Before you begin this exam: First: You are allowed to have a simple model set at your seat. Please put away all other materials. Second: Place your student identification on your desk. A proctor will come around to check everyone’s ID. Third: Read through the entire exam. Your goal, as always, is to score as many points as possible. Do not waste time on problems that you can’t do if there are others that look easy. Fourth: It is critically important that your answers be written in a clear, unambiguous manner. Answers in which your intentions are unclear will not receive credit. Fifth: READ THE INSTRUCTIONS FOR EACH PROBLEM.

If you wish to have your exam score posted beside your student ID number in the glass case (1st floor, CP Building, behind CP-139) with the exam key, place an ‘X’ in this space. If you do not mark this space, your exam score will not be posted.

You have until 8:50 to complete this exam. There will be no extensions, so budget your time carefully.

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<th>Problem Number</th>
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1. (15 points) Assign the configuration at all stereogenic centers in the following compounds using the R,S convention.

a) 
\[ \text{CH}_3\text{CH}_2\text{Br} \]

b) 
\[ \text{H}_2\text{N}\text{NH}\text{CO}_2\text{H} \quad \text{(Aspartame, a sweetener)} \]

c) 
\[ \text{OH} \]

\[ \text{H}_3\text{C} \text{OH} \]

d) 
\[ \text{O} \]

\[ \text{H} \]

\[ \text{HO} \]

\[ \text{CH}_3 \]

2. (10 points) Assign the E,Z configuration at all of the alkenes below.

a) 
\[ \text{H} \]

\[ \text{CH}_3 \]

\[ \text{CH}_3 \text{CH}_3 \]

\[ \text{CH}_3 \text{CH}_2\text{CH}_3 \]

b) 
\[ \text{F} \]

\[ \text{CH}_3\text{CH}_3\text{CH}_2\text{CH}_3 \]
c) (Do all 3 C=O double bonds in this example)

(Zantac, anti-stomach acid medication)

3. (20 points) Consider the conformations of 2-methylbutane. Construct a qualitative potential energy diagram for 360 degree rotation about the C2-C3 bond in this compound. Your answer must show the Newman projections for the conformations that correspond to the 6 energy minima and maxima.
4. (8 points) Which of the following compounds are chiral? (Circle the chiral ones)

![Chemical structures](image)

5. (10 points) There are three stereoisomers of tartaric acid; two that are enantiomers and a diastereomer that is meso. Draw the meso diastereomer (wedge-and-dash or sawhorse drawing) and show the plane of symmetry with a dashed line. Be sure that you draw an appropriate conformation that allows you to clearly show the plane of symmetry. A wedge-and-dash or a sawhorse drawing would be appropriate.

![Tartaric Acid](image)

6. (9 points) Draw the structures that correspond to the following names.

a) 1-(1-chloroethyl)-cyclopentene
b) (R) 2-chlorobutane

c) Z 1-fluoro-1-propene

7. (20 points) Draw the following compounds in their most stable chair conformation. Be sure that your drawing clearly shows which groups are axial (if any) and which are equatorial (if any).

a) \[
\begin{align*}
\text{HOCH}_2 & \text{O} \text{OH} \\
\text{HO} & \text{O} \text{OH} \\
\text{OH} &
\end{align*}
\]
(β-D-glucose)
8. (8 points) In **two words or less**, state the relationship between the pairs of compounds below. (For example, if one pair of compounds are enantiomers, write ‘enantiomers.’ If they are identical, write ‘identical’, or ‘the same.’)

These compounds are ________________

These compounds are ________________

These compounds are ________________

These compounds are ________________