Alcohols and Retrosynthesis

1. Give Names or structures for the following: (9 points)

ortho-chlorophenol

![ortho-chlorophenol structure]

2. For each of the following pairs, circle the one that is higher boiling and put a square around the one with the higher water solubility. (4 points)

a. 

b. 

3. Of the listed four chemicals, circle those which would ionize methanol (convert it to sodium or magnesium methoxide)? (4 points)

Na  NaNH₂  NaOH  CH₃MgBr

4. If an ether solution of the following three compounds was washed with NaOH/H₂O, which (if any) of the compounds would remain in the ether layer? Circle any that would. (3 points)

![compounds A, B, C]

5. Of the following common solvents, circle those that are unsuitable as solvents for the preparation and reactions of Grignard reagents (assuming you want the Grignard reagent to react with something else). (3 points)

ethyl acetate  diethyl ether  isopropanol  tetrahydrofuran
6. Give the major product of the following reactions.  (3 points each)

1. \( \text{CH}_3\text{MgBr} \)

2. \( \text{H}_3\text{O}^+ \)

Ph\(\text{MgBr}\) \(\text{OCH}_3\)

1. \( \text{LiAlH}_4 \)

2. \( \text{H}_3\text{O}^+ \)

\(\text{OH}\)

1. \( \text{Na} \)

2. \( \text{Br} \)

\(\text{OH}\)

\(\text{H}_2\text{CrO}_4\)

\(\text{OH}\)

1. \( \text{TsCl}, \text{pyridine} \)

2. \( \text{NEt}_3, \text{heat} \)

\(\text{OH}\)

1. \( \text{HBr} \)

2. \( \text{Mg} \)

3. \( \text{H}_2\text{C}=\text{O} \)

4. \( \text{H}_3\text{O}^+ \)
7. Draw mechanisms for the following reactions. (3, 5, and 5 points)

8. Suggest a possible structure for an unknown A whose formula is C\textsubscript{6}H\textsubscript{12}O, and gives the following chemical test results: (Double check that your answer is consistent with all the data) 5 pt

<table>
<thead>
<tr>
<th>Test</th>
<th>Reagent</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogenation Test</td>
<td>H\textsubscript{2}/Pt</td>
<td>No reaction</td>
</tr>
<tr>
<td>Chromic Acid Test</td>
<td>H\textsubscript{2}CrO\textsubscript{4}</td>
<td>Turns green</td>
</tr>
<tr>
<td>Lucas Test</td>
<td>HCl/ZnCl\textsubscript{2}</td>
<td>No reaction</td>
</tr>
</tbody>
</table>

Formula: C\textsubscript{6}H\textsubscript{12}O
9. Provide reagents for the following transformations. ("workup" means H$_3$O$^+$ or H$_2$O steps) (First two are 3 points each; last four are 5 points each)

(First two are 3 points each; last four are 5 points each)

(1 step)

(2 steps, counting workup)

(3 steps, counting workup)

(4 steps, counting workup)

(4 steps, counting workup.)

(4 steps, counting workup)
10. Design syntheses for the following. Allowed starting materials (same as practice) include:
   bromobenzene 6 points each
   cyclopentanol
   any acyclic alcohol or alkene with ≤5 carbons
   any esters
   ethylene oxide
   formaldehyde (CH₂O)
   iodomethane
   any "inorganic" agents (things that won't contribute carbons to your skeleton)

Note: In this test, I had allowed alcohols of up to 5 carbons, not limited to only 4.