

Seat No. _____

LAST NAME WST

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

Spring 2007 (1/26/07)

I. (22 points) _____

II. (20 points) _____

III. (12 points) _____

IV. (10 points) _____

V. (10 points) _____

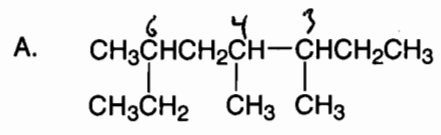
VI. (14 points) _____

VII. (12 points) _____

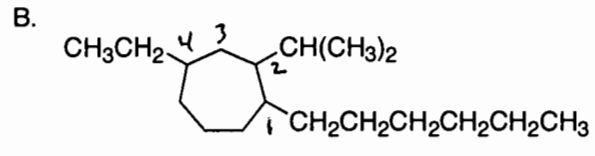
TOTAL (100 points) _____

1 point substituents
1 point numbering
1 point parent

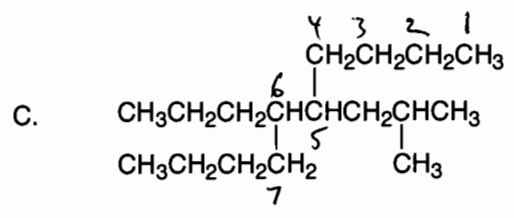
I. (22 points). Give IUPAC names for the following compounds.



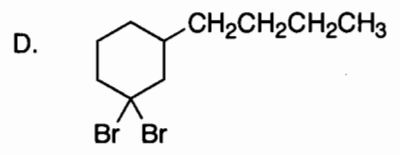
3,4,5-trimethyloctane



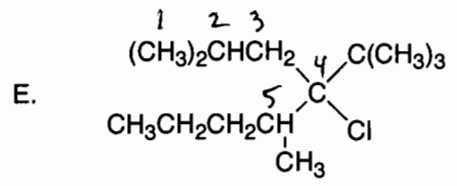
4-ethyl-1-hexyl-2-isopropylcycloheptane



(2-methylpropyl)
5-isobutyl-6-propyldecane



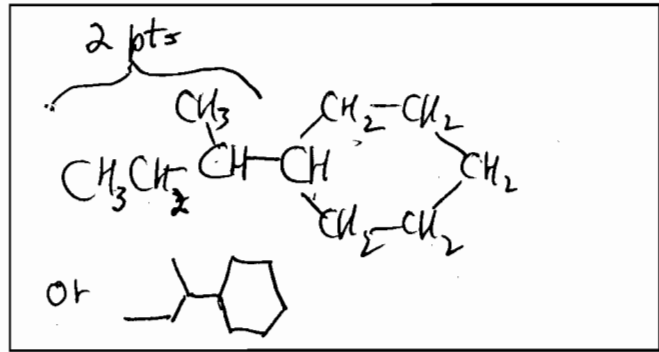
1,1-dibromo-3-butylcyclohexane



4-tert-butyl-4-chloro-2,5-dimethyloctane

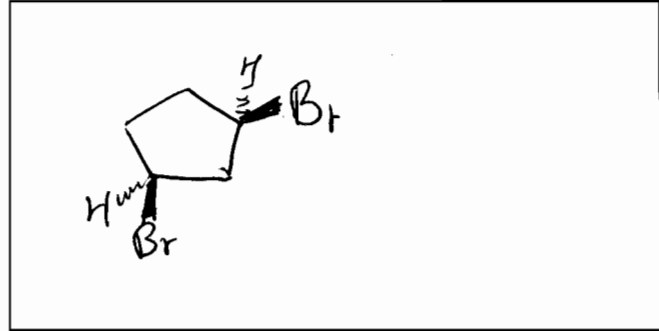
Draw the structures for the following names (show all hydrogens).

F. *sec*-butylcyclohexane



G. (4 points) *cis*-1,3-dibromocyclopentane

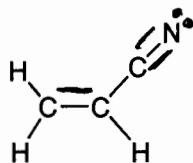
2 pts



II. (20 points)

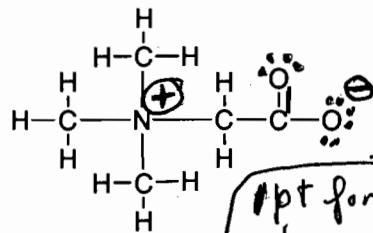
A. (6 points) Partial Lewis structures showing all σ -bonds are given below (both molecules are overall neutral). Complete the structures by showing all other bonding and nonbonding electron pairs. Show formal charges if appropriate. All structures follow the octet rule.

1.



0 errors = 3 pts
1 error = 2 pts
2 errors = 0 pts

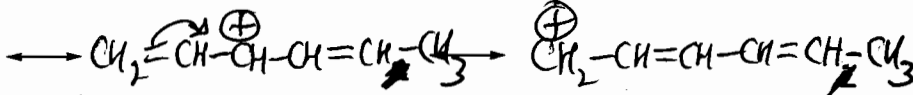
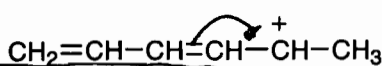
2.



1 pt for correct charges

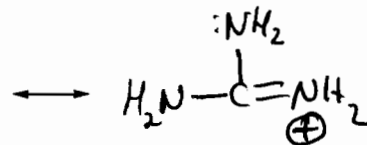
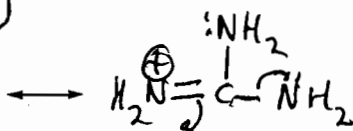
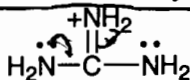
B. (10 points) Draw two additional resonance structures for each of the following ions.

1.

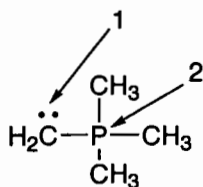


1 correct structure = 2 pts
2 correct structures = 5 pts

2.



C. (4 points) Assign formal charges to the atoms indicated.

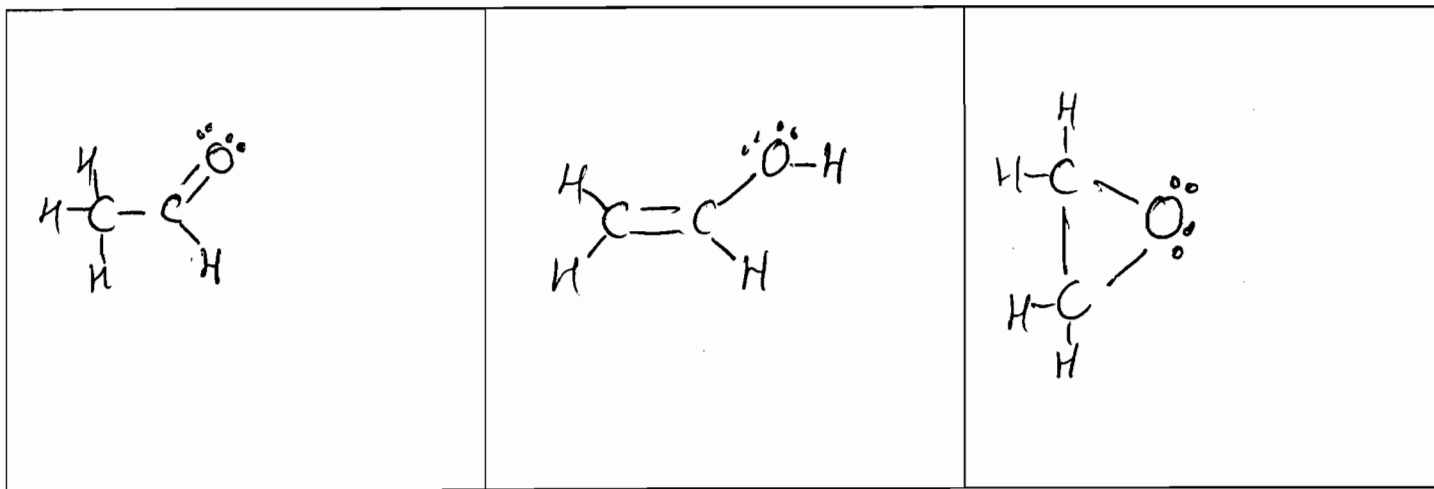


1. _____

2. _____

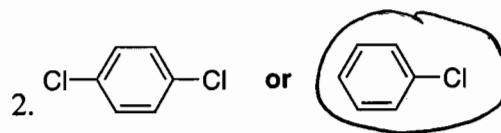
1A 1	2A 2											3A 13	4A 14	5A 15	6A 16	7A 17	8A 18 2														
H 1.01																	He 4.00														
3 Li 6.94	4 Be 9.01											5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2														
11 Na 23.0	12 Mg 24.3	3B 3	4B 4	5B 5	6B 6	7B 7	8B 8 9 10			11 11	12 12	13 Al 27.0	14 Si 28.1	15 P 31.0	16 S 32.1	17 Cl 35.4	18 Ar 39.9														
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	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 79.9	36 Kr 83.8														
37 Rb 85.5	38 Sr 87.6	39 Y 88.9	40 Zr 91.2	41 Nb 92.9	42 Mo 95.9	43 Tc (98)	44 Ru 101	45 Rh 103	46 Pd 106	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131														
55 Cs 133	56 Ba 137	57 La 139	58 Ce 140.9	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226	89 Ac 227	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)										110 Ds (271)	111 Rg (272)	112 Uue (289)	113 Uub (288)	114 Uuq (289)	115 Uup (288)	116 Uuq (289)	117 Uup (288)	118 Uuq (289)	119 Uup (288)	120 Uuq (289)			

III. (12 points) In the boxes below draw line-bond structures that are consistent with valence rules for three molecules that have the molecular structure C_2H_4O . Show all hydrogen atoms and non-bonding valence electrons (use dots for electrons).

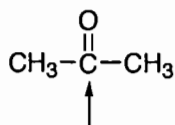


IV. (10 points)

A. (4 points) Circle the more polar compound of each pair.



B. (6 points) Give the hybridization and approximate C-C-C bond angle for the atoms marked with an arrow.



hybridization

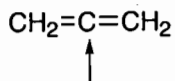
sp^2

2 pts

approximate C-C-C bond angle

120°

1 pt



sp

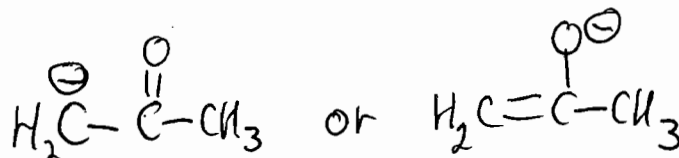
180°

V. (10 points)

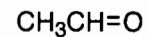
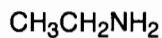
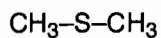
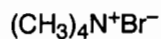
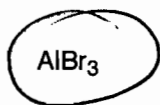
A. (6 points) The pK_a of water is 15.74. Acetone, $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$, is a weaker acid than water.

a. (2 points) Circle the pK of acetone: 9.9 or **19.3**

b. (4 points) Draw the conjugate base of acetone.



B. (4 points) Circle the following reagents which are likely to act as Lewis acids (4 points for no errors; 2 points for one error; 0 points for 2 or more errors).

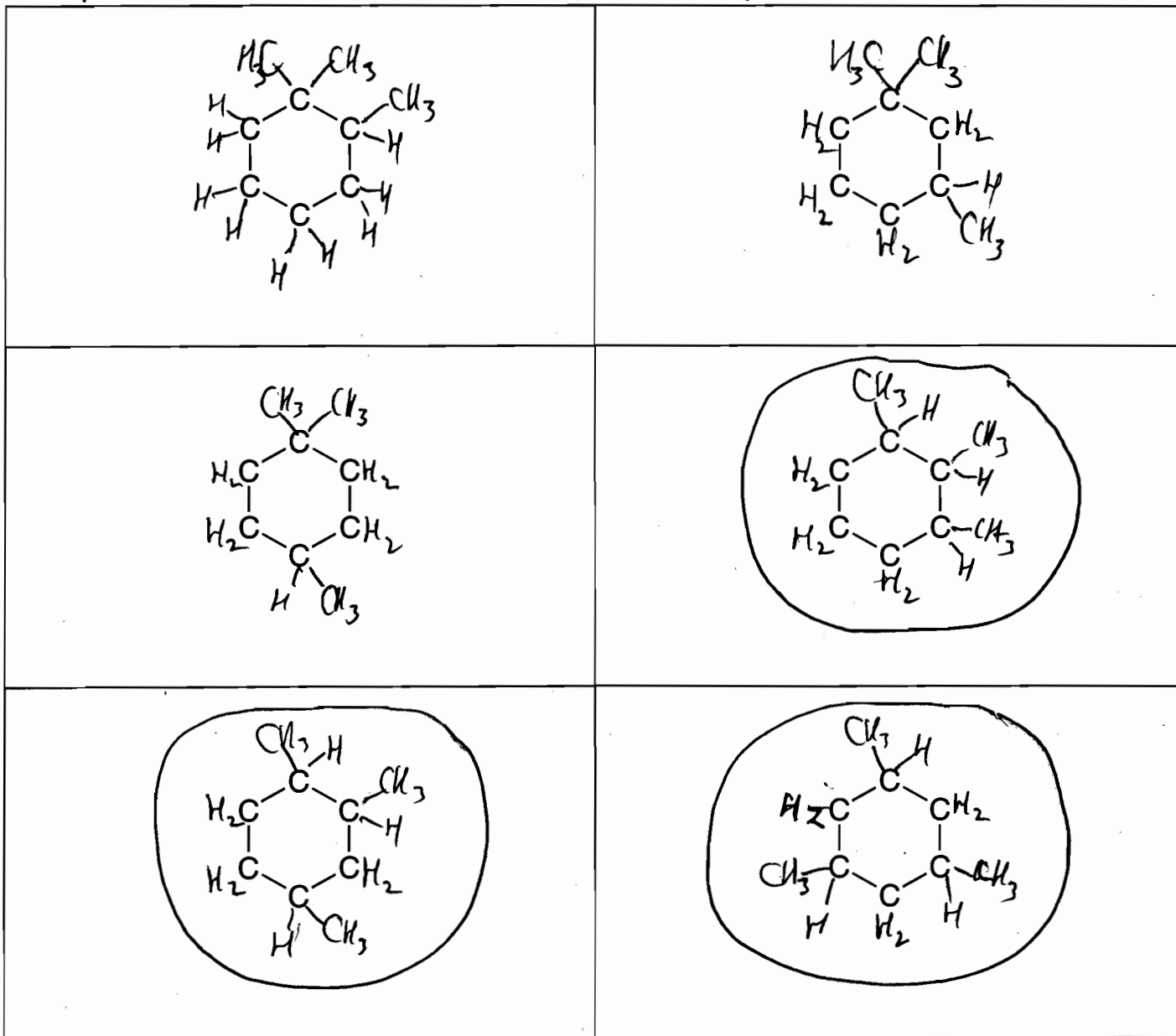


3 pts if Hs not shown

VI. (14 points)

A. Complete the structures below to show ALL constitutional isomers (note: constitutional isomers only, no stereoisomers) of cyclohexanes that have the formula C_9H_{18} and have three methyl groups (i.e., they are all trimethylcyclohexanes). 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 for correct structure -2 pts for duplicate or incorrect structure

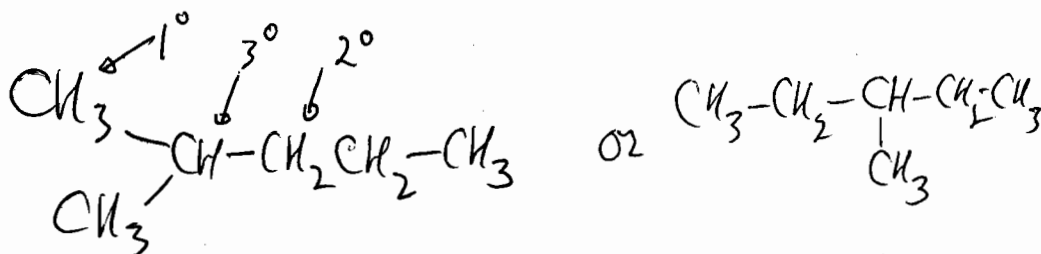


B. Circle all constitutional isomers that can exist as two or more cis-trans isomers.

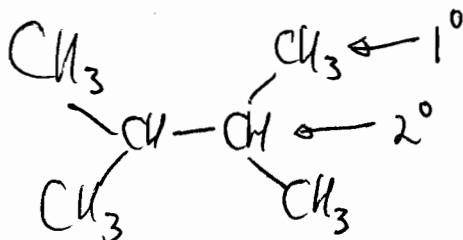
3 correct circles = 2 pts 1 or more incorrect circles = 0 pts
 2 u u = 1 pt
 1 u u = 0 pts

VII. (12 points)

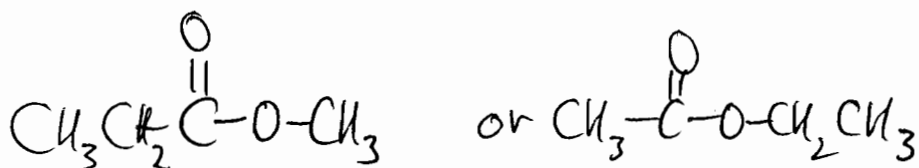
A. Draw the structure of an isomer of C_6H_{14} that has 1° , 2° , and 3° hydrogens.



B. Draw the structure of an isomer of C_6H_{14} that has only 1° and 3° hydrogens.



C. Draw the structure of an ester that has the molecular formula $C_4H_8O_2$.



D. Circle the alkane that should have the highest boiling point.

