1. Deduce the structure of a compound that is consistent with each of the following IR spectra.

a. \( C_6H_{11}N \)

\[
\text{v} = \frac{10 + 2 + 1 - 1}{2} = 1
\]
b. C₅H₆O

\[ UN = \frac{10 + 2 - 8}{2} = 2 \]
c. \( C_5H_{12}O \)

\[
\nu_N = \frac{14 + 2 - 12}{2} = 2
\]
2. Assign the appropriate carbonyl stretching frequency to each of the following compounds. The options are: 1687, 1786, and 1798 cm<sup>-1</sup>.

\[ \text{1786} \quad \text{1798} \quad \text{1687} \]

Briefly describe your reasoning for the assignments you made above. Include any structures that will aid in your discussion.

- Least single bond character \( \rightarrow \) most strongest

\[ \begin{align*}
\text{least single bond characte} & \rightarrow \text{most strongest} \\
\text{ester} & < \text{ester} < \text{ester} \\
\end{align*} \]

- \( \text{N} \) is a great donor:
  - (better than \( \text{O} \), which withdraws electron-density through induction)

- Esters have same type of resonance:

\[ \begin{align*}
\text{ester} & \leftrightarrow \text{ester} + \text{ester} \leftrightarrow \text{ester} \\
\end{align*} \]

- But there is competing conjugation in one case:

\[ \begin{align*}
\text{s} & \leftrightarrow \text{ester} \leftrightarrow \text{ester} \leftrightarrow \text{ester} \\
\text{s} & \leftrightarrow \text{s} \leftrightarrow \text{s} \leftrightarrow \text{s} \\
\end{align*} \]

- Slightly stronger \( \text{C}=\text{O} \), but oxygen lone pair is also in conjugation with \( \text{C}=\text{C} \).
  - Less donation to \( \text{C}=\text{O} \).