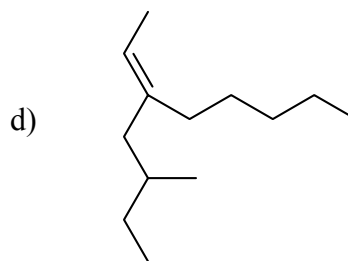
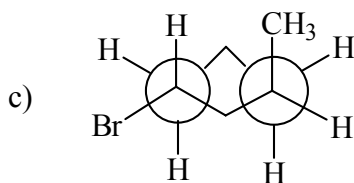
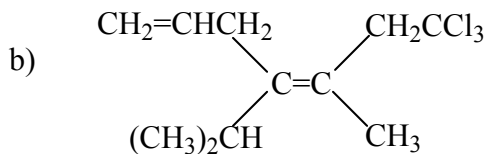
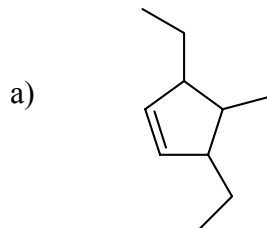


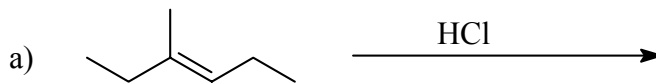
1.(16) Name the following compounds using I.U.P.A.C. nomenclature. Be sure to denote stereochemistry (*Z*, *trans* etc.) when appropriate.



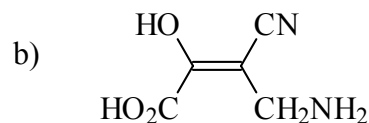
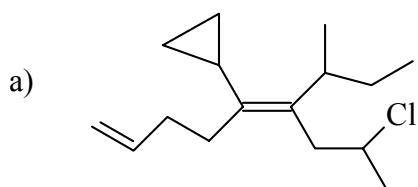
2.(16) Consider the molecule **3-methylpentane** citing along C_2-C_3 . Construct all six rotational conformers using Newman projections. **Also**, identify the *highest* and *lowest* energy conformations and determine the energy difference (KJ/mol) between the two. *Please be sure to draw the correct molecule!*

Interaction	Energy cost (KJ/mol)
methyl-methyl <i>gauche</i>	3.8
methyl-ethyl <i>gauche</i>	4.2
methyl-H <i>eclipse</i>	4.0
ethyl-H <i>eclipse</i>	4.2
methyl-methyl <i>eclipse</i>	11.0
methyl-ethyl <i>eclipse</i>	12.0

3.(12) Give the major product for the following reactions:

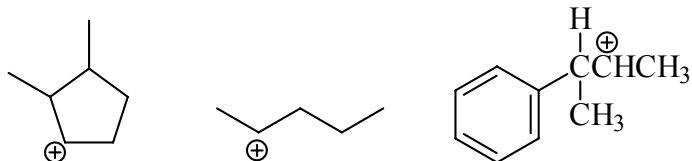


4.(10) Identify the high and low priority substituents and assign (*E*) or (*Z*) in the following molecules:



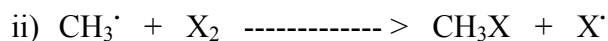
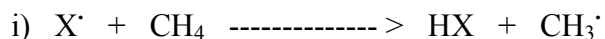
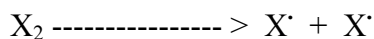
5.(14) The molecule ***trans*1-methyl-3-propylcyclohexane** can exist in two conformations that have a **difference in energy of only 1.0 KJ/mol**. Draw the two chair conformations of this molecule and **label the alkyl groups** as axial-up, axial-down, equatorial-up, or equatorial-down. If the energy value of a 1,3-diaxial interaction between a methyl group and a hydrogen is 3.8 KJ/mol, what is the value of a 1,3-diaxial interaction between a propyl group and a hydrogen.

6.(10) Carbocations tend to undergo 1,2-hydride shifts or 1,2,-methide shifts in order to achieve greater stability. From the carbocations below, identify the *two* species that you would expect to undergo a rearrangement and draw the rearranged cation below it.



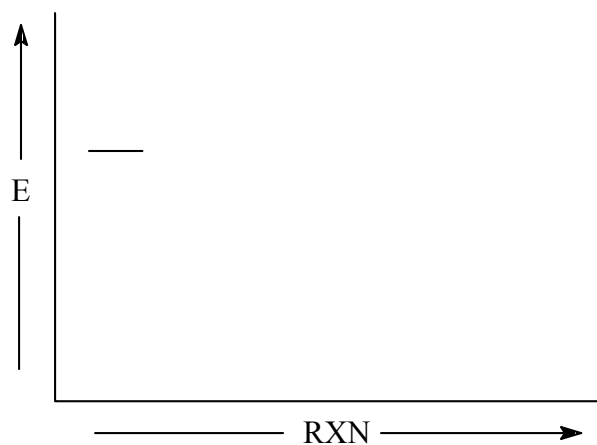
7.(12) Give the structures of the alkenes that would most likely give rise to the above carbocations (question #6) as the major intermediate upon protonation with HCl.

8.(16) Consider the free radical halogenation (X_2) of **methane** with both **fluorine (F_2)** and **bromine (Br_2)**. Use the information below and the data table provided to answer the following questions. $CH_4 + X_2 \rightarrow CH_3X + HX$



- a) Using the two propagation steps shown above (i and ii), calculate ΔH_i and ΔH_{ii} , and ΔH_{rxn} for the reaction with both F_2 and Br_2 (see BDE values on next page).
- b) Are the reactions endo- or exothermic overall? _____

- c) Which step is the rate determining step in the **bromination** reaction?
- d) Which reaction is likely *not* a safe reaction to carry out in the lab? Why?
- e) On the axes below, construct a reaction profile for the **bromination** propagation steps. Keep your profile roughly to scale. With vertical arrows, **Label ΔH°** for step i, ii, and for the overall reaction.



Bond	Bond Dissociation Energy (KJ/mol)
CH ₃ -H	438
CH ₃ -Br	293
CH ₃ -F	456
H-Br	366
H-F	569
Br-Br	193
F-F	157