Academic Honesty Policy. Academic honesty is strictly enforced on quizzes, exams, and other aspects of this course. Academic dishonesty will result in a failing grade in the class and a letter in the student's file. Activities constituting academic dishonesty include:

**Cheating**
- Copying from others during an examination.
- Communicating exam answers with other students during an examination.
- Offering another person's work as one's own.
- Taking an examination for another student or having someone take an examination for oneself.
- Tampering with an examination after it has been corrected, then returning it for more credit.
- Using unauthorized materials, prepared answers, written notes, or concealed information during an examination.

**Dishonest Conduct**
- Stealing or attempting to steal an examination or answer key from the instructor.
- Allowing another student to copy off of one's own work during a test.

**Collusion**
- Any student who knowingly or intentionally helps another student perform any of the above acts is subject to discipline for academic dishonesty.

I understand and will abide by this academic honesty policy: ________________________ (signature)
1. Write the structure of a compound that meets the criteria indicated below. (24 points)

a. A ketone containing only three carbon atoms:

b. A tertiary amine containing only three carbon atoms:

c. An aldehyde containing only three carbon atoms:

d. An ether containing only three carbon atoms:

e. A saturated hydrocarbon that is a gas at room temperature:

f. An isomer of hexane that contains primary (1°) and tertiary (3°) carbon atoms but no secondary (2°) or quarternary (4°) carbon atoms:
2. Write the systematic (IUPAC) name or structure of the compounds indicated below. (12 points)

a. 4-isopropyloctane (structure):

b. 

name: __________________________________________

c. 1-sec-butyl-3-methylecycloheptane (structure):

d. 

name: __________________________________________

3. (12 points)

a. Write the products of the following acid-base equilibrium:

\[ \text{H}^-\text{C≡C}^-\text{H} + \text{CH}_3\text{CH}_2\text{O}^- \rightarrow \]

b. Does the equilibrium lie to the right or to the left? ______________ Explain briefly:

c. Estimate the equilibrium constant: ______________ Explain briefly:
4. Write resonance structures for the following species. Make sure to show all atoms, bonds, lone pairs of electrons and formal charges. (12 points)

a. 1,3-dimethylallyl cation CH₃–CH=CH–CH⁺–CH₃ (two equivalent resonance structures):

b. nitromethane anion H₂C––NO₂ (three resonance structures):

5. Draw the products of each of the following reactions indicated by the curved-arrow reaction mechanisms. Make sure to show all lone pairs of electrons and all formal charges. (8 points)

a. an electrocyclic ring opening:

b. SN1 substitution (first step):
6. (12 points)

\[ \text{2,2-dimethylbutane} \]

\[ \text{2,2-dimethylbutane} \]

\[ \text{staggered conformation} \]

\[ \text{eclipsed conformation} \]

b. Sketch a graph of the potential energy of 2,2-dimethylbutane as a function of the C–C–C–C dihedral angle $\theta$. 

\[ \text{Energy} \]

\[ \text{0} \]

\[ \text{60} \]

\[ \text{120} \]

\[ \text{180} \]

\[ \text{240} \]

\[ \text{300} \]

\[ \text{360} \]

\[ \theta \text{ (degrees)} \]
7. (20 points)

a. Make a conformationally realistic drawings of *trans*-1,4-dimethylcyclohexane in its most stable conformation. Make sure to show all hydrogen atoms on the ring in your drawing. [Hint: Draw the cyclohexane ring in a chair conformation.]

b. Use your Darling (Molecular Visions) Molecular Models to make a molecular model of *trans*-1,4-dimethylcyclohexane in its most stable conformation. Use a ruler to measure the distance between the carbon atoms of the methyl groups.

What is the distance? _________ cm

c. Make a conformationally realistic drawings of *trans*-1,4-dimethylcyclohexane in the less stable conformation in which the cyclohexane ring is flipped. Make sure to show all hydrogen atoms on the ring in your drawing. [Hint: Draw the cyclohexane ring in the ring-flipped chair conformation.]

d. Use your Darling (Molecular Visions) Molecular Models to make a molecular model of this conformer. Use a ruler to measure the distance between the carbon atoms of the methyl groups.

What is the distance? _________ cm

e. Estimate how much higher in energy is the less stable conformer relative to the more stable conformer:

__________________________ (Don't forget your units!)

f. Explain briefly your thinking in part e.