Week 6: covering material through 13.12

Major concepts from this week:
- Chemical shift
- Integration of $^1$H NMR signals
- Diamagnetic anisotropy
- Spin-spin coupling and the coupling constant (J)

Problem solving

1. For the following four compounds, label the protons in the following compounds. The proton that gives the signal at the lowest frequency should be labeled $a$, the next $b$, etc.
2. An unknown compound with molecular formula $\text{C}_9\text{H}_{10}\text{O}$ was analyzed by $^1\text{H}$ NMR and infrared spectroscopy. Determine the identity of the unknown compound from the below spectra.

Integral ratios of peaks (from left to right): 2:2:3:3
3. When methyllithium was reacted with propylene oxide, two products were formed:

\[
\begin{align*}
\text{Li} & \quad \text{H}_3\text{C} \\
\text{O} & \quad \text{H}_3\text{C} \\
\end{align*}
\]

\[\text{A} + \text{B}\]

The products were purified, and $^1$H NMR spectra acquired. These are shown below. Identify the two products of the reaction, and which NMR spectrum corresponds to which product. Assign the resonances in the two NMR spectra.

0.9 ppm – t, 3H
1.1 ppm – d, 3H
1.5 ppm – doublet of triplets, 2H
2.4 ppm – s, 1H
3.7 ppm – multiplet, 1H

0.9 ppm – d, 6H
1.8 ppm – septet, 1H
2.1 ppm – s, 1H
3.4 ppm – d, 2H