1. Write the systematic name for the following heterocycles. (12 pts)

- 3-methyl-6-phenyl-[1,3]-oxazinane
- 2,3-diphenyl-1H-azole
- 2,4-dimethyl-2H,4H-[1,3,6]-oxathiazocine

2. Rank the following according to their stability to ring opening conditions, e.g., high temperature, strong acids, etc. Use 1 for least stable and 3 for most stable. NOTE: The entire sequence has to be correct, otherwise zero points. (3 pts)

3. Rank the following according to their stability to acidic conditions, e.g., H₂O/H⁺. Use 1 for least stable and 3 for most stable. NOTE: The entire sequence has to be correct, otherwise zero points. (3 pts)
4. Draw the structure of products formed in the following reactions. If no product is formed, write none. (8 pts)

\[
\begin{array}{c}
\text{NH}_2^+ \text{COO}^- \\
\text{MeS} \\
\text{MeS}
\end{array}
\xrightarrow{\text{Hydrolytic Enzyme}}
\begin{array}{c}
\text{NH}_2^+ \text{COO}^- \\
\text{MeS}
\end{array}
\]

\[
\begin{array}{c}
\text{Et} \\
\text{H}_2\text{C} \\
\text{Et}
\end{array}
\xrightarrow{\text{Epoxide Hydrolase}}
\begin{array}{c}
\text{Et} \\
\text{H}_2\text{C}
\end{array}
\]

5. Following is a chair form of a monosaccharide. Draw its conformational isomer that might exist in equilibrium. Circle the conformation that is expected to be more stable. Justify your choice in not more than 2 or 3 sentences. (3+1+2 pts)

The identified conformation is expected to be more stable because it has least number of 1,3-diaxial interactions. For example, in conformation II, three –OH groups and one –CH$_2$OH group are axial thereby generating considerable 1,3-diaxial repulsion. In contrast, conformation I has only one –OH group axial resulting in much less 1,3-diaxial repulsion.

6. For the structure below, draw the appropriate tautomer that may exist in equilibrium. What is this tautomerism called? (3+1 pts)

KETO - ENOL TAUTOMERISM

7. Circle each chiral center in the following molecule. Note: Each chiral center should have only one atom. Negative points for identifying wrong chiral centers. (4 pts)
8. What is the Cahn-Ingold-Prelog identification (the R or S form) of the following stereoisomer? (4 pts)

![Chemical Structure]

9. Whereas conformational isomers can be obtained by mere rotation around single bonds, to interconvert configurational/geometric isomers one has break bonds. (2 pts)

10. Clearly define the following terms. (4 pts)

Enantiomers: Mirror image stereoisomers that are non-superimposable

Diastereomers: Pair of stereoisomers containing more than one chiral center that are not related as mirror image isomers