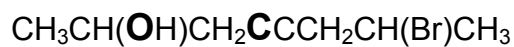
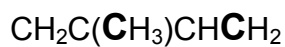
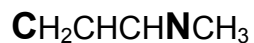
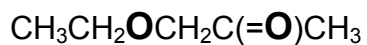


Name: _____

Exam I – Principles of Organic Chemistry I – CH 211
October 19th 2004 – 1:00 to 3:00 PM

**Look over the whole exam and work on what you feel more comfortable FIRST!
Show all your work if you want to receive partial credit. Use front and back of
each page to write your answers. Be clear and concise, and use PENCIL to avoid
making a big mess...**

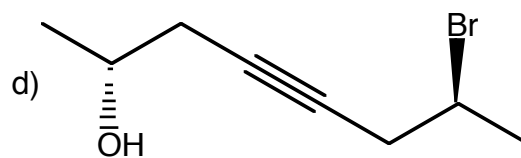
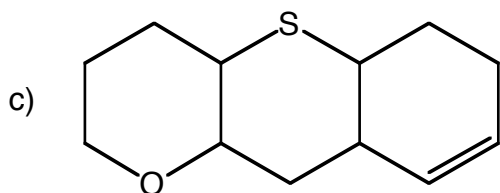
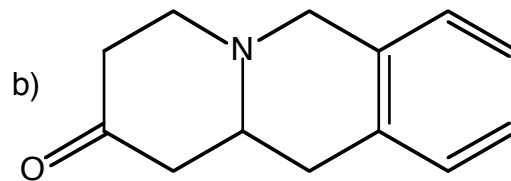
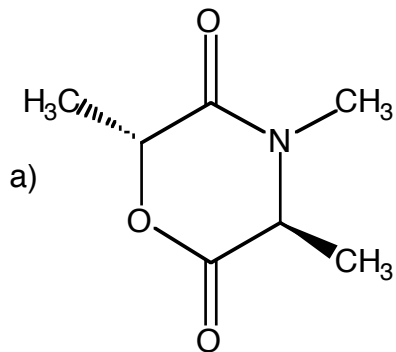
- 1) (20 points) a) For the compounds presented below as condensed structures, draw their corresponding bond-line structure representations:



- b) Describe the hybridization and geometry of the atoms marked in bold letters.

Name: _____

2) (20 points) Identify and name all the functional groups in the following molecules:



Name: _____

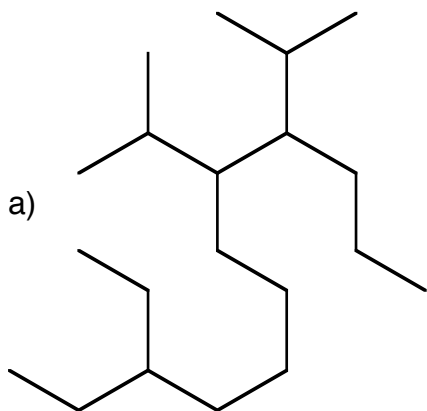
- 3) (20 points) Thiocyanate ion, $\{\text{SCN}\}^-$, is an important reagent in organic chemistry that can be used to introduce sulfur into molecules.
- Draw two Lewis structures for the thiocyanate ion.
 - Using bond-line representation, draw two resonant forms that will contribute to the thiocyanate ion structure, and indicate clearly which one will be the major contributor. Remember to include all non-bonding electrons (i.e., don't forget the lone-pairs...), and account for the movement of electrons properly when going from one resonant form to the other.
 - Draw a detailed orbital diagram for one of the two resonant forms of thiocyanate ion you proposed in part (b). Make sure to place the bonding and non-bonding electrons in the proper orbitals, to label the hybridization of all the atoms, and mark the different bonding orbitals as σ or π .

Hints:

- The "{ }⁻" indicates that the negative charge is delocalized over the whole ion...
- It may be easier to do (b) first and then go back to (a)...
- The electronegativities of **S** and **N** are 2.6 and 3.0, respectively, but remember that **S** is bigger...
- You *do not* need to consider **S** valence shell expansion to do this problem...

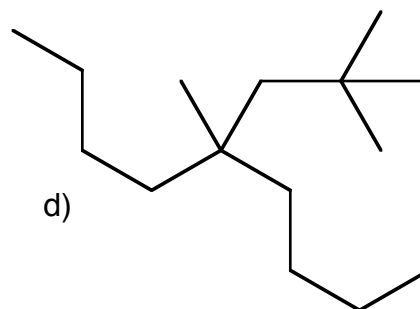
Name: _____

- 4) (20 points) Provide IUPAC names for the alkanes drawn below, and draw the structures for those whose names are provided using bond-line representation:



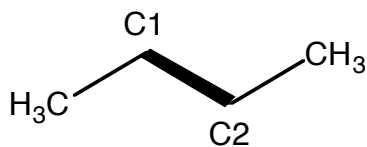
b) 8,9-di(1-methylpropyl)-3-propyldodecane

c) 5-(2,2-dimethylpropyl)-5-methylnonane

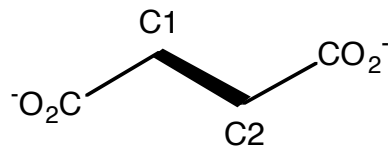


Name: _____

- 5) (20 points) The voices in your head told you to study the torsional potential of butane and succinate ion:



Butane

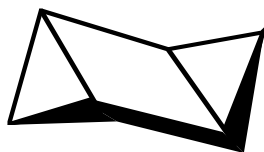


Succinate

- Draw all the Newman projections for a full rotation around the C1-C2 bond in 60° increments (the bolded bonds), and clearly indicate the *anti*-staggered, *gauche*-staggered, and eclipsed rotamers for butane and succinate.
- Using your responses for part (a) and your knowledge of non-bonded interactions, draw qualitative potential energy diagrams for both molecules. Try to superimpose them in the same diagram, using for example dashed (---) and dotted lines (···) for each curve. Make sure that the *relative energies* of the two diagrams make sense.
- A variety of studies have shown that there is free rotation around the C1-C2 bond in butane, but rotation around the C1-C2 bond in succinate is severely restricted. Are the answers you presented in (b) in agreement with these observations? Explain clearly.

Name: _____

6) (20 points) Consider the following polycyclic alkane:



- Draw all the different mono-chlorination products that can be obtained for this compound. Although they are, *do not* consider axial and equatorial positions as being different...
- Taking into account the relative reactivities of primary, secondary, and tertiary carbons towards chlorination (1:4:5), predict the theoretical yield of the compounds you came up with in part (a).
- Write a detailed mechanism for the formation of the compound obtained in *lowest* yield in part (b), including **initiation**, **propagation**, and **termination** steps. Push electrons wisely, and remember that there is one initiation, two propagation, and three termination reactions...
- For 10 brownie points*, is the compound presented above a fused or a bridged polycyclic alkane?

Name: _____

Name: _____