1. Nomenclature. Provide the structure or the name for the following. If stereochemistry is a factor, do not neglect it. (6 pt)

3-isopropylbenzaldehyde

optically active

2. Rank the following, with 1 being highest, or most. (6 pt)

Equilibrium concentration of enol

Reactivity toward MeMgBr

Acidity
3. Draw the products for the following reactions (3 pt each)

- \( \text{CH}_3-\text{C}=\text{C}-\text{H} \xrightarrow{\text{Hg}^{2+}, \text{H}_2\text{O}, \text{H}_2\text{SO}_4} \)

- \( \text{CH}_3-\text{C}=\text{C}-\text{H} \xrightarrow{\text{NaOEt, EtOH, heat}} \)

- \( \text{Ph-C}=\text{O} \xrightarrow{\text{NaOMe, MeOH}} \)

- \( \text{Ph-C}=\text{O} \xrightarrow{\text{NaOMe, MeOH}} \)

- \( \text{H}_2\text{O}, \text{H}^+ \)

- \( \text{MeOH}, \text{H}^+ \)

- \( \text{KCN, HCN} \)
4. Draw the products for the following multistep reactions. (3 pt each)

\[
\text{MeO} \quad \text{Ph} \\
\text{O} \quad \text{O} \\
\text{1. LDA} \\
\text{2. BrCH}_2\text{CH}_3
\]

\[
\text{Br} \\
\text{1. PPh}_3 \\
\text{2. BuLi} \\
\text{3. acetone}
\]

\[
\text{MeO} \quad \text{Ph} \\
\text{O} \quad \text{O} \\
\text{1. NaOEt, EtOH} \\
\text{2. BrCH}_2\text{Ph} \\
\text{3. H}_3\text{O}^+, \text{heat}
\]
5. For the following chemicals, describe the extent to which each would be deprotonated by LDA (LiN-iPr₂) or by NaOH at equilibrium. Fill in all 6 boxes. Options are complete deprotonation (A), a little deprotonation (B), and no deprotonation (C). (6 pt)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>LDA</th>
<th>NaOH</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Chemical 1" /></td>
<td><img src="image2.png" alt="Box" /></td>
<td><img src="image3.png" alt="Box" /></td>
</tr>
<tr>
<td><img src="image4.png" alt="Chemical 2" /></td>
<td><img src="image5.png" alt="Box" /></td>
<td><img src="image6.png" alt="Box" /></td>
</tr>
<tr>
<td><img src="image7.png" alt="Chemical 3" /></td>
<td><img src="image8.png" alt="Box" /></td>
<td><img src="image9.png" alt="Box" /></td>
</tr>
</tbody>
</table>

Options:
A = completely (~100%)
B = a little, but not much (< 10% but not 0%)
C = none at all (0%)

6. Suggest a plausible structure consistent with the following information. (5 pt)
   a. It reacts positively with 2,4-dinitrophenylhydrazine.
   b. It reacts positively with NaOH/I₂, the iodoform test
   c. It does not react with Tollens's reagent [Ag(NH₃)₂⁺OH⁻].
   d. It does not react with Br₂ in dichloromethane solvent.
   e. Chemical formula is **C₇H₁₂O**
   f. Its ¹³C spectrum shows 5 carbons (1 singlet, 1 doublet, 2 triplets, and 1 quartet)

7. Which of the following would **not** undergo decarboxylation (loss of CO₂) upon heating? (2 pt)

| ![Chemical 4](image10.png) | ![Chemical 5](image11.png) | ![Chemical 6](image12.png) |
8. Put in the starting materials from which the following would be made. (3 each)

9. Draw the mechanisms for the following reactions. (4 pt each)
(Note: this one counts as 2 problems, 8 points total)

All steps are actually in equilibrium, but I only want you to show the forward direction.
10. Provide reagents for the following transformations. (4 pt each)

```
\[ \text{CHO} \rightarrow \text{CH(OH)CH(OH)CH(OH)CH(OH)CH(OH)} \]
```

11. Design a synthesis for the following alkene FROM ALCOHOLS WITH NO MORE THAN 5 CARBONS. (6 pt)

```
\[ \text{PhCH(OH)CH(OH)CH(OH)CH(OH)CH(OH)} \rightarrow \text{PhCH=CHCH=CHPh} \]
```