1. (4) Draw curved arrows for the following transformation:

\[
\underset{\Theta}{\text{CH}_3\text{O}} + \underset{\text{Cl}}{\text{H}}\underset{\text{H}}{\text{C}}\underset{\text{H}}{\text{C}}\underset{\text{H}}{\text{H}} \rightarrow \underset{\Theta}{\text{CH}_3\text{OH}} + \underset{\text{H}}{\text{H}}\underset{\text{C}}{\text{C}}\underset{\text{H}}{\text{H}} + \underset{\text{Cl}}{\text{Cl}}\underset{\Theta}{\text{H}}
\]

2. (6) (a) Draw the major product expected for the reaction of a disubstituted alkene of the general form shown below and HCl:

\[
\underset{\text{R}}{\text{C}}\underset{\text{C}}{\text{H}}\underset{\text{R}}{\text{H}} + \text{HCl} \rightarrow
\]

(b) Draw the structure of the intermediate carbocation formed in this reaction.

(c) Why does very little, if any, \( \text{R}_2\text{CHCH}_2\text{Cl} \) form in this reaction?
3. (6) Draw a reaction coordinate diagram for the conversion of A to C where B is an intermediate, the overall reaction has a positive $\Delta G^\circ$, the conversion of A to B is exergonic, and B to C is rate-limiting.

4. (4) For each of the following, indicate which are likely to be electrophiles and which nucleophiles. For each, indicate specifically the site on the molecule that is responsible for the nucleophilicity or electrophilicity.

- BF$_3$
- $(\text{CH}_3)_2\text{C}=\text{C}(\text{CH}_3)_2$
- H$_2$S
- $\text{NH}_2^-$

5. (2) To be certain that a reaction is spontaneous, the enthalpy change should be _________ and the entropy change _________.

A. negative and negative.
B. positive and positive.
C. positive and negative.
D. negative and positive.

6. (2) A curved arrow in a mechanism connects:

A. an e$^-$ rich site with an e$^-$ poor site.
B. a Lewis base site with a Lewis acid site.
C. a nucleophilic site with an electrophilic site.
D. all of the above.