***Student Name* (first, last):**

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Social Security Number:

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CHEMISTRY 3311 (100)
FIRST MIDTERM EXAMINATION

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September 23, 2004

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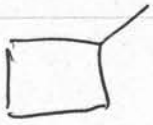
1. (40 points) Check the correct statements only and make no marks at the incorrect statements:

(X) 2-Hexanol is a secondary alcohol.
( ) 2-Aminohexane is a secondary amine.
( ) Trimethylamine is not a Lewis base.
( ) An orbital is a region of space where an electron is likely to be found.
(X) Going from an imine to an amine requires a reduction.
(X) Each bond orbital in methane is a sum of one of the sp^3 hybrids on C and a 1s orbital on H.
( ) An oxygen atom is less electronegative than a carbon atom.
( ) The two lone pairs in the water molecule have equal properties; therefore, it takes the same amount of energy to remove an electron to infinity from either one of them.
( ) Among the isomers of C_5H_{12}, *n*-pentane has the least negative heat of combustion.
(X) Cyclopropane has a higher ring strain than cyclohexane.
(X) The heterolytic cleavage of the carbon-halogen bond is easier in allyl bromide than in methyl bromide.
( ) The sulfur atom can have more than eight electrons in its valence shell.
( ) The relative strengths of bonds in O_2 and F_2 can be determined solely from the boiling points of these elements.
( ) The pi orbital of ethylene is symmetric relative to reflection in the plane of the molecule.
(X) Relative to the 1s orbital in H, the sigma orbital of H_2 is stabilized less than the sigma* orbital is destabilized.
( ) Molecular orbitals are mathematical surfaces that describe the likely positions of electron density.
(X) Homolytic cleavage of a single bond produces a pair of radicals.
(X) 1-Butene has a more negative heat of hydrogenation than 2-butene.
( ) Cyclobutadiene is aromatic.
( ) Furan has eight electrons in its pi orbitals.

2. (20 pts) Write the structures of all possible isomeric compounds of overall formula C_5H_{10} and label each with its IUPAC name (including the cis, trans, *E* or *Z* symbols if appropriate). You do not need to list separately compounds that are mirror images of each other.

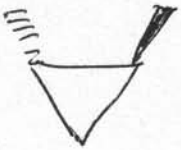
cyclopentane



methylcyclobutane

1,1-dimethylcyclopropane

cis-1,2-dimethylcyclopropane

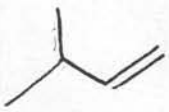


trans-1,2-dimethylcyclopropane

1-pentene

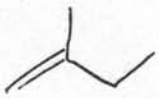
E-2-pentene

Z-2-pentene



3-methyl-1-butene

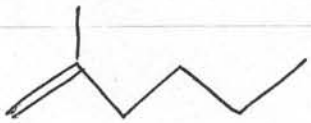
2-methyl-2-butene



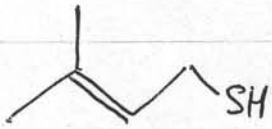
2-methyl-1-butene

3. (20 pts) Write the formulas of the following molecules (one resonance structure suffices):

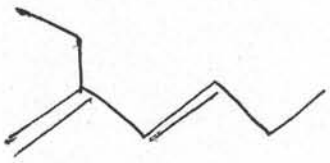
(a) 2-methyl-1-hexene



(b) 3-methylbut-2-ene-1-thiol

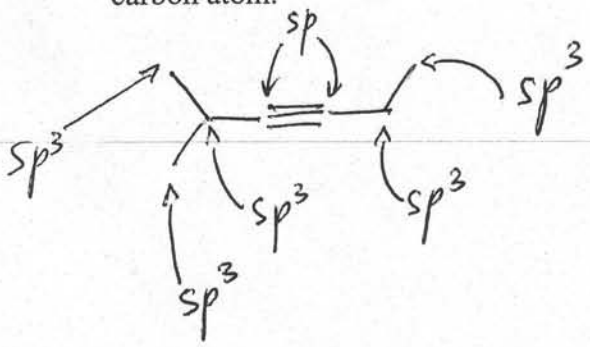


(c) *trans*-2-ethyl-1,3-hexadiene

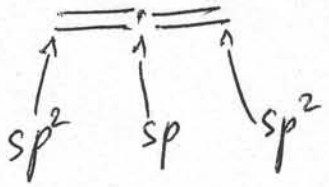


(d) styrene

4. (10 pts) (a) Draw the structure of 2-methyl-3-hexyne and indicate the hybridization state of each carbon atom.



(b) Draw the structure of allene and indicate the hybridization state of each carbon atom.



5. (10 pts) Draw five important resonance structures of the benzyl radical.