Complete the following table.

<table>
<thead>
<tr>
<th>STARTING MATERIAL NAME (where required)</th>
<th>REAGENTS/ CONDITIONS</th>
<th>CONSTITUTIONAL FORMULA(S) OF MAJOR ORGANIC PRODUCT(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[\text{CH}_3\text{CH} = \text{CH}_2\text{CH}_2\text{OH}]</td>
<td>[\text{Zn} / \text{dilute HCl}]</td>
<td>[\text{CH}_3\text{CH} = \text{CH}_2\text{CH}_2\text{OCH}_3]</td>
</tr>
<tr>
<td>[\text{S-S}]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Complete the following table. Make sure you complete the name of the starting material where indicated.

<table>
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</table>
| ![Sulfur Dioxide]

Name: \( \text{Cl}_2 / \text{CCl}_4(\text{solvent}) \) | | |
| ![Aldehyde]

Name: \( \text{CH}_2\text{Br}_2 \) | | |
| ![Haloalkane]

Name: \( \text{H}_2\text{O} / \text{Cr}_2\text{O}_7^{2-} \) | | |
| ![Ester]

Name: \( \text{H}_2\text{O} / \text{Cr}_2\text{O}_7^{2-} \) | | |

Total Marks: 13
Complete the following table. Make sure you complete the name of the starting material where indicated.

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<tbody>
<tr>
<td>CH₃CH₂CHCH₂CH₃ Br</td>
<td></td>
<td>CH₃CH₂CHCH₂CH₃ Br⁻ N(CH₃)₃</td>
</tr>
<tr>
<td>Name:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH₃CH₂CH₂CCH₃</td>
<td>1. LiAlH₄ / dry ether</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. H⁺ / H₂O</td>
<td></td>
</tr>
<tr>
<td>Name:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Ag(NH₃)₂]⁻ / dil. OH⁻</td>
</tr>
</tbody>
</table>
The structure of testosterone, an important male hormone, is shown below.

Give the molecular formula of testosterone.

Identify the functional groups present in testosterone.

How many stereogenic (chiral) centres are there in testosterone?

Draw the constitutional formula of the product formed when testosterone is treated with the following reagents.

- Excess methanol / HCl
- LiAlH₄ in dry ether; then H⁺ / H₂O
- Concentrated H₂SO₄ / heat
- H₂ / Pd catalyst
• (+)-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.

\[
\text{citronellal}
\]

Give the molecular formula of citronellal.

Identify the functional groups present in citronellal.

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

\[
\text{Cr}_2\text{O}_7^{2-} / \text{H}^+ \\
3 \text{ M H}_2\text{SO}_4 \\
\text{excess CH}_3\text{OH} / \text{catalytic amount H}_2\text{SO}_4
\]
• Devise a synthesis of 1,2-dibromocyclohexane from cyclohexanone. Note that more than one step is required and you should indicate all necessary steps and the constitutional formulas of any intermediate compounds.

\[
\text{O} \quad \text{Br} \\
\text{Br}
\]

• Indicate the reagents used in the laboratory to undertake the following transformations.

\[
\begin{align*}
\text{A} & : \\
\text{B} & : \\
\text{C} & :
\end{align*}
\]

A: 
B: 
C: 

Provide a description for transformation B.

Provide a description for transformation D.
• Acyclovir is an analogue of the nucleoside guanosine, and is used clinically as an antiviral agent.

\[
\begin{array}{c}
\text{HO} \\
\text{N} \\
\text{O} \\
\text{O} \\
\text{NH}_2 \\
\end{array}
\]

acyclovir

Hydrolysis of acyclovir gives the nucleic base guanine, a diol and a carbonyl compound. Give the structures of guanine, a tautomer of guanine, and the diol and carbonyl compounds formed.

<table>
<thead>
<tr>
<th>guanine</th>
<th>tautomer of guanine</th>
</tr>
</thead>
<tbody>
<tr>
<td>the diol</td>
<td>the carbonyl compound</td>
</tr>
</tbody>
</table>

THE REMAINDER OF THIS PAGE IS FOR ROUGH WORKING ONLY.
• Show clearly the reagents you would use to carry out the following chemical conversions. Note that more than one step is required and you should indicate all necessary steps and the constitutional formulas of any intermediate compounds.

\[ \text{Br} \quad \rightarrow \quad \text{H}_3\text{CO} \quad \text{OCH}_3 \]

\[ \text{OH} \quad \text{Br} \quad \rightarrow \quad \text{OH} \quad \text{Al} \]

Marks 6