1. When the optically active bromide (A) shown below was reacted with CH$_3$SNa in CH$_3$OH, the reaction was observed to be a second order kinetic process (Rate = k [RBr][SCH$_3$]) and the substitution product shown was formed almost exclusively. Show the mechanism for this reaction and predict the stereochemistry of the product.

![Chemical structure with reaction equation]

The 2nd order kinetics require an S$_\text{N}$2 mechanism which is always accompanied by inversion of stereochemistry resulting from backside attack of the nucleophile at the C-Br bond.

![Mechanism diagram]
2. When a molecule has both a nucleophile and a leaving group, either intermolecular or intramolecular substitution reactions can take place, depending on the concentration of the bifunctional molecule. For the following iodoalcohol, write the product B that would be formed when an intramolecular reaction takes place. Write an electron pushing mechanism for the formation of B.

\[
\text{HOCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{I} \xrightarrow{\text{HO}^-} \text{HOCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} + B + C + D + ...
\]

In the above reaction, a mixture of HOCH\_2\text{CH\_2CH\_2CH\_2OH}, B, C, D, etc are formed. Write the product C when an intermolecular reaction between two molecules of the iodoalcohol takes place. Write the product D of the reaction of C with a third molecule of the iodoalcohol. Will high or low concentration of iodoalcohol lead to an increased percentage of B? Will high or low concentration of iodoalcohol lead to an increased percentage of isomers C, D, etc?

\[
\begin{align*}
\text{I} & \quad \xrightarrow{\text{HO}^-} \quad \text{B} \\
\text{I-CH\_2CH\_2CH\_2CH\_2-O} & \quad \xrightarrow{\text{HO}^-} \quad \text{C} \\
\text{I-CH\_2CH\_2CH\_2CH\_2-OH} & \quad \xrightarrow{\text{HO}^-} \quad \text{D}
\end{align*}
\]

Low concentration of HO\^{}^- will give more B.

The rate of formation of B depends on \([\text{I}^-\text{OH}]^1\)

but the formation of C depends on \([\text{I}^-\text{OH}]^2\).

At high concentration more C, D etc will be found.
3. Indicate the relationship between the following structures.

(a) [Images of two molecular structures] 
- enantiomers
- diastereomers
- conformers
- same
- structural isomers

(b) [Images of two molecular structures] 
- enantiomers
- diastereomers
- conformers
- same
- structural isomers

(c) [Images of two molecular structures] 
- enantiomers
- diastereomers
- conformers
- same
- structural isomers

(d) [Images of two molecular structures] 
- enantiomers
- diastereomers
- conformers
- same
- structural isomers

(e) [Images of two molecular structures] 
- enantiomers
- diastereomers
- conformers
- same
- structural isomers