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

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

+ \quad \rightarrow

\[
\begin{align*}
\text{(O)} & \quad \text{(O)} \\
\text{(N)} & \quad \text{(N)} \\
\text{H} & \quad \text{N}
\end{align*}
\]

\[
\text{n}
\]

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

\[
\text{Cl}
\]

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

\[
\text{H}_2\text{N} \quad \text{NH}_2
\]

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 backbone 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.
Give the reagents A and B used for the following reactions.

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

Draw in appropriate partial charges (δ⁻ and δ⁺) and curly arrows to show the mechanism of the following reaction. Classify the starting materials as nucleophile, electrophile or neither, indicating your choice in the appropriate box.

THE REMAINDER OF THIS PAGE IS FOR ROUGH WORKING ONLY
Consider the following reaction sequences.

List the reagents A - E.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>NaOH</td>
</tr>
<tr>
<td>B</td>
<td>hot, concentrated H$_2$SO$_4$</td>
</tr>
<tr>
<td>C</td>
<td>NaNH$_2$</td>
</tr>
<tr>
<td>D</td>
<td>CH$_3$COCl or (CH$_3$CO)$_2$O</td>
</tr>
<tr>
<td>E</td>
<td>Cr$_2$O$_7^{2-}$/H$^+$</td>
</tr>
</tbody>
</table>

Compare the acidity of a phenol to that of a carboxylic acid.

**Phenols are less acidic than carboxylic acids.** Phenols react with aqueous hydroxide solution to form the phenoxide ion; carboxylic acids react with either aqueous hydroxide or aqueous hydrogen carbonate to form the carboxylate ion.

The difference in stability arises from the relative stability of the conjugate base: there is delocalisation of the charge in the carboxylate ion over two electronegative oxygen atoms. The resonance stabilisation of the charge in the phenoxide ion is over the much less electronegative carbon atoms of the ring.
• Show the structure(s) of all products formed when dipeptide F is treated with hot, concentrated HCl.