Name:_____

CHEMISTRY 3311, Fall 2000
Professor Walba
First Hour Exam
September 28, 2000

scores:

1)

2)

3)

4)

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This is a closed-book "open model" exam. You may use models, but no notes or books. Please put all your answers on the test. Use the backs of the pages for scratch.

PLEASE read the questions carefully!

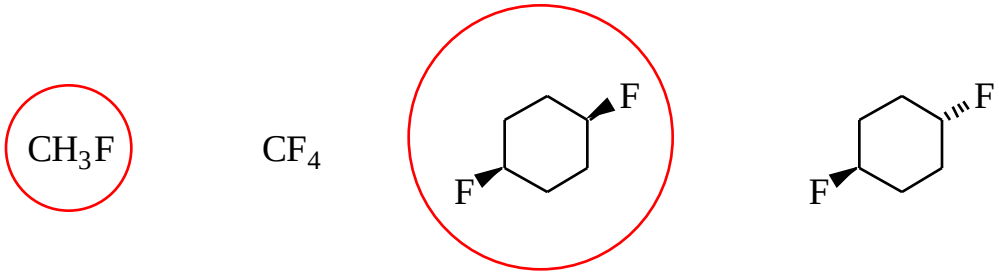
Partial Periodic Table

1A							8A
1 H	2A	3A	4A	5A	6A	7A	2 He
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
						35 Br	
						53 I	

Name:_____

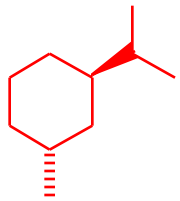
1) (20 pts) a) Draw all of the possible constitutional isomers with the molecular formula C_4H_9F. Draw each isomer only once. Use molecular graphs (bond line formulas) to show the structures without any geometrical cues (i.e. no wedges and dashes). DO NOT indicate any stereoisomerism.

b) Some of the following molecules have a net molecular dipole moment, and some have exactly zero dipole moment. Circle the structures representing molecules WITH a dipole moment.



c) Using molecular graphs with wedges and dashes to indicate stereochemistry draw structures for the following molecules. Note – I'm not asking for conformations here; the rings should be flat.

trans-1-Isopropyl-3-methylcyclohexane



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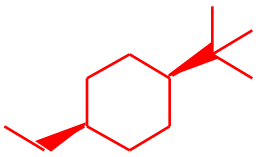
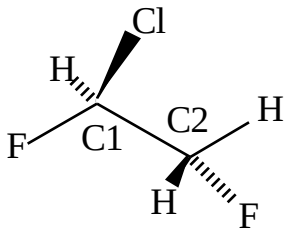
cis-1-*tert*-Butyl-4-ethylcyclohexane

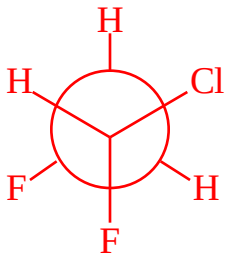


Name:_____

2) (26 pts) Referring to the conformation of 1,2-difluoro-1-chloroethane shown below:



a) Draw a Newman projection for this conformation sighting down the C1-C2 bond (C2 in back).

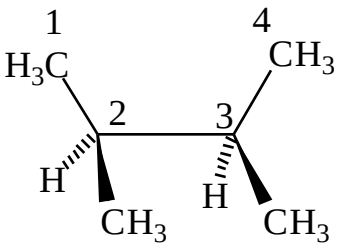


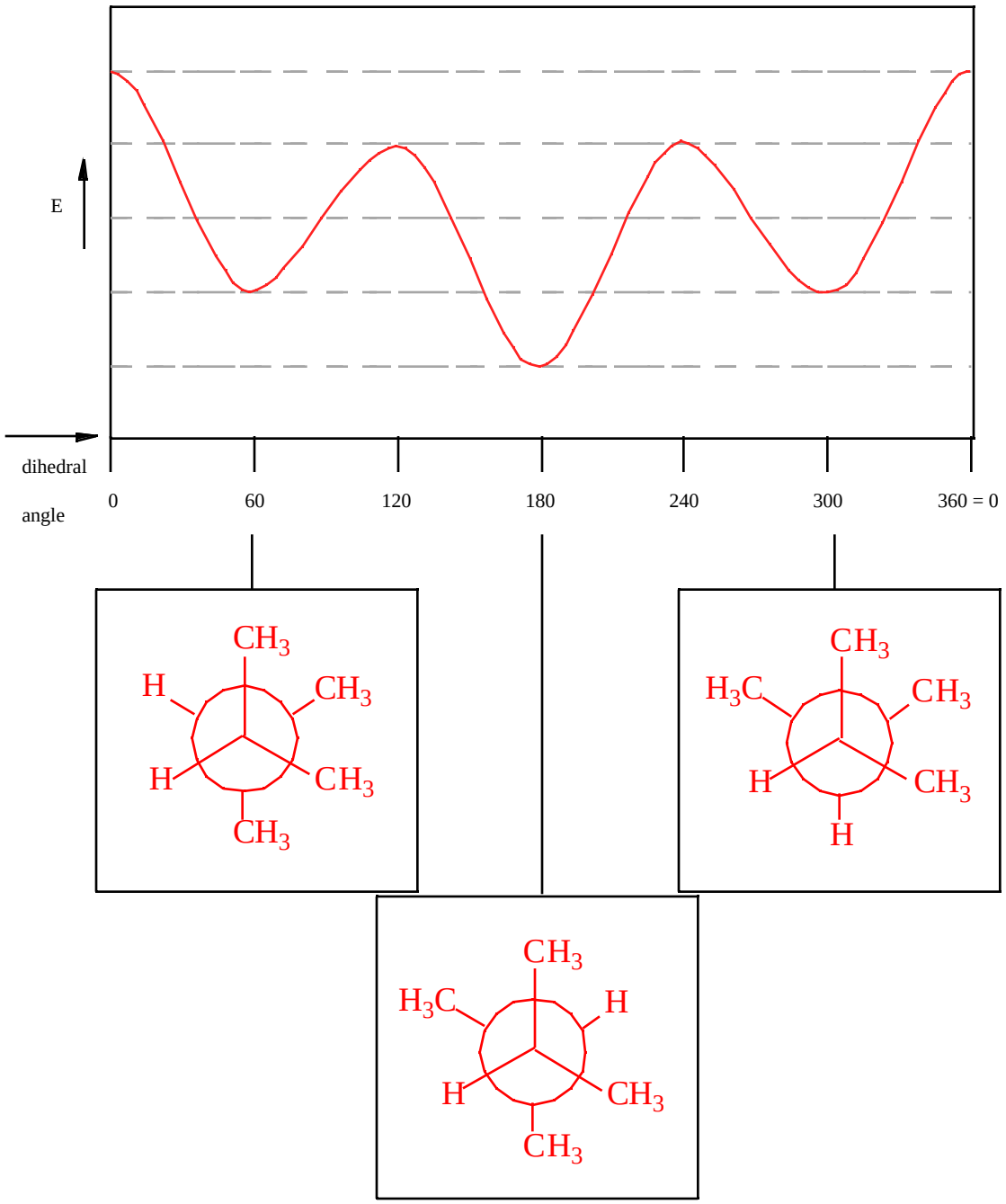
b) What is the dihedral angle between the carbon-chlorine bond at C1 and the carbon-fluorine bond at C2?

180°

Name:_____

c) An eclipsed conformation of 2,3-dimentylbutane is indicated in the wedges and dashes structure shown to the right. Complete the following energy diagram for rotation about the C2-C3 bond of this molecule. Use the conformation shown, sighting down the C2-C3 bond with C3 in back, as the conformation with dihedral angle = 0° = 360°. This means that the dihedral angle represented in the diagram is the C1-C2-C3-C4 dihedral. Please rotate the back carbon (C3) clockwise to generate your conformations. Carefully show the relative energies of all the conformational wells and transition states (of course, no numbers are required), and fill in the rest of the energies with smooth curves. Also, draw Newman projections of the conformations with dihedral angles = 60°, 180°, and 300° in the boxes.





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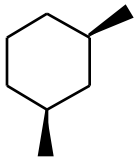
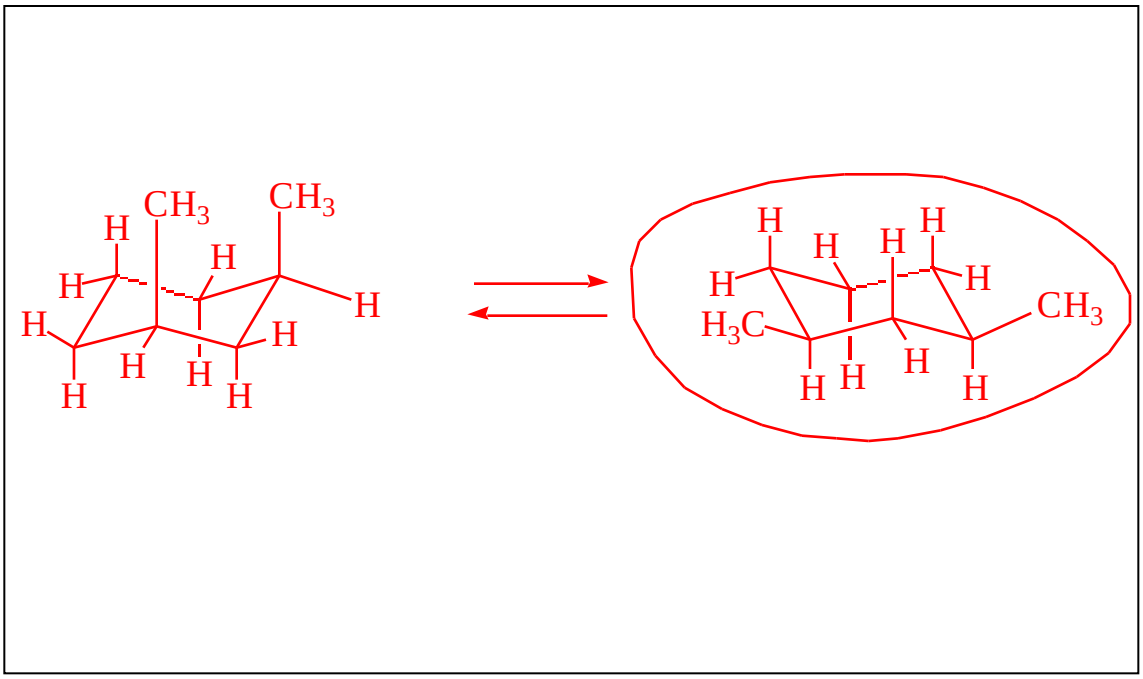
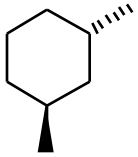
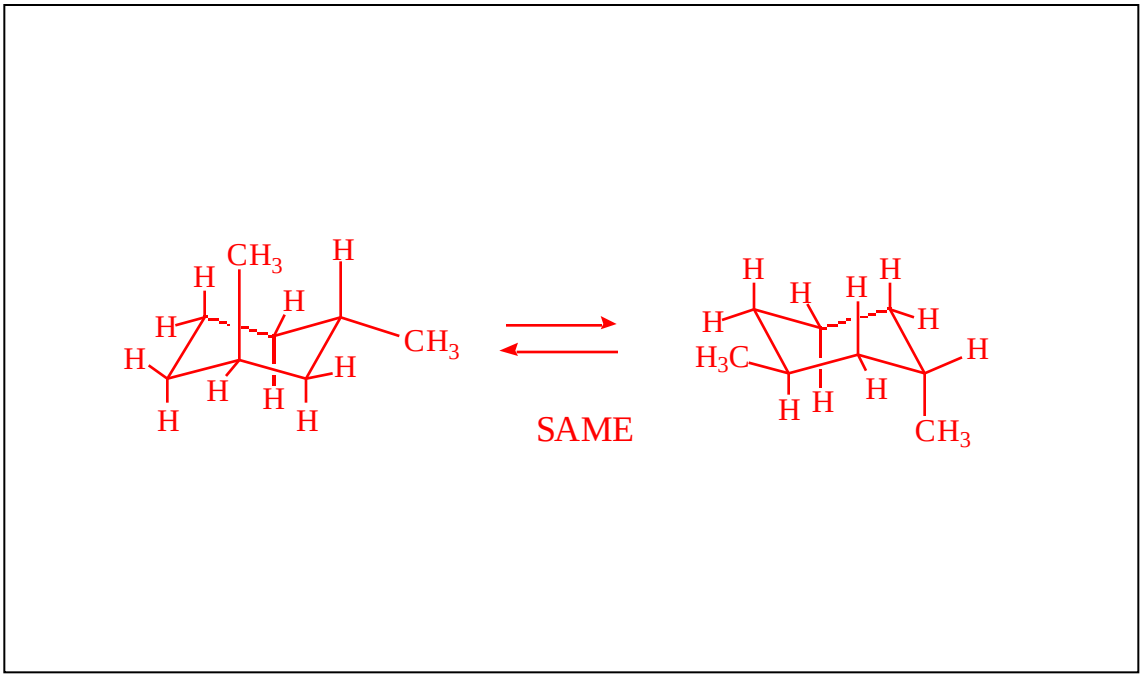
3) (27 pts) a) For the following substituted cyclohexane isomers, carefully draw the two possible chair conformations for each isomer (that means you should have four perspective chair structures drawn, two equilibrating structures in each box). Please put all the H atoms on the rings, but abbreviate the methyl groups with $-CH_3$. For each pair of conformations, circle the more stable one. If the two conformations have the same energy, label that pair "same".









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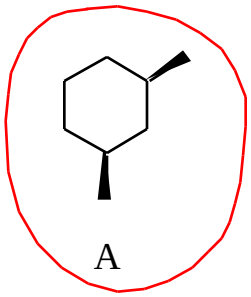
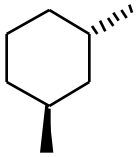
3-continued

b) The same isomers from part a) are reproduced below. Circle the structure of the more stable compound.



A

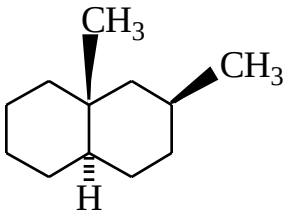


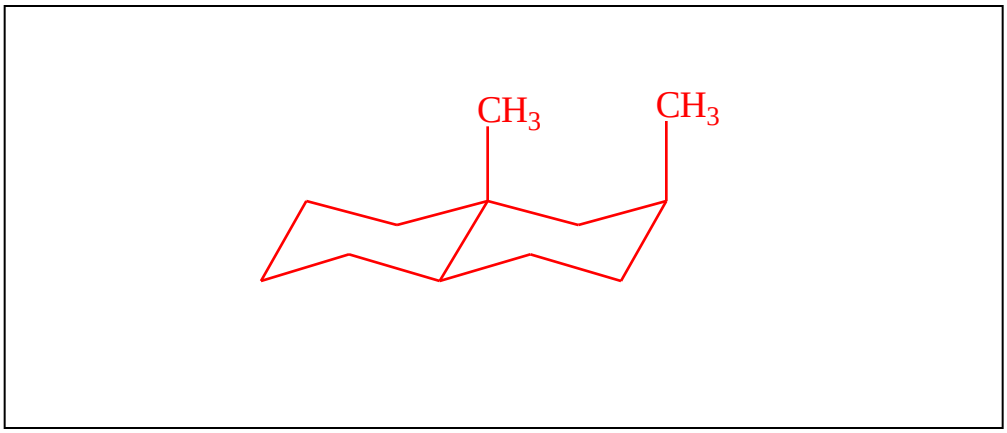
B

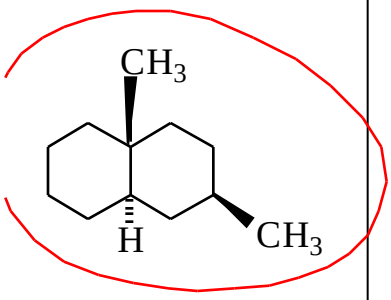
c) If one burns compound A (combustion), then a lot of heat is produced. If one burns compound B, a different amount of heat is produced. Which compound gives more heat of combustion?

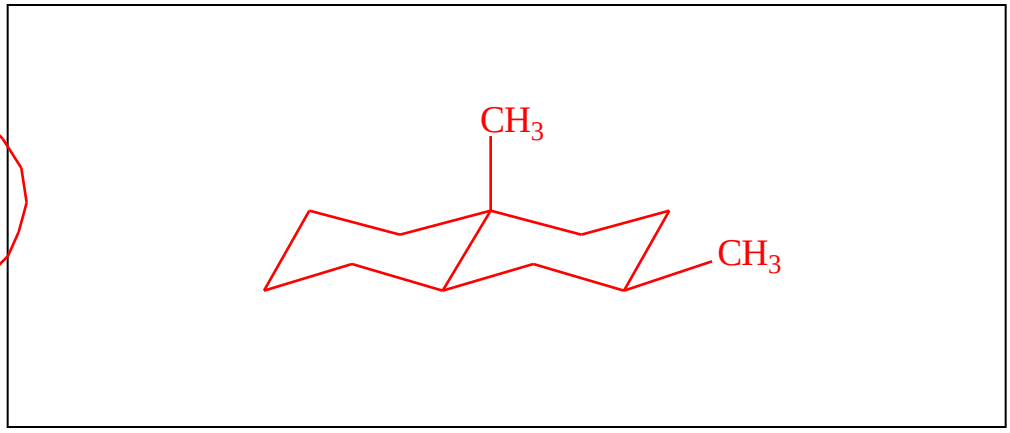
B

d) Draw one perspective chair picture for each of these substituted decalin isomers. CIRCLE THE MORE STABLE ISOMER.









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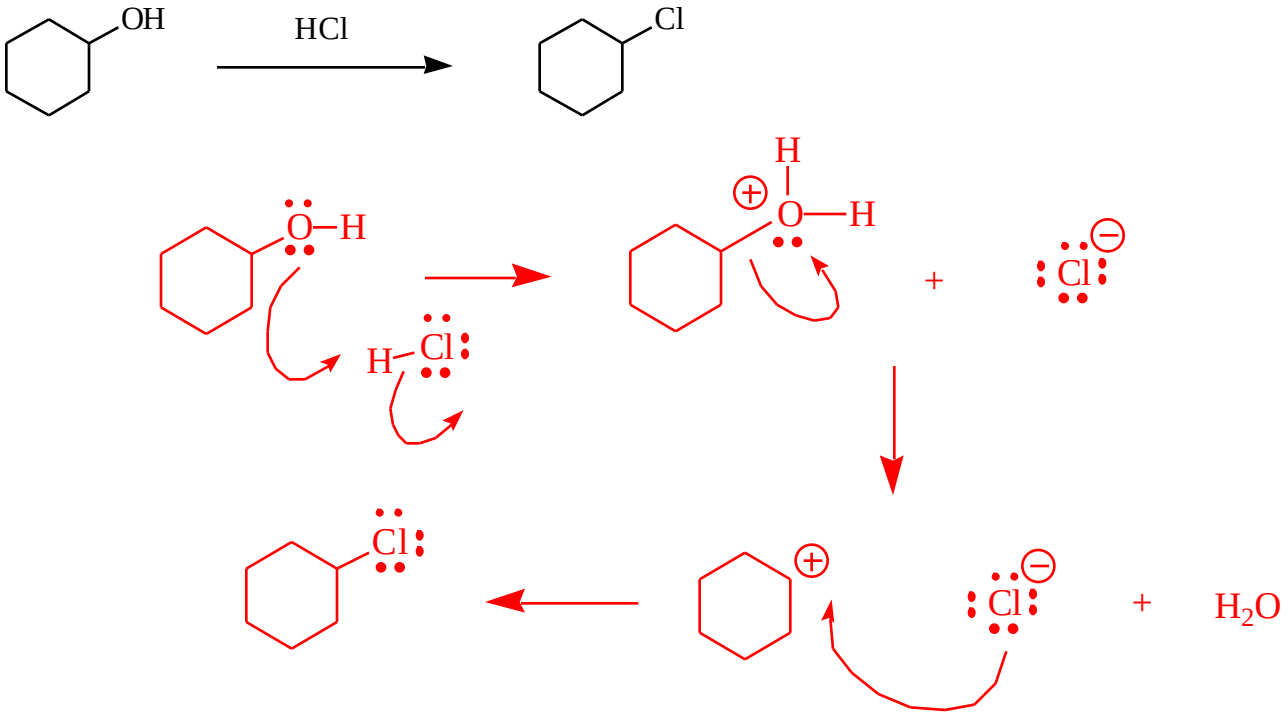
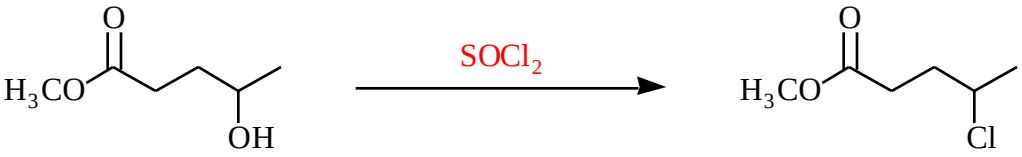
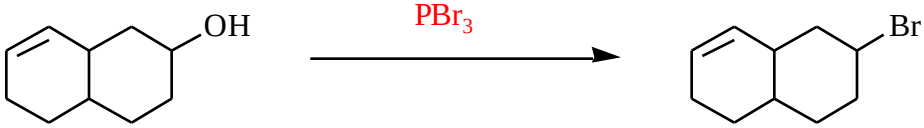
4) (27 pts) a) Propose an arrow-pushing mechanism for the following transformation. Carefully draw a valid valence-bond structure for each intermediate in your mechanism, showing unshared electrons and formal charges. DO NOT show any transition states or energy diagrams.



b) Propose reagents for accomplishing the following transformations of the indicated alcohol starting materials. Due to other functional groups in these starting materials, you CANNOT use HBr or HCl to accomplish the required reactions!





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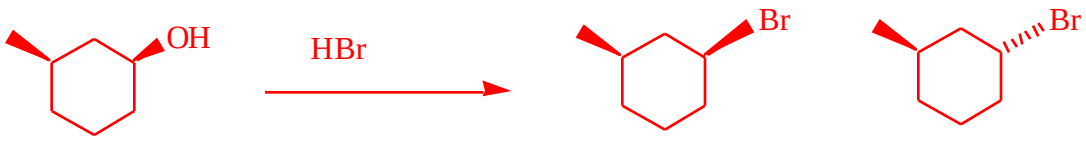
4-Continued

c) The reaction shown below provides TWO alkyl bromide products! Using wedges and dashes, show the structures of these two products.



TWO products

d) Circle the structure of the alcohol from the following pair which reacts FASTER with HBr?