1. Please name the following compounds using IUPAC nomenclature. Place your answers in the boxes provided. 3 pts each for 6 total points. (No partial credit)

- 2,3,4-trimethylhexane
- 1,3-dibromo-3-methylpentane

2. Please provide line drawings for the following compounds. Place your answers in the boxes provided. 3 pts each for 12 total points.

- 3-chloro-4-ethyl-2-iodo-5-methylhexane
- 4-isopropylheptane
- cis-1-bromo-2-chlorocyclopropane
- 3-bromo-2,2-dimethylbutane
3. Answer the following questions concerning the pharmaceutical Dronabinol, which is a synthetic preparation of tetrahydrocannabinol. This medication is given to cancer patients undergoing chemotherapy to relieve nausea. It is also given to stimulate the appetite of cancer and AIDS patients. 2 pts each for 20 total points. *No partial credit.*

Place your answers in the boxes provided.

a) How many non-bonding electrons does the oxygen in the ring have?  

b) Place a star (*) next to the 4\textsuperscript{th}-carbon.

c) What is the hybridization of carbon 1? \( \text{sp}^2 \)

d) What is the hybridization of carbon 2? \( \text{sp}^3 \)

e) What is the hybridization of carbon 3? \( \text{sp}^3 \)

f) How many methyl groups are there in this molecule? 4

g) How many methylene groups are there in this molecule? 6

h) How many methyl groups are bonded to \text{sp}^3 hybridized carbons? 1

i) Circle the pentyl group.

j) What two orbitals overlap to form the C\textsubscript{1}-C\textsubscript{2} bond; be specific. \( \text{C}_1 \text{sp}^2 - \text{C}_2 \text{sp}^3 \)
4. Draw an Energy versus Orbital diagram that shows the formation of one of the carbon-hydrogen bonds of methane. Draw and label each orbital that must overlap to form the bond and the two new molecular orbitals resulting from their linear combination. Place the electrons in the appropriate orbitals. Use the template below (I drew hydrogen's \( \psi_{1s} \) orbital to get you started). Make sure you correctly draw and label each orbital to received full credit. This problem is from page 53 of your book. 5 pts

5. Draw "important" (heavily weighted) resonance structures for the structures below. Show movement of electrons with curved arrows and use the proper arrow notation to denote resonance.

a) 3pts

3/3

A

\[
\begin{array}{c}
\text{\textcircled{C}} \\
\text{\textcircled{V}} \\
\text{\textcircled{+}}
\end{array}
\]

\[\leftrightarrow\]

B

a1) Which resonance structure is more important? 2 pts

\text{EQUAL}
b) 3 pts each for 9 total points

b1) Which resonance structure is most important? 2 pts

D

c) 3 pts each for 9 total points

c1) Which resonance structure is least important? 2 pts

D

6. Looking down the C₂-₃ bond, draw a Newman projection of the molecule below in the conformation that is drawn. Use the template provided. 4 pts.
7. Using the templates provided, draw Newman projections (looking down the C₂-C₃ bond) of the lowest energy conformation and the highest energy conformation of the molecule shown below. 4 pts each for 8 total points

8. Which alkane has the highest boiling point, compound 1 or 2? 2 pts WHY?? 3 pts

Why:
9. Draw Newman Projections of each of the conformations shown below (looking down the C3-C4 bond. Use the templates provided. Which conformation is highest in Energy; WHY (discuss the important interactions making this a high energy conformation). 10 points total.

WHY:

242. The second one (B). This conformation has two CH3/H eclipsed rings and one ethyl/isopropyl eclipsed interaction.

10. The following carbocation reaction with Cl\(^-\) to yield three products, which are isomers. They have the formula C\(_{11}\)H\(_{16}\)Cl Draw them. (3pts)