Spring 2008, Dr. Hunter

Chemistry 1506: Mid-Term Exam

Name: ___________________________  Last name  ___________________________  First name

Student Number (your social security number): ___________________________

Signature: ___________________________

In addition to this cover page, this midterm exam consists of 5 pages of questions for 6 pages in total. Please make sure you place your name (last name first) and your student number (i.e., your Social Security number) in the spaces above and sign on the line. Initial each page in the top right hand corner (i.e. near the page number) in case your exam pages get separated.

To obtain maximum credit for each question, show your work in detail. Partial credit for questions will not be assigned if no work is shown. Be sure and indicate the positions and bonding of all atoms! On some questions, full credit will not be granted if work is not shown. Feel free to use short text explanations to explain your drawings if your pictures are ambiguous. If you have to make guesses, assumptions, etc., write me a short note with your reasoning so I can follow your thinking and assign part marks.

You may use molecular models to help you answer questions. Feel free to ask me questions.

You may bring in one 8.5 x 11 sheet of paper with whatever you want written on it into the exam.

This midterm is worth 150 points out of the 600 points for this semester (i.e., 25% of the final grade).
1. [30 points maximum] For each of the following, show your reasoning and/or your work.

(a) For each of the following functional groups, draw a specific example of a molecule having this group:

Alkyne

\[
\text{H} - \text{C} = \text{C} - \text{H}
\]

Amine

\[
\text{H}_3\text{C} - \text{N} - \text{H}
\]

Aromatic

\[
\text{H}
\]

\[
\text{H}
\]

\[
\text{H}
\]

\[
\text{H}
\]

Ketone

\[
\text{H}_3\text{C} - \text{C} - \text{CH}_3
\]

Alcohol

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

(b) Clearly describe the structure and the bonding of the carbon-carbon double bond in \(\text{CH}_2=\text{CH}_2\). Include in this description a comparison of a carbon-carbon double bond to the carbon-carbon single bond in \(\text{CH}_3\text{-CH}_3\).
2. [30 points maximum] For each of the following molecules, draw the Lewis structure and check if your Lewis structure is correct. For each atom in these molecules, predict the bond lengths and angles. For the three atoms with stars (*) in each molecule, give their hybridizations.

(a)

(b)

S = short
m = medium
l = long

"120°" line in number of attached groups but geometric constraints make them close to 90° in reality.
3. [30 points maximum] For each of the following molecular formulae, draw 5 structural isomers. Be sure that you show all atoms and bonds for each.

(a) \( \text{C}_6\text{H}_{13}\text{N} \)

\[ UN = \frac{2 \times 6 + 1 + 1 - 13}{2} = 1 \]

(b) \( \text{C}_4\text{H}_{10}\text{O}_2 \)

\[ UN = \frac{2 \times 4 + 2 - 10}{2} = 0 \]
4. [60 points maximum] For each of the following structures or names, give an IUPAC name or draw the correct structure (including all atoms), as required.

(a) 2,3-difluoro-3-ethylhexane

(b) 1,2-dibromo-cyclohexene

(c) 4-secoethyl-3-isopropylnonane
(d) 3,5-diethyl-trans-3-octene

(e) 1,3-dimethylcycloheptane

(f) Valine