1. (9 pts) Draw the structure of aspartic acid under the following pHs.

\[
\begin{align*}
\text{pH} = 1.2 & \quad \text{pH} = 7.1 & \quad \text{pH} = 12.3 \\
\end{align*}
\]

2. (8 pts) Consider the following tri-peptide.

\[
\begin{align*}
\text{A} & \quad \text{B} & \quad \text{C} \\
\end{align*}
\]

a) Put a box around the peptide bonds.

b) Which of the above amino acids would most likely be found at the center portion of the tertiary structure of a globular protein? Explain your reasoning.

3. (10 pts) List how a protein can be denatured and which bonds are disrupted.

<table>
<thead>
<tr>
<th>Denaturing factor</th>
<th>Disrupted bonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td></td>
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<tr>
<td>c)</td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td></td>
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<tr>
<td>e)</td>
<td></td>
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</tbody>
</table>
4. (14 pts) Determine whether the following statements refer to primary, secondary, tertiary or quaternary structure of a protein.

a) Two proteins form an active protein. ______________________

b) $\alpha$-helix ______________________

c) An enzyme looses activity due to denaturation. ______________________

d) The sequence in which the amino acids are linked. ______________________

e) Globular protein. ______________________

f) Disulfide linkage. ______________________

g) Ionic bonds. ______________________

5. (8 pts) Identify whether the following statements best represent competitive or non-competitive inhibition.

a) Addition of more substrate increases the rate. ________________

b) The inhibitor’s shape resembles the substrate. ________________

c) Inhibition takes place at a site that is not part of the active site. ________________

d) Inhibition by heavy metals with side groups. ________________

6. (12 pts) a) Explain the effect on rate of an enzyme at low and high temperatures.

Low temp-

High temp-

b) Name two other factors that effect the rate of an enzyme.
7. (12 pts) Answer the following questions.
   a) Under aerobic conditions, there is a net production of _______ ATP in glycolysis from one glucose molecule.

   b) Under anaerobic conditions in muscles pyruvic acid is converted to _________.

   c) Glucose consists of six carbons, but in glycolysis two acetyl coenzyme A molecules are produced which total four carbons, account for the missing two carbons.

   d) In the electron transport chain what metal is bound to proteins to act as an electron carrier? ______________

   e) Which two molecules go from the citric acid cycle to the electron transport chain?

   __________________________  __________________________

   f) How many ATPs are produced from one glucose molecule and what is the molecule that is produced at the end of metabolism?

   __________________________  __________________________

   g) How many ATPs are produced from NADH and FADH\(_2\) in the electron transport chain?

   __________________________  __________________________

   h) Why does the NADH produced in glycolysis only produce two ATPs?

   e) Explain and account for the 6 ATPs that are produced when 2 pyruvates are transformed to 2 acetyl CoA.

8. (8 pts) Show how many ATPs are produced from a ten carbon fatty acid?
9. (8 pts) Label the products as being oxidized or reduced. (put an O or R)
   a) 
   \[
   \text{FAD} + \begin{array}{c}
   \text{H} \\
   \text{H}
   \end{array} \rightarrow \begin{array}{c}
   \text{O} \\
   \text{C}
   \end{array} + \text{FADH}_2
   \]
   b) 
   \[
   \text{NAD}^+ + \begin{array}{c}
   \text{OH} \\
   \text{H}
   \end{array} \rightarrow \begin{array}{c}
   \text{O} \\
   \text{C}
   \end{array} + \text{NADH} + \text{H}^+
   \]

10. (8 pts) Predict the products of the following reaction.
   a) 
   \[
   \text{H}_3\text{C} - \text{C} - \text{COO}^- + \text{OOCC} - \text{C} - \text{C} - \text{COO}^- \overset{\text{Transaminase}}{\longrightarrow} \]
   b) 
   \[
   2\text{NH}_4^+ + \text{CO}_2 \rightarrow \]

11.(12 pts) Answer the following questions based on the following compound.

   a) What is the name of this compound? ___________________

   b) Draw arrows to the portion of this molecule that reacts and write the species it reacts with.

   c) What is the function of this compound?