ORGANIC CHEMISTRY **CH 384, Fall 2012**

WORKSHOP 5

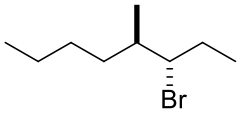
Alkene Structures

1. Three dicarboxylic acids, $C_2H_2(CO_2H)_2$, **I**, **J**, and **K**, are catalytically hydrogenated (react with H_2 in the presence of a catalyst) to give dicarboxylic acids with formulas of $C_2H_4(CO_2H)_2$. Hydrogenation of both **I** and **J** gives the same dicarboxylic acid **L**. Compound **K** hydrogenates to form compound **M**. Give structures for compounds **I**-**M**. **Explain your reasoning.**

2. Draw an atomic orbital model for $CH_2=C=CH_2$. Consider first the geometry at each carbon and select the appropriate hybridization. Label the orbitals used and show all valence electrons. The geometry should be clear from your drawing. Draw a dash/wedge structure for it.

Compare the geometry of this molecule with that of a typical alkene.

3. Draw, name, and decide which would be the major through minor alkene products if:
   a. compound X undergoes an E1 reaction.
   b. compound X undergoes an E2 reaction



Compound X

4. Write a detailed stepwise mechanism for the transformation shown below. Identify each species in the mechanism as a Lewis acid or Lewis base and use curved arrows to show the movement of electron pairs. Construct a plot that describes the energy of the system as a function of the progress of the reaction (reaction energy diagram). On your diagram, clearly label the positions of the reactants, any intermediate(s), and the product. Also, specify the energy difference that corresponds to the ΔG° for the overall reaction and the energy difference that corresponds to $\Delta G^{\neq}$ for each step. Explain (in words) what is happening as the system makes its way from reactants to products.

$$H_2C=CH_2 + HCl \rightarrow CH_3CH_2Cl$$

5 Draw and name all the alcohols which would yield 1-methylcyclohexene in an acid catalyzed E1 reaction.