1. Draw all possible resonance structures for the structure shown below. Be sure to show movement of electrons with arrows.

\[ \text{Structure Image} \]

2. Consider 2,3-dimethylbutane.

\[ \text{Structure Image} \]

Sighting down the C2-C3 bond, draw all possible Newman projections. \(0^\circ-360^\circ\) Indicate which is the lowest energy projection and which is the highest energy projection.

3. Below are several stereorepresentations for Lactic acid.

\[ \text{Structure Images: A, B, C, D} \]

a) Give the configuration for A.
b) Which of the other representations are identical to A?
c) Which of the other representations are enantiomers to A?

4. Consider the following reaction:

\[ \text{Reaction Image} \]

a) Give the rate law for this reaction.
b) How many steps are in the mechanism of this reaction?
c) What happens to the reaction rate if the Br is replaced with I in the starting alkyl halide?
d) Will the rate of reaction change significantly if some water is added to the solvent, which is \(\text{CH}_3\text{CH}_2\text{OH}\)? Explain your answer.
e) If only one enantiomer of the starting alkyl bromide were used, what would be the stereochemical outcome of this reaction?

5. Propose a mechanism that accounts for the formation of all products shown. **Show all intermediates, and indicate flow of electrons with arrows.** Indicate which compound will be the major product.

![Diagram of chemical reaction]

6. Give the missing compound or reagent(s) in each of the reactions shown below:

a) ? \[\overset{1. \text{O}_3}{\longrightarrow}\overset{2. (\text{CH}_3)_2\text{S}}{\longrightarrow}\] H\(_3\)C\(\overset{\text{O}}{\text{H}}\) + H\(_3\)C\(\overset{\text{O}}{\text{CH}}\)\(_3\)

b) ? \[\overset{\text{HCl}}{\longrightarrow}\] CH\(_3\)CH\(_2\)CH\(_2\)CH\(_2\)CH\(_2\)CH\(_2\)CH\(_3\)

c) CH\(_3\)CH\(_2\)CH\(_2\)C≡CH \[\overset{1. \text{Si}_2\text{BH}}{\longrightarrow}\overset{2. \text{H}_2\text{O}_2, \text{OH}^-}{\longrightarrow}\] ?

d) ? \[\overset{\text{?}}{\longrightarrow}\text{C} \overset{\text{O}}{\text{C}} \overset{\text{OH}}{\text{OH}}\]

e) ? \[\overset{\text{xs NaNH}_2}{\longrightarrow}\overset{\text{NH}_3}{\longrightarrow}\]

7. Give the structures for the unknown compounds in the reaction scheme shown below: