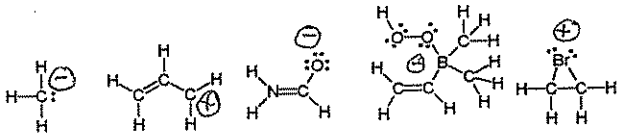
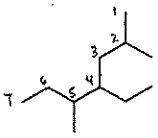
Questions 1 - 5 correspond to material on Exam. 1.

1.(10 points)Assuming that the following Lewis structures are drawn in the standard manner with all bonds and non-bonded electrons showing, correctly place (closest to the correct atom) any formal charges which are present.

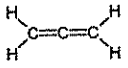


2.(5 points) Give a correct (IUPAC) name for the following molecule.



4-ethyl-2,5-dimethylheptane

3.(5 points) The molecule drawn below is allene. It contains three carbons. From the choices which follow, circle the answer which represents the hybridization of these three carbons.



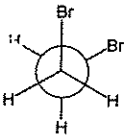
a. All three are sp^2.
b. Two are sp^2 and one sp^3.
c. Two are sp^3 and one sp.
d. One is sp^2 and two are sp.
e. None of these are correct.

4. (10 points) Indicate the relationship between the two molecules in each of the following pairs. They are either:

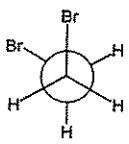
A. identical molecules
B. conformational isomers
C. configurational isomers
D. constitutional isomers
E. different molecules, but not isomers

A

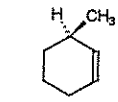
A

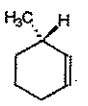


A

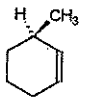


C

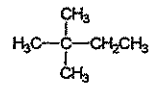




D



5.(5 points) How many ^{13}C signals would appear in the NMR spectrum of the following compound?



four

Questions 6 - 9 correspond to material on Exam. 2.

6. (10 points) Answer each of the following questions.

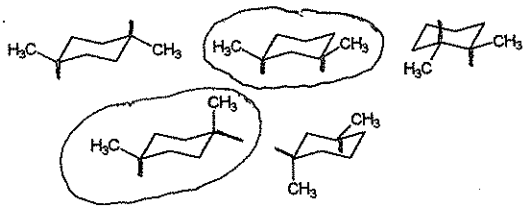
a. Which of the following compounds is most likely to act as a base?

CH_3I $(CH_3)_3COK$ BH_3 I^- H_3O^+ H_2O Cl^-

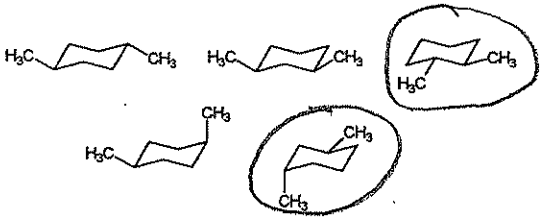
b. Which of the following compounds is most likely to act as a Brønsted acid?

CH_3I $(CH_3)_3COK$ BH_3 I^- H_3O^+ H_2O Cl^-

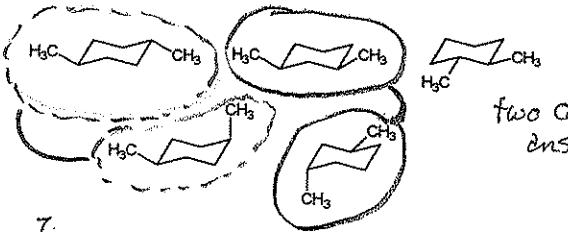
c. In the following set of structures, circle all in which two substituents are *cis*.



d. In the following set of structures (same set as c) which molecules are chiral?

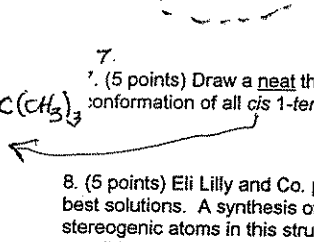


e. In the same set of structures, reproduced below, find two structures which are stereoisomeric and circle these.

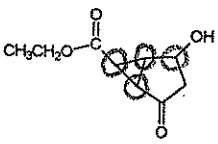


two correct answers

7. (5 points) Draw a neat three-dimensional representation of the most stable chair conformation of all *cis* 1-*tert*-butyl-3,4-dimethylcyclohexane.



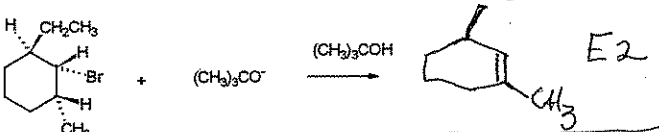
8. (5 points) Eli Lilly and Co. posts synthetic problems on a web site and rewards the best solutions. A synthesis of the compound below was worth $2,000. Circle the stereogenic atoms in this structure. How many stereoisomers are theoretically possible? Eliminating those with unreasonable strain, how many are probably possible? It's probably a good idea to draw in the H atoms before attempting the answer.



Theoretical $2^4 = 16$
actually possible = 8

9. (3 × 5 points =15 points) For each of the following, show the major product or products or write "no reaction". If more than one product is significant, say (if predictable) which is major. For those reactions which take place, indicate whether the mechanism is S_N1, S_N2, E1, E2, or some combination of these.

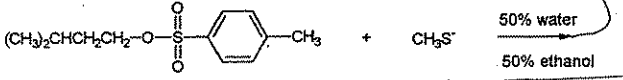
a.



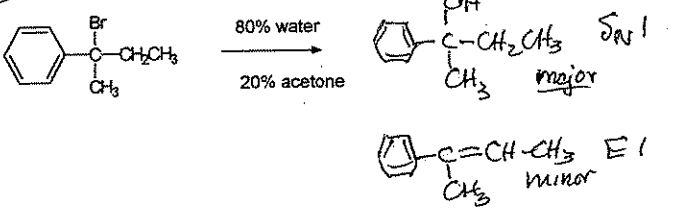
E2

S_N2 $(CH_3)_2CHCH_2CH_2SCH_3$

b.



c.



S_N1 major

E1 minor