This exam contains 8 questions, some with multiple parts. Write your answers to each question in the space provided. The points for each question are indicated at the end of each question. Overall this is a 100 point exam.

Name____________________________________

Signature __________________________________________________________________________

Section (Check One)

________ Section 1    Monday Afternoon

________ Section 2    Tuesday Morning

________ Section 3-- -Tuesday Afternoon

Total Points ______________________
1. Draw the structure of the compound (Z)-3-chloro-4-methylhex-3-ene. (6 pts)

2. Name the following compounds. (18 pts)

   a. 

   b. MgHPO₄

   c. Na₂O₂

3. Draw all possible isomers of formula, C₄H₁₀O. Include any possible stereoisomers. (12 pts)

4. Give the oxidation state of the indicated element in each of the following compounds? (8 pts)

   a. Se in MgSeO₃

   b. N in N₂H₄ (hydrazine)

   c. P in Na₂H₂P₂O₇

   d. C in HCN
5. Balance the following oxidation-reduction reaction. It occurs in acid solution. (12 pts)

$$\text{I}^- (aq) + \text{MnO}_4^{-1} (aq) \rightarrow \text{Mn}^{+2} (aq) + \text{I}_2 (s)$$
6. A student was given an unknown monoprotic carboxylic acid for analysis. The compound contained the elements, C, H and O only. A 0.400 gram sample was subjected to combustion analysis. The CO$_2$ was trapped and had a mass of 0.799 grams, the H$_2$O was trapped and had a mass of 0.327 grams.

\[ \text{Unknown acid} \xrightarrow{\text{O}_2} \text{CO}_2 + \text{H}_2\text{O} \]

- a. What is the empirical formula of the unknown acid? (8 pts)

A 0.300 gram sample of the unknown was dissolved in water and titrated with 0.095 M NaOH. The equivalence point occurred after the addition of 23.89 mL of NaOH.

- b. What is the molecular weight of the unknown acid? (8 pts)
- c. What is the molecular formula of the unknown acid? (5 pts)
- d. Draw a possible structure for the unknown acid. (5 pts)

(Note: there are several possible structures.)
7. A student was given a mixture of 1-hexene and 1-octene and was asked to determine the mass percentage of 1-hexene in the sample. The student remembered that bromine, Br$_2$, would add to alkene double bonds to give a dibromoalkane. The clever student thus took a 1.00 gram sample of the mixture and titrated it against bromine. The color of the bromine disappeared as the addition reaction took place. After 1.55 grams of Br$_2$ were added the reaction was over and the color of Br$_2$ could be seen. (18 pts)

\[
\begin{align*}
\text{C}_6\text{H}_{12} + \text{Br}_2 & \rightarrow \text{C}_6\text{H}_{12}\text{Br}_2 \\
\text{C}_8\text{H}_{16} + \text{Br}_2 & \rightarrow \text{C}_8\text{H}_{16}\text{Br}_2
\end{align*}
\]

What is the mass percentage of 1-hexene in the mixture?

To save you time, here are some possibly useful molecular weights.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Molecular formula</th>
<th>Molecular weight (g/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-hexene</td>
<td>C$<em>6$H$</em>{12}$</td>
<td>84.16</td>
</tr>
<tr>
<td>1,2-dibromohexane</td>
<td>C$<em>6$H$</em>{12}$Br$_2$</td>
<td>243.97</td>
</tr>
<tr>
<td>1-octene</td>
<td>C$<em>8$H$</em>{16}$</td>
<td>112.21</td>
</tr>
<tr>
<td>1,2-dibromo-octane</td>
<td>C$<em>8$H$</em>{16}$Br$_2$</td>
<td>272.02</td>
</tr>
<tr>
<td>Bromine</td>
<td>Br$_2$</td>
<td>159.81</td>
</tr>
</tbody>
</table>