

Seat No. _____

LAST NAME WST

Section A

FIRST NAME _____

There are 7 pages to this exam. Check to make sure you have a complete exam.

PLEASE ALSO PRINT YOUR NAME ON THE TOP OF
THE BACK OF THE LAST PAGE OF THE EXAM

CHEMISTRY 331

EXAM I

Fall 2006 (9/12/06)

I. (22 points) _____

II. (16 points) _____

III. (8 points) _____

IV. (12 points) _____

V. (6 points) _____

VI. (10 points) _____

VII. (14 points) _____

VIII. (12 points) _____

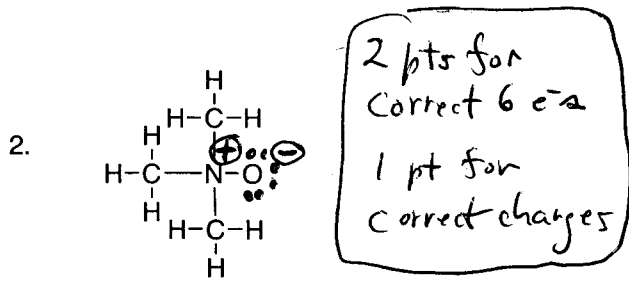
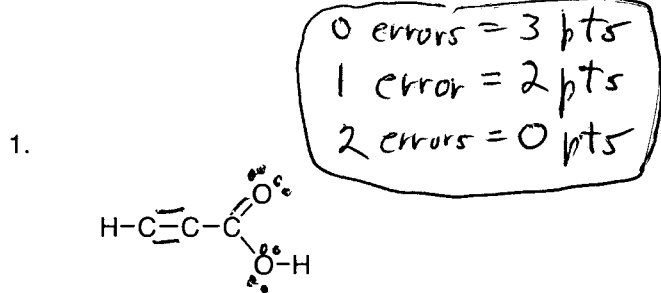
TOTAL (100 points) _____

Seniors graduating Fall 06 please check box

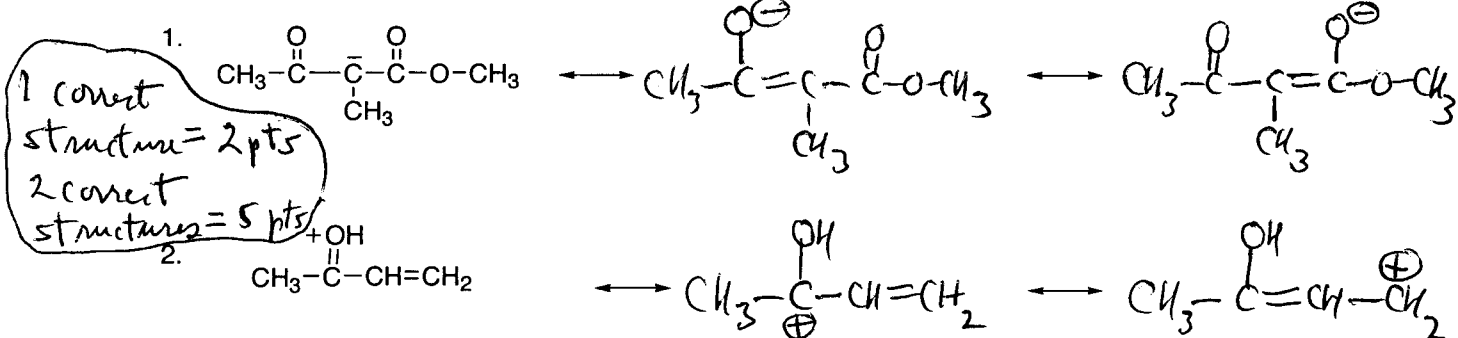
Seniors will not be excused from final.

II.(16 points)

A. (6 points) Partial Lewis structures showing all σ -bonds are given below. Complete the structures by showing all other bonding and nonbonding electron pairs. Show formal charges if appropriate. All structures follow the octet rule.

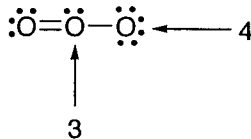
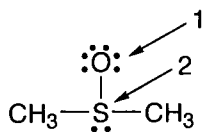


B. (10 points) Draw two additional resonance structures for each of the following ions.



III.(8 points)

A. Assign formal charges to the atoms indicated.



1.
2.
3.
4.

1A 1	2A 2											3A 13	4A 14	5A 15	6A 16	7A 17	8A 18
H 1.01	He 4.00											B 10.8	C 12.0	N 14.0	O 16.0	F 19.0	Ne 20.2
3 Li 6.94	4 Be 9.01	8B										13 Al 27.0	14 Si 28.1	15 P 31.0	16 S 32.1	17 Cl 35.4	18 Ar 39.9
11 Na 23.0	12 Mg 24.3	3B 3	4B 4	5B 5	6B 6	7B 7	8 8	9 9	10 10	1B 11	2B 12	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 79.9	36 Kr 83.8
19 K 39.1	20 Ca 40.1	21 Sc 45.0	22 Ti 47.9	23 V 50.9	24 Cr 52.0	25 Mn 54.9	26 Fe 55.8	27 Co 58.9	28 Ni 58.7	29 Cu 63.5	30 Zn 65.4	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
37 Rb 85.5	38 Sr 87.6	39 Y 88.9	40 Zr 88.9	41 Nb 91.2	42 Mo 92.9	43 Tc 95.9	44 Ru (98)	45 Rh (98)	46 Pd 106	47 Ag 108	48 Cd 112	81 Tl 204	82 Pb 207	83 Bi 209	84 Po (209)	85 At (210)	86 Rn (222)
55 Cs 133	56 Ba 137	57 La 139	72 Hf 178	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	109 Uue (266)	110 Uuo (266)	111 Uuh (266)	112 Uus (266)	113 Uuq (266)	114 Uur (266)
87 Fr (223)	88 Ra 226	89 Ac 227	104 Rf (261)	105 Ha (262)	106 Unh (263)	107 Uus (263)	108 Uuo (264)	109 Uuh (265)	110 Uur (265)	111 Uus (265)	112 Uuq (266)	113 Uur (266)	114 Uus (266)	115 Uuq (266)	116 Uur (266)	117 Uus (266)	118 Uuo (266)

IV. (12 points) Multiple Choice. Circle the correct answer.

A. Which of the following compounds should have the lowest boiling point?

1. $\text{CH}_3(\text{CH}_2)_5\text{CH}_3$ 2. $(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3\text{CH}_3$ 3. $(\text{CH}_3)_3\text{CCH}(\text{CH}_3)_2$ 4. $\text{CH}_3(\text{CH}_2)_6\text{CH}_3$

B. Which of the following compounds should have the highest melting point?

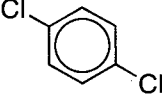
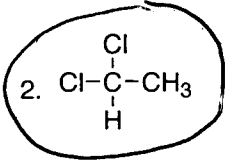
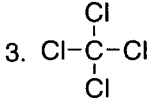
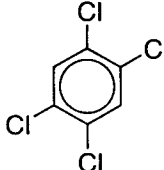
1. $\text{CH}_3(\text{CH}_2)_5\text{CH}_3$ 2. $(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3\text{CH}_3$ 3. $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{CH}_2-\text{C}-\text{CH}_2\text{CH}_2\text{CH}_3 \\ | \\ \text{H} \end{array}$ 4. $\text{CH}_3(\text{CH}_2)_4\text{CH}_3$

C. Which set of pKa's is correct?

- | | | | |
|--------------------------------------|-------|--------------------------------------|------|
| 1. $\text{CH}_3\text{CH}_2\text{OH}$ | -16.0 | 2. $\text{CH}_3\text{CH}_2\text{OH}$ | 15.7 |
| CH_3COOH | -4.8 | CH_3COOH | 18.0 |
| HOH | -15.7 | HOH | 16.0 |

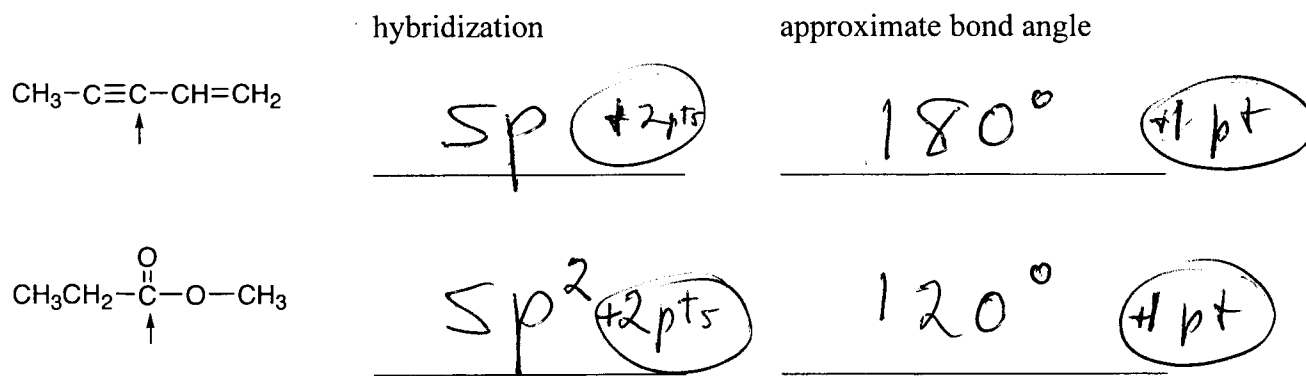
- | | | | |
|--------------------------------------|------|--------------------------------------|------|
| 3. $\text{CH}_3\text{CH}_2\text{OH}$ | 16.0 | 4. $\text{CH}_3\text{CH}_2\text{OH}$ | 16.0 |
| CH_3COOH | 15.7 | CH_3COOH | 4.8 |
| HOH | 4.8 | HOH | 15.7 |

D. Which molecule would be the most polar (have the greatest dipole moment)?

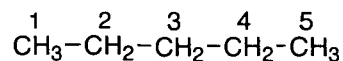
1.  2.  3.  4. 

V. (6 points)

A. (6 points) Give the hybridization and approximate bond angles for the atoms marked with an arrow.

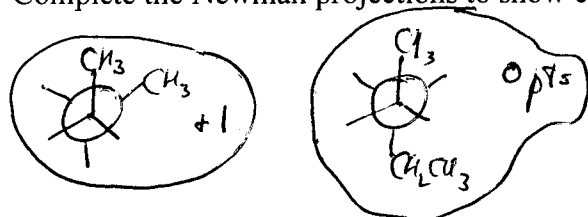


VI. (10 points)

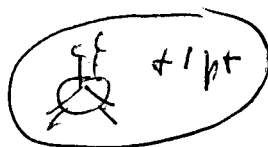
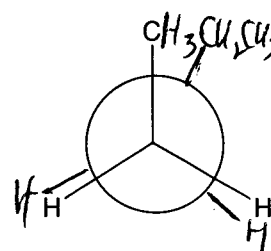
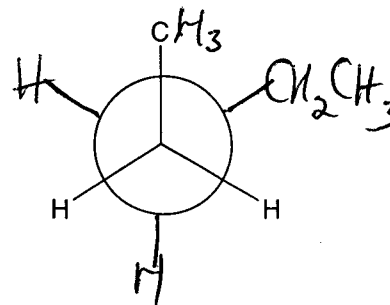
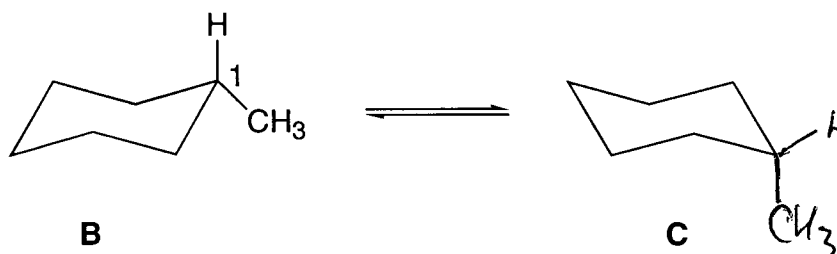
A. (6 points) Consider rotation about the C₂-C₃ bond of pentane A.

A

Complete the Newman projections to show conformations which fit the following descriptions.



1. The gauche conformation

2. The less stable eclipsed conformationB. (4 points) One of the conformations of methylcyclohexane is structure **B**. Only the methyl group and the hydrogen atom attached to carbon 1 are shown. Conformation **B** undergoes a ring flip to form conformation **C**. On the cyclohexane structure below, complete **C** by drawing in the methyl group and the hydrogen atom attached to carbon 1.

1 error = 2 pts
2 or more errors = 0 pts

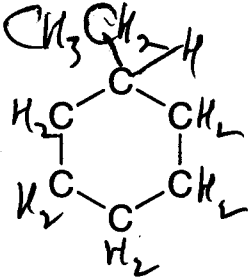
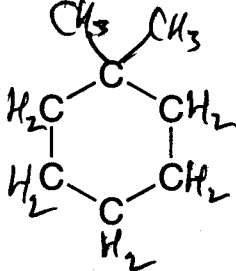
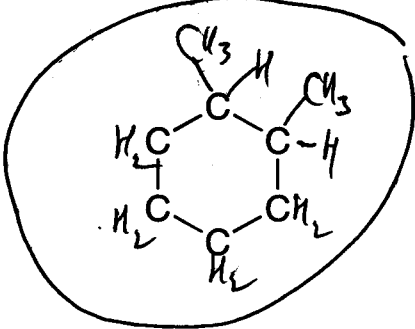
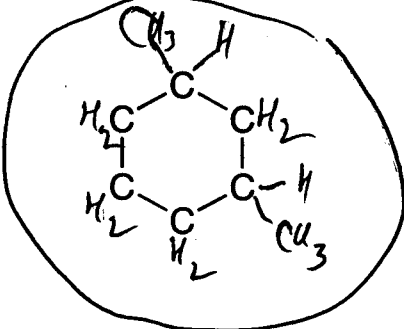
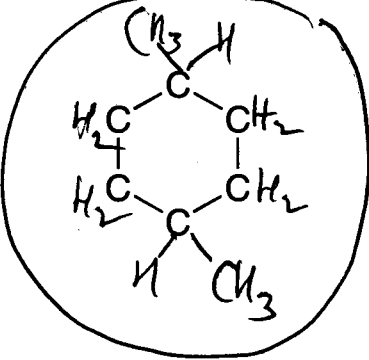
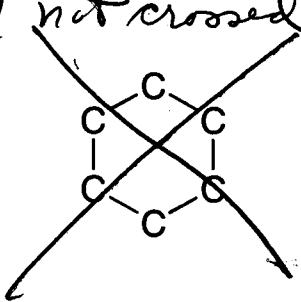
VII. (14 points)

-2 for duplicate or incorrect structure

-3 pts if H not shown

A. Complete the structures below to show ALL constitutional isomers (note: constitutional isomers only, no stereoisomers) of the substituted cyclohexanes that have the formula C_8H_{16} . Be sure to show all hydrogens. There are no more than 6 constitutional isomers and there may be fewer. Cross out any boxes that are not used. Points will be deducted for duplicate or incorrect structures.

+ 2 pts / correct structure

	
	
	<p>-2 if not crossed out</p> 

B. Circle all constitutional isomers that can exist as a pair of cis-trans isomers.

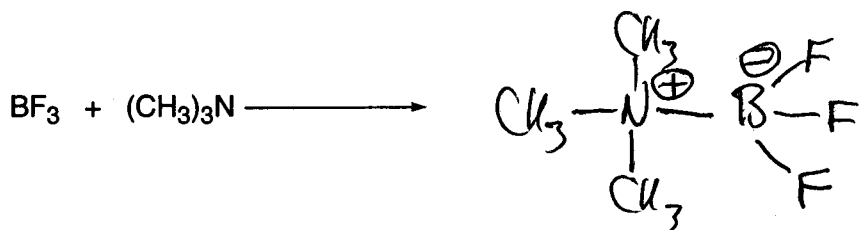
3 circles = 4 pts
 2 " = 2 "
 1 " = 1 "
 > 3 " = 0 pts

} all correct circles

1 or more incorrect circles = 0 pts

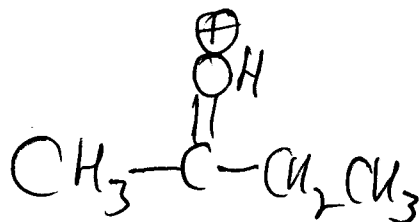
VIII. (12 points)

A. Draw the structure of the product(s) of the following reaction (show formal charges if appropriate).



-1 if no formal charges.

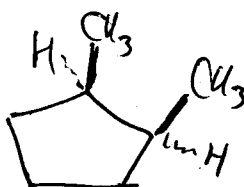
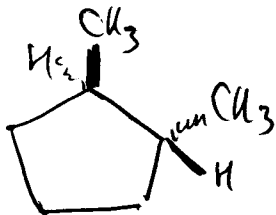
B. Draw the structure of the conjugate acid of a ketone that has 4 carbon atoms.



-1 pt no charge

1 pt only for ketone

C. Draw a pair of stereoisomers that are cyclopentanes and have the molecular formula C_7H_{14} .



+1 pt for one isomer

pair of enantiomers = +3 pts

D. Draw the structure of a 5-carbon atom molecule that has only primary hydrogen atoms.

