Department of Chemistry and Biochemistry

Chemistry 59-230/232 **Midterm #1**
Time: 50 min. **Oct. 12, 2007**

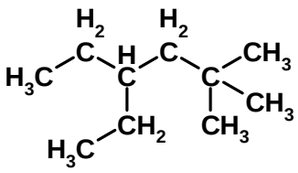
NAME _____**ID#**_____

LAB SECTION – enter day/time/TA_____

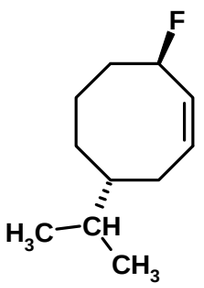
Note: ***Please answer on the test paper.*** *There is an extra sheet for rough work at the back, but it will not be marked. Tests written in pencil will be marked, but cannot be returned for remarking. For the 'promised' size ranking, see the intro to* ***4a****.*

1. Give correct IUPAC names for the following compounds. Include stereochemical descriptors where relevant. (4 marks each, total 20 marks)

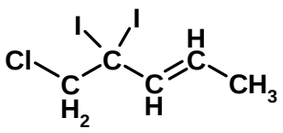
a



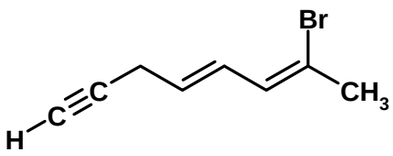
b.



c.



d.



e. Indicate for the structure in **1a** which carbon atoms are primary, secondary, tertiary and quaternary.

2. Draw structures which correspond to the following given names. Drawings showing only carbons and other non-hydrogen atoms are acceptable. Please include the appropriate stereochemical aspects of the structure where it is needed. (4 marks each, total 12)

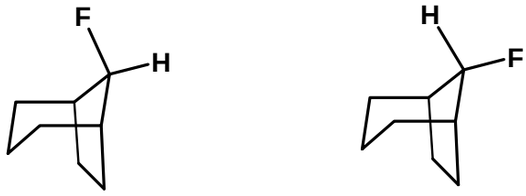
a. *(5E)*-5-chloro-4-ethyl-1,5-heptadiene

b. 2-iodo-3,3-dimethyldecane

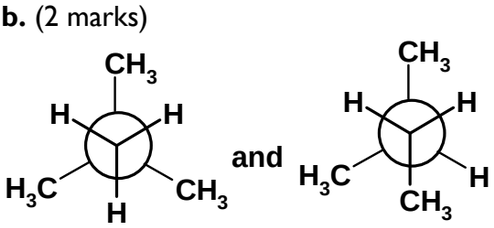
c. *cis* 1-pentyl-3-phenylcyclobutane

3. (Total 17 marks) For each of the (a-d) below, assign the appropriate terminology (structural isomers, geometric (cis/trans) isomers, different conformations of the same molecule, identical) to the following.

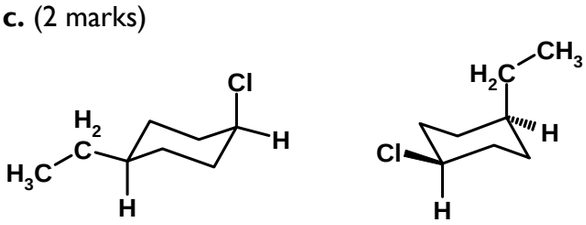
a. (2 marks)



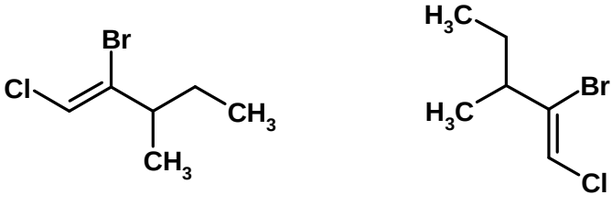
b. (2 marks)



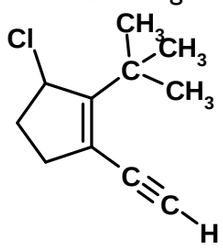
c. (2 marks)



d. (2 marks)



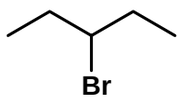
e. Assign the Z- or E- stereochemical descriptor to the following systematically. Show your work. Do *not* give the complete name of the compound (5 marks).



f. Indicate the hybridization of each carbon atom in the above structure (in e). (4 marks)

4 (Total 12 marks)

a. Draw the possible Newman projections of *all* the possible staggered conformations of the following compound, viewed down the C2-C3 bond. Rank them in terms highest to lowest stability. (In terms of size, $C(CH_3)_3$ > $CH(CH_3)_2$ > $CH_2CH(CH_3)_2$ ≈ CH_2CH_3 > CH_3 > NH_2 > OH > F, Cl, Br, I > **H**) (9 marks)



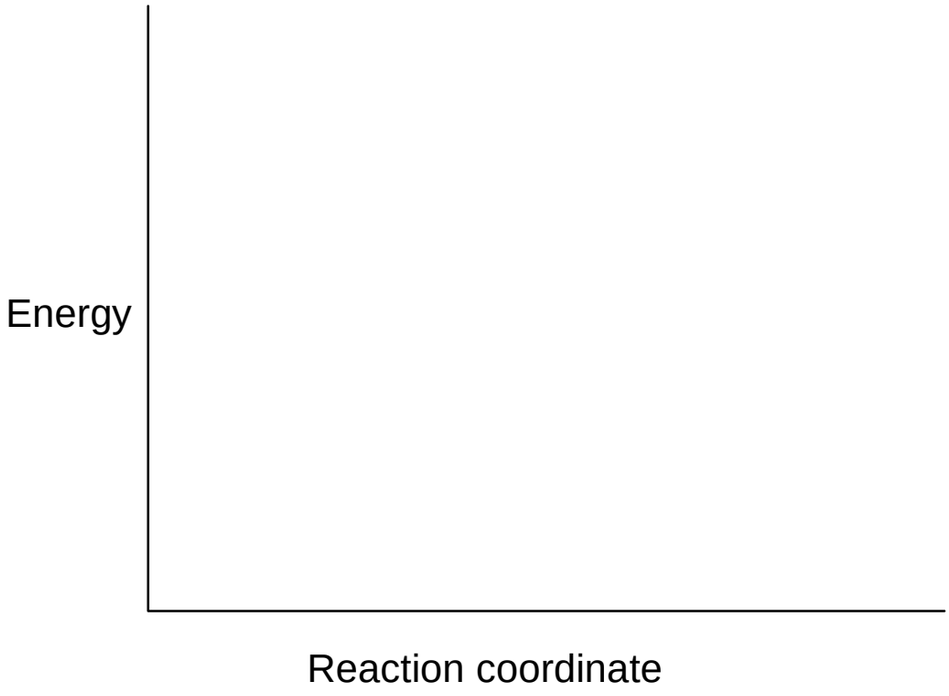
b. In each of the projections in **4a**, what is the relationship in orientation between the bromine function and the methyl group on the neighbouring carbon atom?(3 marks) Note: I am looking for terminology *more* detailed than staggered/eclipsed.

5 (total 19 marks)

a. Draw the two possible chair structures of *trans* 1-bromo-4-(1,1-dimethylethyl)cyclohexane> Indicate which is the most stable conformation and label the (non-hydrogen) substituents as axial or equatorial. (9 marks). (For size rankings, see **4a**)

b. Draw a reaction profile (energy versus reaction coordinate) for the following situation. The one step reaction of A and B can give either compound C or compound D. When the reaction is conducted at -78 °C for 1 minute (lets consider these minimum conditions), there is 90% C and 10% D produced. When the reaction is reaction is conducted at 57 °C for 1 day (let's call these forcing conditions), there is 92% C and 8% D produced. Label A, B, C, and D, *and* the transition states in the reaction to C and D, respectively (use C* and D*). (6 marks)

C ⟵ **A + B** ⟶ **D**



c. Rank the following from strongest to weakest conjugate base (4 marks).

$^{-}NH_2$ ^{-}Cl HO^{-} ^{-}Br HS^{-}

Bonus. (Up to 4 additional marks) Propose a reasonable candidate for a substituted cyclohexane where the largest substituent(s) prefer(s) to be axial.