1. Name the following compound. Use the IUPAC system and include configurational (R,S) designations.

![Compound Diagram]

2. Compound A (optically pure) and Compound B (optically pure) have the following properties.

<table>
<thead>
<tr>
<th>Property</th>
<th>Optically Pure A</th>
<th>Optically Pure B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific rotation</td>
<td>40.</td>
<td>100</td>
</tr>
<tr>
<td>Vapor pressure at 100 deg C</td>
<td>500 torr</td>
<td>300 torr</td>
</tr>
<tr>
<td>density</td>
<td>0.95 g/mL</td>
<td>1.1 g/mL</td>
</tr>
</tbody>
</table>

A mixture of A and B has a specific rotation of 50 degrees. What fraction of the mixture is compound A?

3. Nitromethane, CH₃NO₂, is a much stronger acid than is methane. Offer an explanation for the relative acidities.
4. Consider the single-step, endothermic ionization of an organic halide to yield a carbocation and a halide ion as shown below.

\[ R-X \rightarrow R^+ + X^- \]

a) Will a polar solvent provide better stabilization for the reactant side of the step or the product side of the step?

Consider two solvents, A (lower polarity) and B (higher polarity) for the ionization.

b) Draw the transition states for ionization in A and in B. Compare the nature of the transition states in the two solvents.

5) Write the balanced reaction for the reaction of acidic chromium trioxide, \( \text{CrO}_3 \), with a secondary alcohol, \( R_2\text{CHOH} \), to yield \( \text{Cr}(+3) \) ion and a ketone, \( R_2\text{CO} \).

6. An unknown compound, \( C_8H_{14} \), is optically active. Ozonolysis of the unknown yields 2-methylpropanal and ethanal. Suggest a structure for the unknown.

7. For the disubstituted cyclohexane shown below complete the Newman projection diagram about the C1 – C2 bond to represent the most stable conformation.
For the following reactions give the missing reactants or products. Show the stereochemistry. Write "NR" if there is no reaction. **Put answers on the answer sheet.** In some questions you are provided with templates for the answer. Use as many of the templates as needed. If additional templates are needed you should draw identical structures. If you are unsure about the notation ask the monitor.

8.

\[
\begin{array}{c}
\text{CH}_3 \\
\text{H}_3C \\
\end{array}
\xrightarrow{\text{excess Br}_2}
\begin{array}{c}
\text{CH}_3 \\
\text{(CH}_2)_2 \\
\text{CH}_3 \\
\end{array}
\begin{array}{c}
\text{CH}_3 \\
\text{(CH}_2)_2 \\
\text{CH}_3 \\
\end{array}
\begin{array}{c}
\text{CH}_3 \\
\text{(CH}_2)_2 \\
\text{CH}_3 \\
\end{array}
\begin{array}{c}
\text{CH}_3 \\
\text{(CH}_2)_2 \\
\text{CH}_3 \\
\end{array}
\]

9.

1. peracid (excess)

\[
\begin{array}{c}
\text{Ph}_2\text{HC} \\
\end{array}
\xrightarrow{\text{aq. acid}}
\begin{array}{c}
\text{H}^+\text{Br}^- \\
\end{array}
\]
11. Show the resonance structures for the carbocation below.

\[
\begin{array}{c}
\text{CH}_2^+ \\
\text{\textbullet} \\
\text{\textbullet} \\
\text{OH} \\
\end{array}
\]

12. For the following triol, characterize the stereoisomers by filling out the table below.

\[
\begin{array}{c}
\text{\textbullet} \\
\text{OH} \\
\text{\textbullet} \\
\text{OH} \\
\text{OH} \\
\end{array}
\]

<table>
<thead>
<tr>
<th>Number of meso structures</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of racemic pairs</td>
<td></td>
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<tr>
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- CH(CH\_3)\_2