V. (28 points)

A. There are many compounds that share the molecular formula C₆H₁₂Cl; some of them are shown below. For each question, you should circle the letter corresponding to the molecule for which the statement is true. You will be graded by the molecule, not the question.

Circle the letters for those molecules (A-G) that...

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>a) ... has an enantiomer</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
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<tr>
<td>b) ... has at least one (R)-stereocenter</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>c) ... is optically active</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>d) ... is unique and has no stereoisomers</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>e) ... has at least one optically inactive diastereomer</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>f) ... has at least one optically active diastereomer</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>g) ... has at least one (S)-stereocenter</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
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<tr>
<td>h) ... is a meso compound</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
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(i) Provide the complete IUPAC name, including stereochemistry where appropriate, for Compound B.

B. Treatment of Compound B with HCl is predicted to yield 2 regioisomeric addition products. Draw these products (spectroscopic data is given), if more than one stereoisomer can form, draw one clearly. Answer the questions about how each of these products will form.

The NMR spectra for this product:

1H-NMR signals: 3 (3:2:1)
13C-NMR signals: 3

This product forms as:
(check all that apply)

- a mixture of 2 diastereomers
- a racemic mixture
- a single chiral compound
- a single achiral compound
- at least one product is optically active
- at least one product is optically inactive

The NMR spectra for this product:

1H-NMR signals: 6 (3:3:2:2:1:1)
13C-NMR signals: 6

This product forms as:
(check all that apply)

- a mixture of 2 diastereomers
- a racemic mixture
- a single chiral compound
- a single achiral compound
- at least one product is optically active
- at least one product is optically inactive