem set) with the correct multiplicity (spin-spin splitting) and relative intensities (approximate). Label each signal with the letter corresponding to the hydrogens it represents.

A. 

D. 

B. 

C. 

For each of the following structures, label the equivalent sets of hydrogens as a, b, c, etc. and sketch the $^1$H NMR spectrum on one of the attached blanks. Show each NMR signal at the correct chemical shift (approximate, use correlation table attached to this problem set) with the correct multiplicity (spin-spin splitting) and relative intensities (approximate). Label each signal with the letter corresponding to the hydrogens it represents.
(coupling to aldehyde H too small to easily see)
II. For each of the following molecules, identify the non-alkyl, key functional group(s). Using the IR correlation table attached at the end of this problem set, give the range in wavenumbers (cm\(^{-1}\)) where you expect the band(s) for each functional group to appear.

A. 

\[ \text{ester} \]

\[ \begin{aligned} \text{C} &= \text{O} & 1650 - 1850 \text{ cm}^{-1} \\ \text{C} &= \text{O} & 1050 - 1200 \text{ cm}^{-1} \end{aligned} \]

B. 

\[ \text{nitrile} \]

\[ \text{C} = \text{N} \quad 2200 - 2300 \text{ cm}^{-1} \]

C. 

\[ \text{alcohol} \]

\[ \text{O} - \text{H} \quad 3400 - 3700 \text{ cm}^{-1} \]

D. 

\[ \text{Ketone} \]

\[ \begin{aligned} \text{C} &= \text{O} & 1650 - 1850 \text{ cm}^{-1} \\ \text{C} &= \text{C} & 1600 - 1700 \text{ cm}^{-1} \\ \text{alkene} \end{aligned} \]
III. For each of the attached $^1$H NMR spectra (labeled A, B, C) draw the structure of the compound it corresponds to. The formulae of compounds A, B, and C are given below. Note that two NMR plots are shown for each compound. The front of the page shows the entire spectral region whereas the back of the page shows an expansion of the areas where the NMR signals occur.

A. $C_5H_{10}O_2$

B. $C_6H_{10}O_2$

C. $C_3H_{10}O$