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 (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 9:50 to complete this exam. There will be no extensions, so budget your time carefully.

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1. (15 points) Classify the relationship between each pair of structures as either skeletal isomers, conformational isomers, enantiomers, or diastereomers.

a) Conformational isomers

b) Enantiomers

c) Diastereomers

d) Diastereomers

e) Skeletal Isomers
2. (14 points) Assign the R, S convention to the indicated stereogenic centers and assign the E, Z convention to the indicated C=C bonds.

a) Lysergic Acid Diethylamide (LSD)

b) Prostaglandin E₂
3. (8 points) Classify each of the following compounds as either chiral or achiral.

a) Nicotine

b) VX, the most potent nerve gas in the US arsenal

c) o-Acetylsalicylic acid (aka Aspirin)

d) HMX (“Her Majesty’s Explosive”)

4. (5 points) Which one of the structures below is the meso isomer of 2,3-dihydroxybutane? (Circle it)

5. (12 points) Draw a Newman projection of the most stable conformation of each of the following compounds:

a) cis-1,3-dichlorocyclohexane

b) 2-methylbutane

c) trans-4-bromo-methylcyclohexane
6. Newman projections I - VI of (meso)-3,4-dimethylhexane are shown below. All of these are sighting down the C3-C4 bond.

a) (5 points) Which one of the eclipsed conformations is of the **highest** energy? (Circle it)

b) (5 points) Which one of the staggered conformations is of the **lowest** energy? (Circle it)

c) (12 points) Draw a rotational energy diagram for 360 degree rotation around the C3-C4 bond of (meso)-3,4-dimethylhexane. Your energy diagram should clearly indicate the relative energies of conformations I - VI. A starting point (conformation IV) has been provided.
7. (15 points) Draw each of the following cyclohexane derivatives in their most stable chair conformation.

a)

b)

c)
8. (9 points) How many stereoisomers are there of each of the compounds shown below? (NOTE: this question does not ask for the maximum number possible. You are to determine how many stereoisomers can be drawn for each compound)

a)

b)

c) (careful with this one....)