1. There are 13 structural alkene isomers with the formula $C_6H_{12}$.
   a) Disregarding cis/trans isomers, draw the 13 alkenes and give their IUPAC names.
   b) Indicate which of the 13 isomers will display cis/trans isomers. Draw them, and name them either using the cis/trans prefix or E/Z prefix.
   c) Which isomer do you think is the most stable?

2. Indicate whether each of the cations below are 1°, 2°, or 3°. Decide whether each will rearrange or not. If the cation can rearrange, draw the structure of the new cation.
   a) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2^+$
   b) $(\text{CH}_3)_2\text{CCH}_2\text{CHCH}_3^+$
   c) $(\text{CH}_3)_2\text{CCHCH}_3^+$
   d) $(\text{CH}_3\text{CH}_2)_2\text{CCH}_2^+$
   e) $(\text{CH}_3)_2\text{CCH(CH}_3)_2^+$

3. What alkene(s) should be used to synthesize each of the following alkyl halides?
   a) $\text{CH}_3\text{CH}_2\text{CHCH}_2\text{CH}_2\text{CH}_3^-$
   b) $\text{CH}_3\text{CHCH}_2\text{CH}_2\text{CH}_2\text{CH}_3^-$
   c) $\text{CH}_3\text{CCH}_3^-$
   d) $\text{CH}_3\text{CHCH}_3^-$
   e) $\text{CH}_2\text{CHCH}_3^-$
   f) $\text{CH}_2\text{CH}_3^-$

4. 1,3-butadiene reacts with 1 mole of HBr according to the reaction shown below. Provide a mechanism that accounts for the products that are formed. **HINT:** Consider resonance structures.

   $\text{CH}_2=\text{CH}=\text{CH}=\text{CH}_2 + \text{HBr} \rightarrow \text{BrCH}_2=\text{CH}=\text{CH}_2 + \text{CH}_3\text{CHBr}_2$
5. When water and a catalytic amount of $\text{H}_2\text{SO}_4$ react with an alkene, an alcohol is formed. The mechanism is similar to the addition of $\text{HX}$ to an alkene.

\[
\text{alkene} + \text{H}_2\text{O} \xrightarrow{\text{H}_2\text{SO}_4} \text{alcohol} + \text{H}^+ \]

A student wished to prepare 3,3-dimethyl-2-butanol from 3,3-dimethyl-1-butene. However, the student discovered that 2,3-dimethyl-2-butanol had been made instead. Propose a mechanism that explains this outcome.