1. Draw the structures and give the names of 7 alkenes with the formula \( C_3H_4Cl_2 \). (21%)

2. Draw the structures and give the names of 3 cyclopropanes with the formula \( C_3H_4Cl_2 \). Do not include enantiomers. (9%)
3. In the following pairs of compounds, indicate if they are enantiomers, diastereomers or identical. Name each R or S when possible. (20%)

a. 

\[
\begin{align*}
&\text{and} \\
\text{Cl} &\text{ C} &\text{CH}_3 \\
\text{CH}_3 &\text{CH}_2\text{CH}_3 &\text{Cl} \\
\text{CH}_3 &\text{CH}_2\text{CH}_3 &\text{H}
\end{align*}
\]

b. 

\[
\begin{align*}
&\text{and} \\
\text{Br} &\text{ H} &\text{Cl} \\
\text{Cl} &\text{ H} &\text{Br} \\
\text{CH}_3 &\text{Br} &\text{CH}_3
\end{align*}
\]

c. 

\[
\begin{align*}
&\text{and} \\
\text{Br} &\text{ Br} &\text{Br} \\
\text{Br} &\text{ H} &\text{H} \\
\text{H} &\text{Br} &\text{CH}_3 \\
\text{H} &\text{CH}_3 &\text{Br}
\end{align*}
\]

d. 

\[
\begin{align*}
&\text{and} \\
\text{Br} &\text{ Br} &\text{H} \\
\text{H} &\text{Br} &\text{H}
\end{align*}
\]

4. There are 4 possible 3,4-dibromoheptanes. Draw them in 3 dimensions, name them using the R and S convention, and indicate the relationship between each (enantiomeric or diastereomeric). (12%)
5. 1-Bromo-2-chloroethane can exist in 3 stable conformers two of which are enantiomers.
   a. Draw Newman projections of all three conformers
   b. Indicate which two conformers are enantiomers.
   c. Indicate which conformer is the most stable and briefly explain why (14%)

6. a. Draw three dimensional structures of the two stable conformers of chlorocyclohexane.
   b. Indicate which conformer is more stable and briefly explain why.
   c. Are either or both of these conformers chiral? If so, indicate which are chiral. (12%)
7. For the compounds shown below:
   a. Name them (for compounds 1 and 2 use either R and S or cis and trans)
   b. Indicate how many signals each compound would show in the carbon-13 NMR.

   (12%)

   ![Chemical Structures]

   1. ________  
   2. ________  
   3. ________  
   4. ________  
   5. ________  
   6. ________  
   7. ________  

   Total minus ________

   Grade

   Name ____________________________