1. Write synthetic sequences showing how to prepare each of the following as major products from benzene or toluene and any other necessary organic or inorganic reagents.

a) ![Chemical Structure](image)

b) ![Chemical Structure](image) \(\text{SO}_2\text{H}\)

c) ![Chemical Structure](image) \(\text{Br}\)

d) ![Chemical Structure](image) \(\text{CH}_3\)

e) ![Chemical Structure](image) \(\text{Cl}\)

f) ![Chemical Structure](image) \(\text{H}_2\text{C}\) \(\text{Br}\) \(\text{CH}_3\)

g) ![Chemical Structure](image) \(\text{O}_2\text{N}\) \(\text{O}\) \(\text{OH}\)

h) ![Chemical Structure](image) \(\text{Br}\)
2. Benzanilide produces a mixture of two mono-chloro derivatives when it reacts with chlorine in acetic acid. Draw reasonable structures for these two isomers.

\[
\begin{align*}
\text{benzanilide} & \quad \text{Cl}_2 (1.0 \text{ eq}) / \text{CH}_3\text{COOH} \\
\end{align*}
\]

3. The following chemical reactions are all reported in the literature as providing a predominantly a single mono-substituted product in acceptable yield. Write the structure of the product.

a) \[
\begin{align*}
\text{HNO}_3 (1.0 \text{ eq}) \\
\text{H}_2\text{SO}_4 \quad \text{heat}
\end{align*}
\]

b) \[
\begin{align*}
\text{AlCl}_3 (1.2 \text{ eq})
\end{align*}
\]

c) \[
\begin{align*}
\text{H}_2\text{SO}_4
\end{align*}
\]

d) \[
\begin{align*}
\text{Br}_2 (1.0 \text{ eq}) \\
\text{CHCl}_3
\end{align*}
\]

e) \[
\begin{align*}
\text{Br}_2 (1.0 \text{ eq}) \\
\text{CH}_3\text{COOH}
\end{align*}
\]