1. Which of the following is most reactive toward nucleophilic aromatic substitution?

I. 

II. 

III. 

IV. 

V. 

2. What are the products of the following reaction?
   a. I
   b. II
   c. III
   d. a and b
   e. b and c
3. Provide a detailed, stepwise mechanism for the following reaction.

\[
\begin{align*}
\text{F} & \quad \text{NO}_2 & \quad \rightarrow & \quad \text{OCH}_3 \\
\text{NO}_2 & \quad \rightarrow & \quad \text{NO}_2 & \quad + \quad \text{F}^-
\end{align*}
\]

4. Draw four resonance structures for the intermediate in the reaction shown in Problem 3.

5. In electrophilic aromatic substitution an electron-withdrawing group ________ (activates/deactivates) the aromatic ring toward substitution and directs the substitution at the ________ (ortho,para/meta) positions. In nucleophilic aromatic substitution an electron-withdrawing group ________ (activates/deactivates) the aromatic ring toward substitution and directs the substitution at the ________ (ortho,para/meta) positions. Predict the products of the following reactions:

\[
\begin{align*}
\text{NO}_2 & \quad \text{Cl} & \quad \xrightarrow{\text{H}_2\text{SO}_4} & \quad \text{Cl} \\
\text{NO}_2 & \quad \text{Cl} & \quad \xrightarrow{\text{SO}_3} & \quad \text{H}_2\text{SO}_4 \\
\text{NO}_2 & \quad \text{Cl} & \quad \xrightarrow{\text{CH}_3\text{ONa}} & \quad \text{CH}_3\text{OH}
\end{align*}
\]