1. Write resonance structures which show why aniline, pyrrole and pentanamide are much weaker bases than cyclohexylamine.

\[
\text{[diagram showing resonance structures for aniline, pyrrole, and pentanamide]}
\]

2. Complete the following syntheses. Use a diazonium salt in each.

a) \[
\text{[diagram showing synthesis of an aromatic compound with reactions labeled]}\]

b) \[
\text{[diagram showing synthesis of another aromatic compound with reactions labeled]}\]

c) \[
\text{[diagram showing synthesis of a brominated aromatic compound with reactions labeled]}\]
3. Give all the products of the following Hofmann elimination. Which is the major product and why?

\[
\begin{align*}
\text{1. } \text{CH}_3\text{I, xs} & \rightarrow \text{NMe}_2 \\
\text{2. } \text{Ag}_2\text{O, H}_2\text{O, heat} & \rightarrow \text{NMe}_2 \\
\text{major prod - least sub. double bond - most accessible } \text{H}^+ \text{ removed}
\end{align*}
\]

4. Write out three possible ways to form the following tertiary amine using the reductive amination reaction. Show the starting materials and reagents over the arrows.
5. Write out the mechanism for the following reductive amination reactions. What is the difference in the two mechanisms?

a) \[ \text{H}_3\text{O}^+ \quad \text{NH}_3 \quad \text{NaBH}_3\text{CN}^- \quad \text{OH} \quad \text{O}^\cdot \quad \text{NH}_2 \]

b) \[ \text{NaBH}_3\text{CN} \quad \text{OH} \quad \text{O}^\cdot \quad \text{NH}_2 \]

6. The Hofmann elimination, just like the basic dehydrohalogenation of halides, requires an *anti periplanar* transition state. Give the stereochemical products of the following reactions taking this into consideration. Models may be helpful.

\[ \text{CH}_3\text{I}, \text{xs} \]

\[ \text{Ag}_2\text{O}, \text{H}_2\text{O} \quad \text{heat} \]

\[ \text{NH}_2 \quad \text{CH}_2\text{CH}_3 \]

\[ \text{CH}_3\text{I}, \text{xs} \]

\[ \text{Ag}_2\text{O}, \text{H}_2\text{O} \quad \text{heat} \]