Propose a mechanism for the following reaction if it is

a. General-acid catalyzed

b. Specific-acid catalyzed

What energy diagram for catalysis would each case correspond to?
Propose a mechanism for the following reaction if it is

a. General-base catalyzed

b. Specific-base catalyzed

\[
\begin{align*}
\text{HO} & \quad \text{OCH}_3 \\
\text{HO} \quad \text{CH}_2 = & \quad \text{OCH}_3 \\
\text{HO} & \quad \text{OH} \\
\end{align*}
\]
Propose a mechanism for the following reaction

\[
\begin{align*}
\text{Cl} & \quad \text{Cl} \\
\text{N} & \quad \text{Cl} \\
& \quad \text{Cl}
\end{align*}
\quad \text{OH}^-, \text{H}_2\text{O}
\quad \begin{align*}
\text{N} & \quad \text{OH} \\
& \quad \text{OH}
\end{align*}
\]

Why is this reaction slower with the following compound

\[
\begin{align*}
\text{Cl} & \\
\text{O}_2\text{N} & \quad \text{N} \\
\text{Cl} & \quad \text{Cl}
\end{align*}
\]
Propose a mechanism for a Co$^{2+}$-catalyzed hydrolysis of glycynamide.

\[
\text{H}_2\text{N} - \begin{array}{c} \text{C} \\ \text{NH}_2 \end{array} + \text{H}_2\text{O} \xrightarrow{\text{Co}^{2+}} \text{H}_2\text{N} \begin{array}{c} \text{C} \\ \text{O}^{-} \end{array} + \text{NH}_3^+ 
\]
Based on **Problems 11 and 12**

Propose the mechanism and explain the differences in the mechanism of hydrolysis for the following two compounds in the box. Note that the nitro groups have a strong withdrawing effect in the ortho and para positions.

![Chemical structures](image)

- The compound on the left hydrolyzes through **intramolecular general base catalysis**.
- The compound on the right hydrolyzes through **intramolecular nucleophilic catalysis**.

**pKa**
- HO-\(\text{Ph}\)
  - pKa = 9

- HO-\(\text{Ph}\)-NO\(_2\)
  - pKa = 4

**Note:** The nitro group has a much stronger acidic effect compared to the phenol group.
Based on Problem 42
2-Acetoxy cyclohexyl tosylate reacts with acetate anion to form 1,2-cyclohexanediol diacetate. The reaction is stereospecific – that is, the stereoisomers obtained as products depend on the stereoisomer used as a reactant. Recall that because 2-acetoxy cyclohexyl tosylate has two stereocenters, it has four isomers – two cis and two trans. Explain the following:

a. Both cis reactants form an optically active trans product, but each cis reactant forms a different trans product.
b. Both trans reactants form the same racemic mixture.
c. A trans reactant is more reactive than a cis reactant.
Based on Problem 41
At pH = 12, the rate of hydrolysis of ester A is greater than the rate of hydrolysis of ester B. At pH = 8, the rates reverse. Explain these observations.

\[
\text{A} \quad \text{B}
\]
Would you expect a difference in the rate and mechanism for hydrolysis of the following two halides? Propose a mechanism for both.

A

B