1. The two mass spectra below correspond to two isomers of C₅H₁₀O: 3-methyl-2-butanone and 3-pentanone. Draw the two structures. Match the spectrum with the compound and draw the fragment ion that corresponds to the base peak.

a) 3-methyl-2-butanone

\[
\begin{align*}
\text{[CH₃C(CH₃)₂CO⁺]} & \quad m^+ = 86 \quad \text{m/z = 43 base peak} \\
\text{[CH₃C(CH₃)]⁻} & \quad m^+ = 86 \quad \text{m/z = 57 base peak}
\end{align*}
\]

b) 3-pentanone

2. The three compounds shown below are structural isomers of each other. Match each compound with its corresponding mass spectrum (a, b, and c) and draw the fragment ion corresponding to the base peak in each.

a) \[
\begin{align*}
\text{[CH₃C(CH₃)₂CO⁺]} & \quad m-29 \rightarrow \quad \text{[CH₃C(CH₃)]⁻} & \quad + \text{CHO}^- \\
\text{m/z = 57}
\end{align*}
\]

b) \[
\begin{align*}
\text{[CH₃CH₂C(O)⁺]} & \quad m-43 \rightarrow \quad \text{[CH₃C(O)]⁻} & \quad + \text{CH₃}^- \\
\text{m/z = 43}
\end{align*}
\]

c) \[
\begin{align*}
\text{[CH₃CH₂CH(OH)⁺]} & \quad m-15 \rightarrow \quad \text{[CH₃CH₂CH(OH)]⁻} & \quad + \text{CH₃}^- \\
\text{m/z = 71}
\end{align*}
\]
3. An unknown compound gives rise to the following infrared and mass spectra. Propose a structure for the compound. Explain by citing features from both spectra.

**Infrared spectrum**

3600-3200 cm\(^{-1}\) O-H str

3300 cm\(^{-1}\) sp C-H str

2900 cm\(^{-1}\) sp\(^3\) CH str

2150 cm\(^{-1}\) CC triple bond str

1050 cm\(^{-1}\) C-O str (1\(^{\circ}\))

**Mass spectrum**

\[
\begin{align*}
\text{HC=CCH}_2\text{CH}_2\text{OH}^+ &\rightarrow \text{H}^+ \rightarrow \text{HC=CCH}_2\text{CHOH}^+ \\
\text{m}^+ = 70 &\rightarrow \text{m}^{-1} = 69 \\
\text{peak at 31 is } &\text{CH}_2\text{OH}^\Phi \\
\text{base peak is very unusual: } &\text{loss of formaldehyde (neutral molecule)} \\
\text{m}^+ = 70 &\rightarrow \text{m/z} = 40
\end{align*}
\]