• Draw the constitutional formula(s) of the major organic product(s) formed in each of the following reactions.

<table>
<thead>
<tr>
<th>Reaction</th>
<th>Product(s)</th>
</tr>
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</table>
| \[
\text{CH}_3\text{CH}_3\text{CH}=\text{CH}_2 + \text{HBr} \rightarrow \\
\]
| \[
\text{CH}_3\text{CH}_3\text{OH} + \text{conc. H}_2\text{SO}_4 \rightarrow \\
\]
| \[
\text{OH} + \text{Cr}_2\text{O}_7^{2-}/\text{H}^{+}/\text{H}_2\text{O} \rightarrow \\
\]|
• Compound Z can readily be identified by ¹H NMR spectroscopy.

How many signals would you expect to see in the ¹H NMR spectrum of compound Z?

Write the letters a, b, c, etc on the diagram of compound Z to identify each unique hydrogen environment giving rise to a signal in the ¹H NMR spectrum.

Sketch the ¹H NMR spectrum for compound Z. Label each signal in the spectrum with a, b, c, etc to correspond with your assignments on the diagram of Z above. Make sure you show the relative number of hydrogens and the splitting pattern (number of fine lines) you would expect to see for each signal.
• Draw the constitutional structure of the major organic product formed in the following reactions. Indicate the correct isomer where appropriate.

\[
\begin{align*}
\text{OH} & \quad \text{Cr}_2\text{O}_7^{2-} / \text{H}^{\ominus} \\
\end{align*}
\]
Draw the constitutional formula of the major organic product formed in each of the following reactions.

<table>
<thead>
<tr>
<th></th>
<th>Marks</th>
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<tbody>
<tr>
<td>2</td>
<td></td>
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</tbody>
</table>

\[
\text{C}_\text{C}_\text{C}_\text{C}_\text{C}_\text{C}_\text{OH} \xrightarrow{\text{Cr}_\text{O}_\text{O}^2^- / \text{H}^\text{\textdegree}} \]

\[
\text{C}_\text{C}_\text{C}_\text{C}_\text{C}_\text{C}_\text{OH} \xrightarrow{\text{conc. HBr}} \]

THE REMAINDER OF THIS PAGE IS FOR ROUGH WORKING ONLY.