• Draw the repeating unit of the polymer formed in the following reactions.

\[
\begin{align*}
\text{Cl} & \quad \text{Cl} \\
\text{H}_2\text{N} & \quad \text{NH}_2 \\
\end{align*}
\]

\[
\begin{align*}
\text{HO} & \quad \text{Cl} \\
\end{align*}
\]

Considering the polymers formed above, which:
(i) would be more stable towards acid-catalysed hydrolysis, and
(ii) would have a greater tensile strength? Give reasons for your answers.

The polyamide is more stable as the ester functional group is more reactive than the amide functional group.

The polyamide has the greater tensile strength as the benzene ring adds greater rigidity to the carbon chain back bone of the polymer and the amide group allows for the formation of hydrogen bonds between chains.

• Briefly describe what is meant by the primary, secondary and tertiary structure of a protein.

The primary structure is the sequence of amino acids in the protein.

The secondary structure is the formation of \(\alpha\)-helices or \(\beta\)-pleated sheets due to intramolecular H-bonding.

The tertiary structure is how the \(\alpha\)-helices and \(\beta\)-pleated sheets fold together because of disulfide bridges, ionic forces, dispersion forces and hydrogen bonds to form the overall shape of the protein, eg globular.
• Draw the constitutional structure of the major organic product formed in the following reactions.

\[ \text{H}_3\text{N}-\text{CH}-(\text{C}-\text{N}-\text{CH}-\text{CO}_2^-) \quad \xrightarrow{\text{H}_2\text{O} / \text{H}^+ (6 \text{ M})} \quad \text{H}_3\text{N}-\text{CH}-\text{COOH} + \text{H}_3\text{N}-\text{CH}-\text{COOH} \]
Give the reagents A and B used for the following reactions.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>CH₃COCl or (CH₃CO)₂O</td>
</tr>
<tr>
<td>B</td>
<td>NaHCO₃</td>
</tr>
</tbody>
</table>

salicylic acid

acetylsalicylic acid

sodium salicylate

 Marks  2
Give the name of the starting material where indicated and the constitutional formula(s) of the major organic product(s) formed in each of the following reactions.

1. $\text{BrCH}_3\text{CH}_2\text{OCH}_2\text{CH}_3 \xrightarrow{\text{Mg / dry ether}} \text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$  
   Name: 2-bromobutane

2. $\text{BrCH}_3\text{CH}_2\text{OCH}_2\text{CH}_3 \xrightarrow{\text{CH}_3\text{CO}^+\text{K}^-} \text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$  

3. $\text{CH}_3\text{CH}_2\text{Br} \xrightarrow{1. \text{Mg / dry ether}} \xrightarrow{2. \text{H}^+ / \text{H}_2\text{O}} \text{CH}_3\text{CH}_2\text{OH}$
• Draw the repeating unit of the polymer formed in the following reactions.

\[
\begin{align*}
\text{CH}_3\text{O} & \quad \text{OCH}_3 \\
\text{H}_2\text{N} & \quad \text{NH}_2
\end{align*}
\]

\[
\begin{align*}
\text{O} & \quad \text{CH}_3 \\
\text{H}_2\text{N} & \quad \text{NH}_2
\end{align*}
\]

\[
\begin{align*}
\text{H}_2\text{N} & \quad \text{NH}_2
\end{align*}
\]

Marks 2

• Show clearly the reagents you would use to carry out the following chemical conversion. Draw constitutional formulas for any intermediate compounds. NOTE: More than one step is necessary.

\[
\begin{align*}
\text{Br} & \quad \text{HBr in CCl}_4 \text{ solvent} \\
\text{Br} & \quad \text{Mg in dry ether solvent}
\end{align*}
\]

\[
\begin{align*}
\text{CO}_2 & \quad (i) \text{H}_2\text{O} / \text{H}^+ \\
\text{H}_2\text{O} & \quad (ii) \text{H}_2\text{O} / \text{H}^+
\end{align*}
\]

(Markovnikov addition with H adding to least substituted end of C=C)
• Draw the repeating unit of the polymer formed in the following reactions.

\[
\begin{align*}
\text{O} & \text{C} & \text{N} & \text{H} \\
\text{O} & \text{C} & \text{O} & \text{N} & \text{H} & \text{N} & \text{O} & \text{H} \\
\end{align*}
\]

\[
\begin{align*}
\text{O} & \text{C} & \text{N} & \text{H} \\
\text{O} & \text{C} & \text{O} & \text{N} & \text{H} & \text{N} & \text{O} & \text{H} \\
\end{align*}
\]

\[
\begin{align*}
\text{O} & \text{C} & \text{N} & \text{H} \\
\text{O} & \text{C} & \text{O} & \text{N} & \text{H} & \text{N} & \text{O} & \text{H} \\
\end{align*}
\]
- Classify the starting materials of the following reactions as nucleophile or electrophile and indicate with $\delta^+$ and $\delta^-$ the polarisation of the C–Br and C=O bonds.

\[
\text{Nucleophile} \quad \text{Electrophile}
\]

- Consider the following reaction sequence.

\[
\text{A} \xrightarrow{\text{NaOH}} \text{B} \xrightarrow{1) \text{LiAlH}_4\, 2) \text{H}^+} \text{C} \xrightarrow{\text{SOCl}_2} \text{D} \xrightarrow{\text{excess methanol}} \text{E} \xrightarrow{\text{conc. HCl} / \text{heat}} \text{F}
\]

Draw the structures of the major organic products, A-F, formed in these reactions.