1. What three factors contribute to the rate of the reaction?

2. Explain how iodide catalyzes the following reaction. \( \text{CH}_3\text{CH}_2\text{Cl} + \text{HO}^- \xrightarrow{\text{H}_2\text{O}} \text{CH}_3\text{CH}_2\text{OH} + \text{Cl}^- \)

3. The following reaction occurs by a general acid catalyzed mechanism. Propose a mechanism.

![Chemical structure](image)

4. The following reaction occurs by a general base catalyzed mechanism. Propose a mechanism.

![Chemical structure](image)

5. Rank the following molecules in order of reaction rate:

![Chemical structures](images)

6. Which compound will form a lactone more rapidly?
   a.
   ![Chemical structures](images)

7. Which isomer, cis or trans will react more rapidly with ethanol?

![Chemical structure](image)
8. At pH=12, the rate of hydrolysis of ester A is faster than the rate of hydrolysis of ester B. At pH=8, the relative rates reverse. Explain these observations.

\[
\begin{align*}
\text{A} & : \text{CH}_3\text{COCH}_2\text{CH}_2\text{NCH}_3\text{CH}_3 \\
\text{B} & : \text{CH}_3\text{COCH}_2\text{CH}_2\text{NCH}_3\text{CH}_3
\end{align*}
\]

9. Which isomer, cis or trans will react more rapidly with ethanol?

\[
\begin{align*}
\text{Cl} & : \text{SC}_6\text{H}_5 \\
\text{CH}_3\text{CH}_2\text{OH} & \xrightarrow{} \text{OCH}_2\text{CH}_3 \\
\text{SC}_6\text{H}_5 & + \text{HCl}
\end{align*}
\]

10. Fill in the reaction mechanism arrows for the enzyme catalysts.

11. Which enzyme goes through acyl enzyme intermediate?

12. What three problems does lysozyme catalyze and how does it accomplish this?

13. If $\text{H}_2\text{O}^{18}$ were used to hydrolyze lysozyme, which ring would contain the label, NAM or NAG?

14. Draw a pH rate profile for an enzyme that has a general acid catalyst ($pK_a = 4.1$) at the active site.

15. How does the environment in the enzyme affect the $pK_a$ of a side chain?