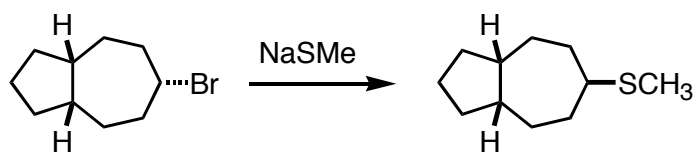


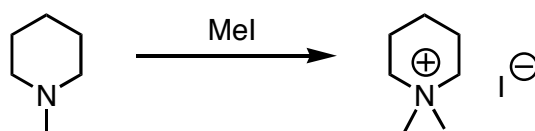
Midterm I - Answer Key

A. (20 points) Draw the product of each of the following reactions:

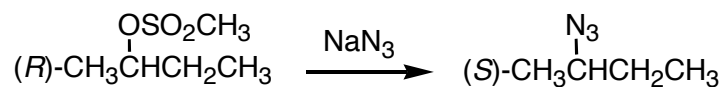
a)



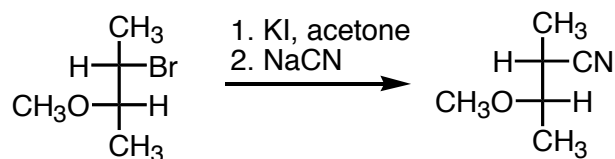
b)



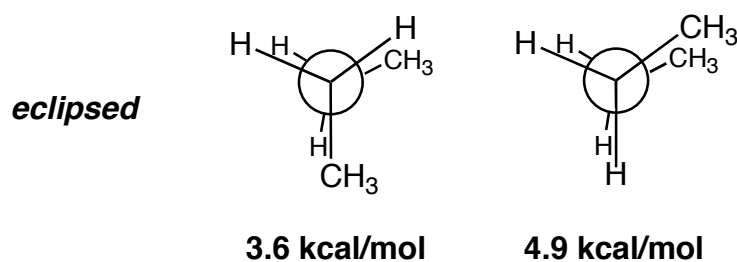
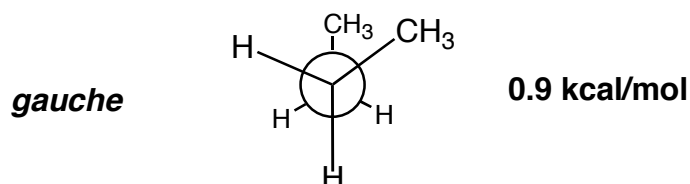
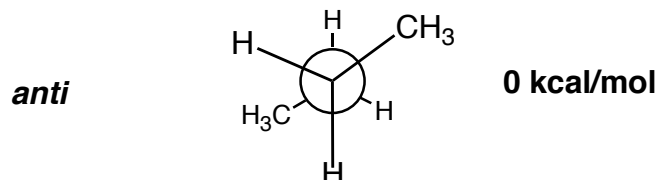
c)



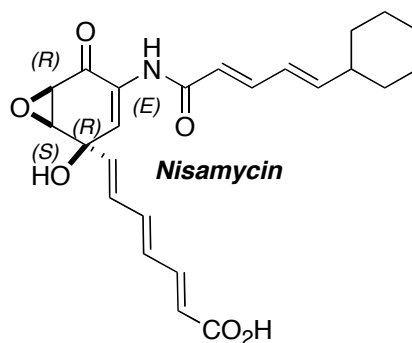
d)



B. (30 points) Draw **Newman projections** of butane in the *anti*, *gauche*, and *eclipsed* conformations. What is the energy difference between these conformations? How many different eclipsed conformations are possible?

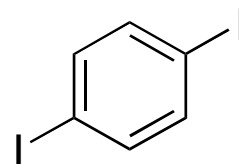
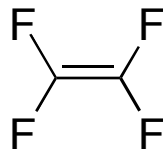
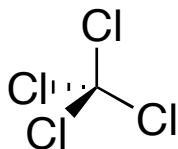


C. (20 points) The following structure shows a natural product that my research group has synthesized a few years ago. Assign the absolute configuration of all stereocenters. How many stereoisomers of this compound are possible?



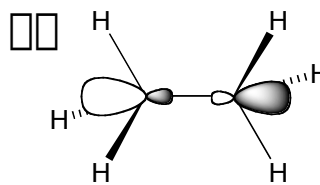
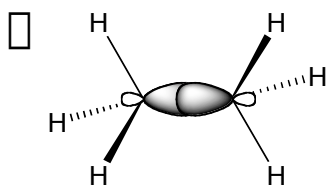
While theoretically the presence of 3 stereocenters should result in a total of 8 stereoisomers, in this case only 4 are possible due to geometrical restrictions of the 3-6-ring fusion!

D. (20 points) Which of the following molecules have a net dipole moment $\mu = 0$?

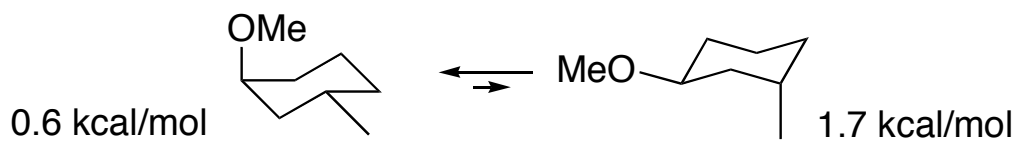


Answer: All of them!

E. (20 points) Draw the bonding (σ) and the antibonding (σ^*) orbitals of the C-C bond in ethane.



F. (30 points) Draw the most stable conformation of *trans*-1-methoxy-3-methylcyclohexane and calculate the relative energy of all possible chair conformers. What ratio of the conformers would you expect based on these energy values?

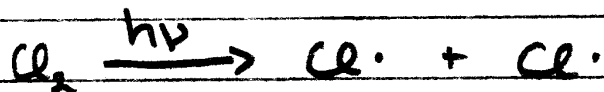


A-value of MeO: 0.6 kcal/mol
A-value of methyl: 1.7 kcal/mol

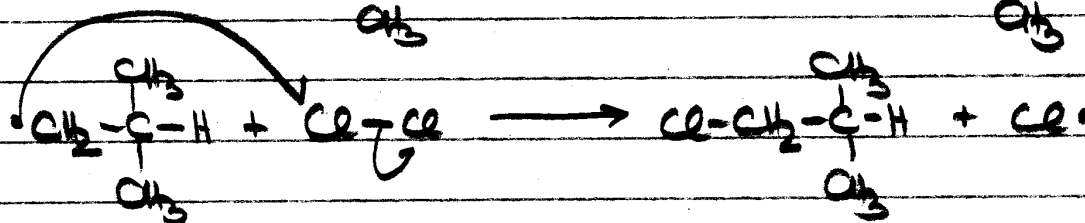
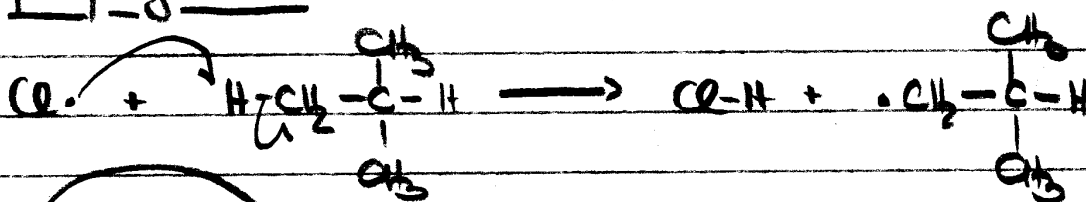
accordingly, the chair conformer with the equatorial methyl group is ca. 1.1 kcal/mol more favored, which translates into a ca. 7:1 ratio at 25 °C according to $\Delta G = -RT \ln K$

G. (30 points)) Write in full the mechanism for monochlorination of 2-methylpropane. Clearly indicate initiation, propagation, and termination steps. What do you expect to be the major product? What is the most reactive C-H bond?

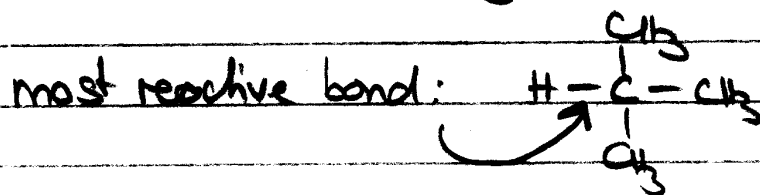
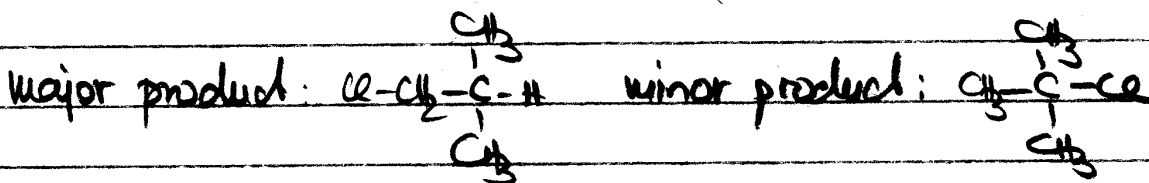
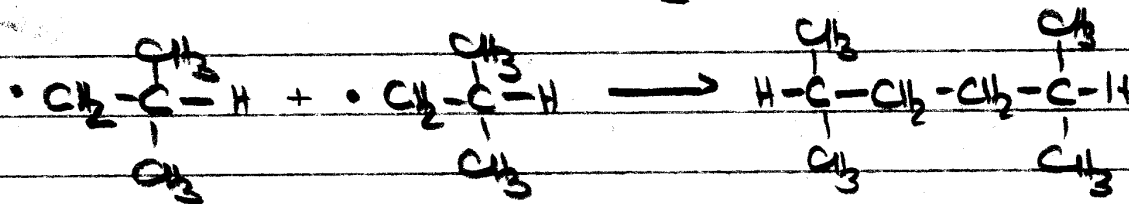
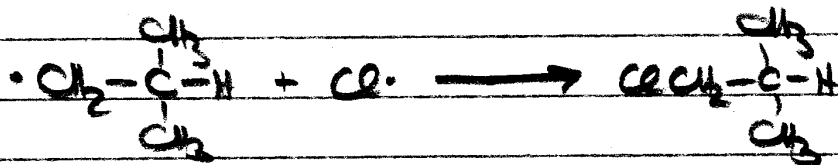
initiation



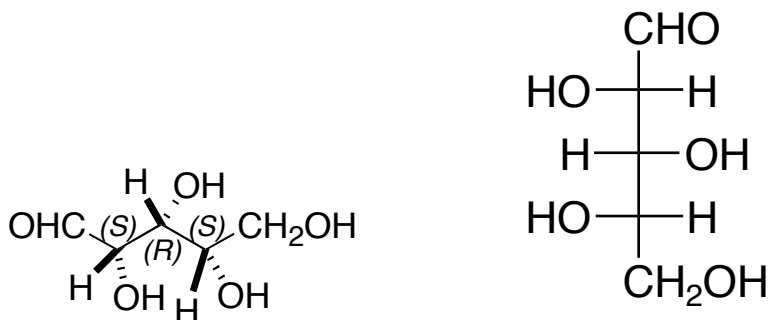
propagation



termination



H. (30 points) Assign the absolute configuration of all stereocenters in the following compound and draw it in the Fischer projection. Is this a meso compound?



not a meso compound!