**CHEM 1611 Assignment Week 9**

1. (+)-Citronellal is a widely occurring natural product, present in citronella oil, lemon and lemon grass. It is used as a soap perfume and in insect repellents.

![Citronellal structure]

(a) Give the molecular formula for citronellal: \( C_{10}H_{18}O \)

(b) Give the names of the functional groups: Aldehyde and alkene

Give the constitutional formula of the major product(s) formed when citronellal is treated with each of the following reagents.

<table>
<thead>
<tr>
<th>REAGENT</th>
<th>CONSTITUTIONAL FORMULA OF PRODUCT(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) ([Ag(NH_3)_2]^+ / HO^-)</td>
<td>![Product structure]</td>
</tr>
<tr>
<td>(ii) excess CH(_3)OH / catalytic amount H(_2)SO(_4)</td>
<td>![Product structure]</td>
</tr>
<tr>
<td>(iii) 1. NaBH(_4) in CH(_3)OH 2. H(^+)/H(_2)O</td>
<td>![Product structure]</td>
</tr>
<tr>
<td>(iv) H(_2)/Pd in ethanol</td>
<td>![Product structure]</td>
</tr>
<tr>
<td>(v) 3 M H(_2)SO(_4)</td>
<td>![Product structure]</td>
</tr>
</tbody>
</table>
2. Complete the following table.

<table>
<thead>
<tr>
<th>STARTING MATERIAL</th>
<th>REAGENTS</th>
<th>CONSTITUTIONAL FORMULA OF PRODUCT(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) acetone</td>
<td>heated in excess methanol with a catalytic amount of H₂SO₄</td>
<td>H₃CO&lt;sub&gt;2&lt;/sub&gt;OCH₃, CH₃CH₂CH₃</td>
</tr>
<tr>
<td>(b) ethylammonium chloride</td>
<td>dilute sodium hydroxide</td>
<td>CH₃CH₂NH₂</td>
</tr>
</tbody>
</table>

3. Give the reagents and reaction conditions required to carry out the following conversions. Note that more than one step may be necessary.

- **Conversions:**
  - From cyclopentanol to cyclopentyl methyl ether:
    - React with excess methanol in the presence of a catalytic amount of H₂SO₄.
    - Heat.
  - From cyclopentanol to cyclopentanone:
    - Oxidize with Cr₂O₇<sup>2-</sup> in the presence of H⁺.
  - From 1-pentanol to 1-pentene:
    - Oxidize with Cr₂O₇<sup>2-</sup> in the presence of H⁺.
    - Heat.
  - From 1-pentanol to 1-pentanol in the presence of conc. H₂SO₄:
    - Heat.
  - From 1-pentanol to 1-pentanol in the presence of dil. H₂SO₄:
    - Heat.
CH₃CH₂OH $\rightarrow$ (CH₃CH₂)₄N⁺ Br⁻

conc. HBr
heat

CH₃CH₂Br

(CH₃CH₂)₃N