<table>
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<th>QUESTION</th>
<th>POINTS</th>
<th>SCORE</th>
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1. Give the structural formula for each of the following compounds (6 points).
   a.) 3,3-dimethyl-4-octyne  
   b.) 1,2-dimethylcyclohexene

2. Provide IUPAC names for the following compounds (10 points).
   a.)  
   b.)  
   c.)

3. Rank the carbocations below in order of increasing stability (least stable=1; most stable =3). (6 points)
   
4. Assign the configuration of the alkene as E or Z. Show your work (5 points).

5. Which of the following carbocations would you expect to rearrange? Briefly explain your answer. If it
does rearrange, show the expected rearrangement product (6 points).
   a.)

   b.)

6. Write a complete stepwise mechanism for the following reaction. Show all intermediate structures and
   show all electron flow using the curved arrow formalism (6 points).

   \[
   \text{reaction} \\
   \text{HBr} \\
   \text{Br}
   \]
7. Give the reagent(s) which could be used to convert methylene cyclohexene to each of the compounds shown below. Place the appropriate reagent in the space next to the product (18 points).

![Methylene Cyclohexene]

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<tr>
<th>a.)</th>
<th>d.)</th>
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<tr>
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<td>OH</td>
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<tr>
<td>b.)</td>
<td>e.)</td>
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<tr>
<td>OH</td>
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<tr>
<td>b.)</td>
<td>e.)</td>
</tr>
<tr>
<td>OH</td>
<td>Cl</td>
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</tbody>
</table>

8. Predict the product of each of the following reactions. Provide a stereochemically explicit product in those reactions marked with a * (25 points).

*a.a.)
\[
\text{CH}_3\text{C}≡\text{C-CH}_3 \xrightarrow{\text{Li, NH}_3} \]

*b.)
\[
\text{CH}_3\text{CH}_2\text{C}≡\text{C-H} \xrightarrow{1. \text{HBSia}_2, \text{THF} \ 2. \text{H}_2\text{O}_2, \text{HO}^-} \]

*c.)
\[
\text{Cyclohexene} \xrightarrow{1. \text{OsO}_4 \ 2. \text{NaHSO}_4} \]

d.)
\[
\text{Cyclohexene} \xrightarrow{\text{HBr, ROOR}} \]

e.)
\[
\text{Cyclohexene} \xrightarrow{\text{Br}_2, \text{CCl}_4} \]

f.)
\[
\text{CH}_3\text{CH}_2\text{C}≡\text{C-H} \xrightarrow{2 \text{Cl}_2} \]

*h.)
\[
\text{Cyclohexene} \xrightarrow{1. \text{BH}_3\text{-THF} \ 2. \text{H}_2\text{O, H}_2\text{O}_2, \text{HO}^-} \]
9. Show how you would accomplish the following synthetic transformation. You should need only two or three steps. (6 points)

\[ \text{CH}_3\text{CH}_2\text{C} = \text{C} - \text{H} \xrightarrow{?} \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br} \]

10. Compounds A, B, C, and D each have the molecular formula C\(_6\)H\(_{10}\) and each reacts with H\(_2\) (hydrogen gas) and Pd/C to give methylocyclopentane. Compounds A and B each react with HCl to give the same organic product. Compounds C and D react with HCl to give a mixture of compounds. Compounds A-D all react with hot basic KMnO\(_4\), but compound B is the only one that gives a gas (CO\(_2\)) as one of the products of that reaction. When compound C is reacted with ozone (O\(_3\)) followed by treatment with Zn/CH\(_3\)CO\(_2\)H, the compound shown below is formed. Deduce the structural formulas of A-D. Show all of your work (12 points).

\[
\begin{align*}
\text{C} & \xrightarrow{1. \text{O}_3} \text{C} & \xrightarrow{2. \text{Zn}, \text{CH}_3\text{CO}_2\text{H}} & \text{C}
\end{align*}
\]