Department of Chemistry and Biochemistry

Chemistry 59-230/232 **Midterm #1**
Time: 50 min. **Oct. 19, 2005**

NAME ______________________________________ **ID#**_________________________

LAB SECTION (***If you can't remember, give your TA's names)***

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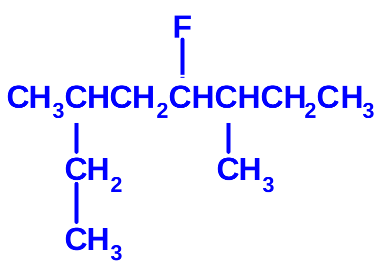
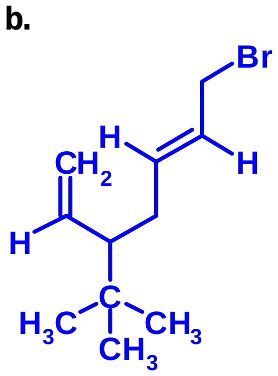
Note: ***Please answer on the test paper.*** *There is an extra sheet for rough work at the back, but it will* *<u>not</u>* *be marked. Tests written in pencil will be marked, but cannot be returned for remarking. For the 'promised' size ranking, see the intro to* ***5a****.*

1. Give correct systematic names for the following compounds. Include stereochemical descriptors where relevant. (4 marks each, total 16 marks)

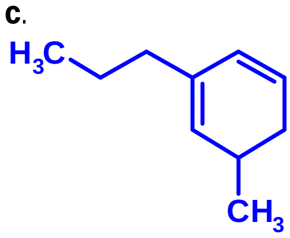
a



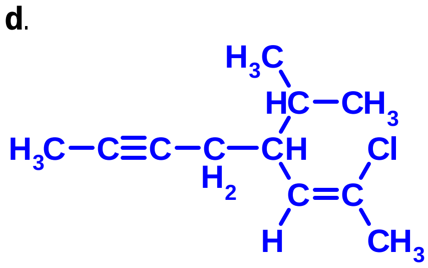
b.



c.



d.



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)

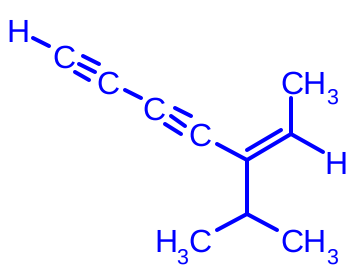
a. *trans*-4-chloromethyl-4-heptene

b. *cis*-3-ethyl-4-iodo-1-phenylcycloheptene (Note: I have *not* put a stereochemical descriptor in for the alkene stereochemistry)

c. (*Z*) 7-bromo-4-bromomethyl-3,6,6-trimethyl-3-heptene

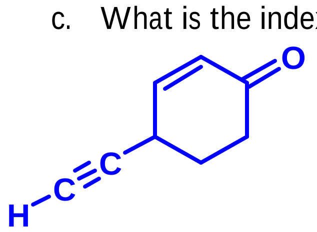
3. (Total 15 marks)

a. Apply the *Z* or *E* stereochemical descriptor where relevant in the following molecule. Show how you arrived at the distinction. (5 marks)

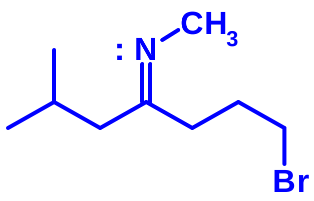


b. In the above (^) compound label each carbon atom with the appropriate hybridization. (3 marks)

c. What is the index of hydrogen deficiency of the following compound? (2 marks)

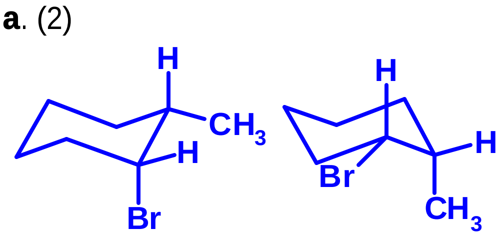


d. Not only C=C double bonds can have geometric isomers. Apply the *Z* or *E* stereochemical descriptor where relevant in the following molecule. Show how you arrived at the distinction. (5 marks) By the way, there are <u>two bonus marks</u> if you can name the double bonded functional group.

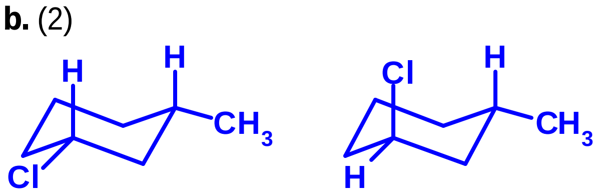


4. For each of the below, assign the appropriate terminology (structural isomers, stereoisomers, geometric isomers, different conformations of the same molecule, identical) to the following. (Total 6 marks)

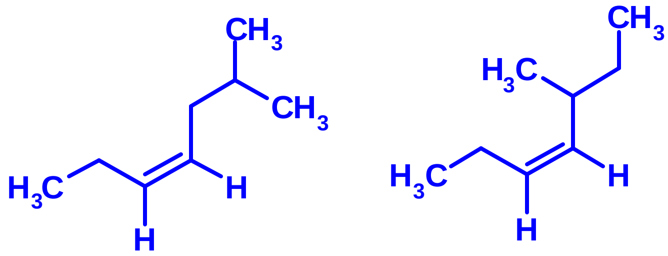
a. (2)



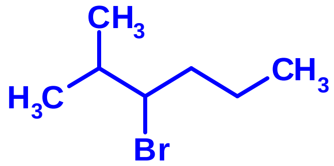
b. (2)



c. (2)



5. a) (22 marks) Draw the Newman projections of the indicated compound in the most stable staggered conformation of the following compound, viewed down the C2-C3 bond. (In terms of size, $C(CH_3)_3$ > $CH(CH_3)_2$ > $CH_2CH_2CH_3$ = CH_2CH_3 > CH_3 > NH_2 > OH > F, Cl, Br, I > **H**) (5 marks)



b) Draw the Newman projection of the same compound (as in ‘a’) in the most stable eclipsed conformation (again, down the C2-C3 bond). Give the name for the relative orientation of the propyl group on the back carbon with respect the methyl groups on the front carbon (6 marks).

c) Draw *cis*-1-fluoro-4-methylcyclohexane in its most stable conformation. Label the non-hydrogen substituents as axial or equatorial (6 marks).

d) Is *trans*-1-fluoro-4-methylcyclohexane more or less stable than *cis*-1-fluoro-4-methylcyclohexane? Please rationalize your answer – by *either* words or drawn structures (5 marks).

6a. **(10 marks)** An exothermic reaction between A and B to give C occurs in three steps. A is consumed in the 1^{st} step and B is consumed in the third step. The 2^{nd} step is the rate determining one.

i) Draw the energy versus reaction coordination plot for this transformation.
ii) Indicate by labeling the highest energy transition state.
iii) Write out the rate equation.

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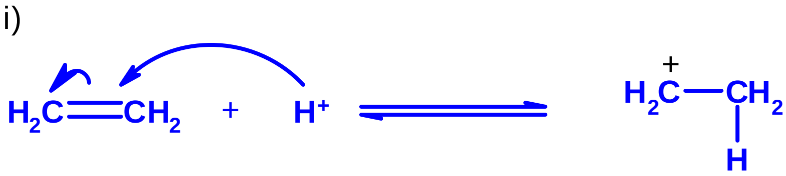
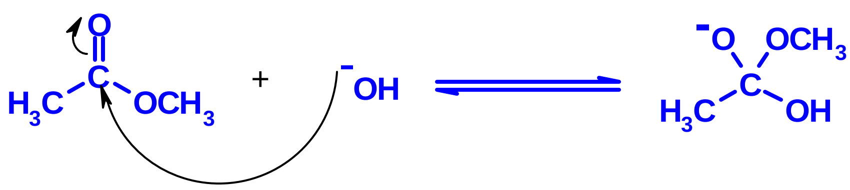
Rate v = k ______________________________

b. Which of the following are proper uses of the curved arrow, and which are not? (6 marks). For any incorrect ones, show what the arrows would indicate the product to be (no matter how unstable it looks).

i)



ii)



c) Rank the following in terms of acid strength, from strongest to weakest (3 marks).

H_2S NH_3 HI PH_3 HCl

Bonus. (Up to 3 additional marks) Six membered all carbon ring systems can occasionally prefer to exist in a boat conformation. Can you supply a reasonable example?