

Chem 331, Spring 2006

William Jenks

Name Key

PLEASE ALSO WRITE YOUR NAME ON THE TOP OF THE BACK OF YOUR EXAM

Please check off which recitation section you are registered for:

Monday, 2:10 p.m.

Tuesday, 9:00 a.m.

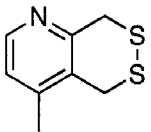
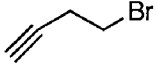
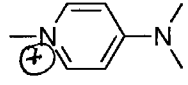
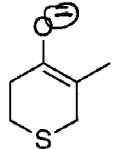
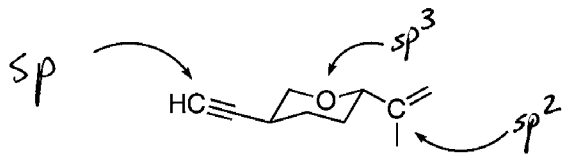
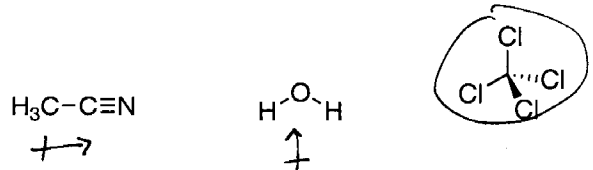
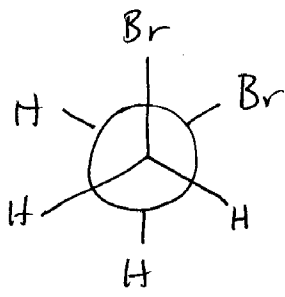
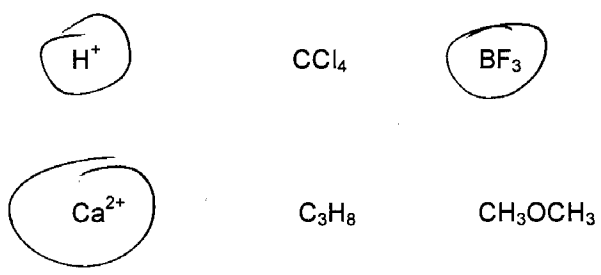
Monday, 4:10 p.m.

Tuesday, 11 a.m.

MIDTERM 1
1 February, 2006

Problem (max score)	Score
I (30)	
II (14)	
III (18)	
IV (12)	
V (10)	
VI (12)	
VII (6)	
Total (102)	

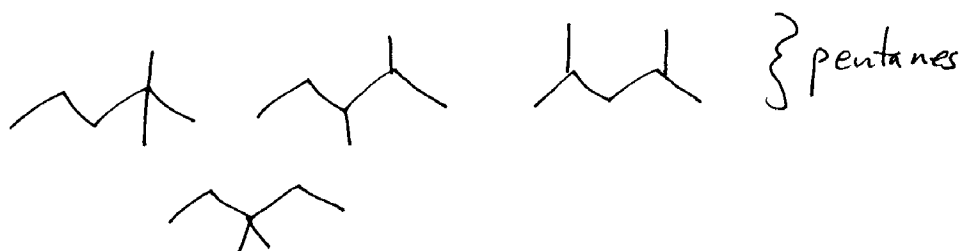
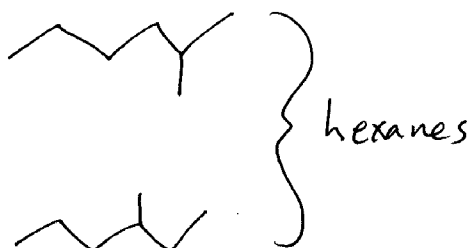
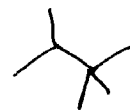
I. 30 points. Short answers

<p>3 pts. Give the molecular formula (e.g., $C_6H_{12}O_6$)</p>  <p>$C_8H_9NS_2$</p>	<p>3 pts. Give the molecular formula</p>  <p>C_4H_5Br</p>
<p>3 pts. Place the formal charge on this cation:</p> 	<p>3 pts. Place the formal charge on this anion:</p> 
<p>6 pts. Indicate the hybridization (sp, sp^2, or sp^3) at the indicated atoms:</p> 	<p>6 pts. Using the standard dipole symbol indicated, draw the direction of the molecular dipole for these molecules. If there is no molecular dipole, circle the molecule.</p> <p>\rightarrow</p> 
<p>3 pts. Sketch 1,2-dibromoethane in a gauche conformation, using a Newman projection along the two carbon atoms.</p> 	<p>3 pts. Circle all the compounds that are Lewis acids</p> 

II. 14 points. There are 7 "constitutional" isomers of C_7H_{16} . Draw them all, using "skeleton structures".

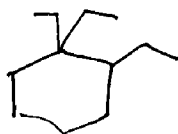


Bonus 8th



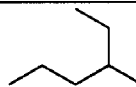
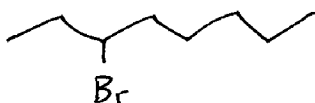
III. Nomenclature (18 points, 3 each). Provide a correct name for the following compounds or draw the corresponding compound, as appropriate.

1,1,2-triethylcyclohexane



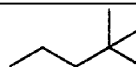
cis-1,3-diethylcyclopentane

3-bromooctane



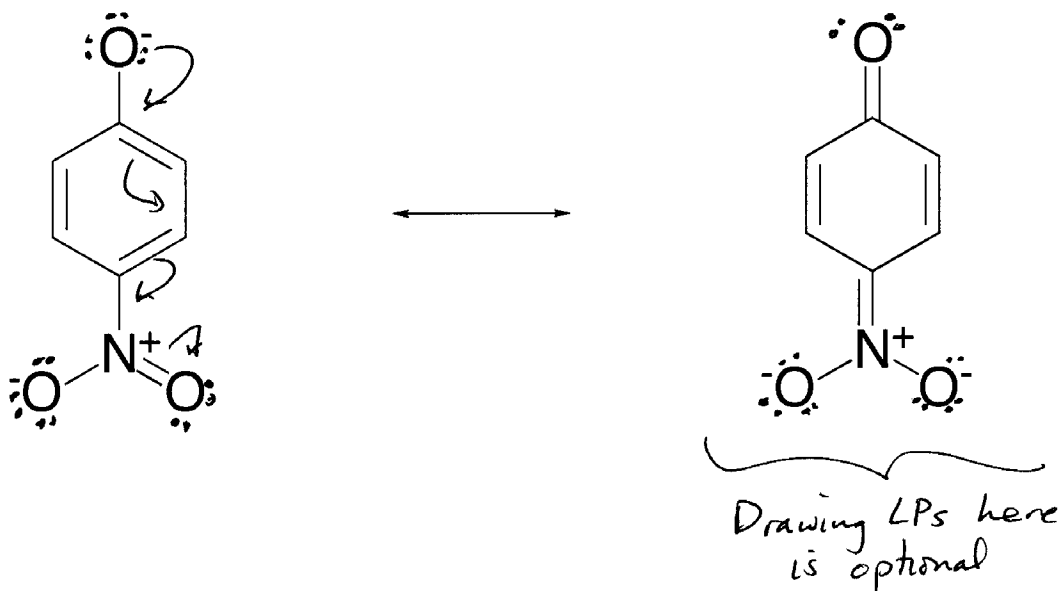
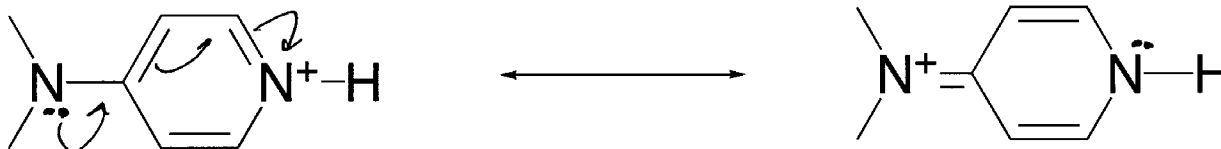
3-methylhexane

2-cyclobutylheptane

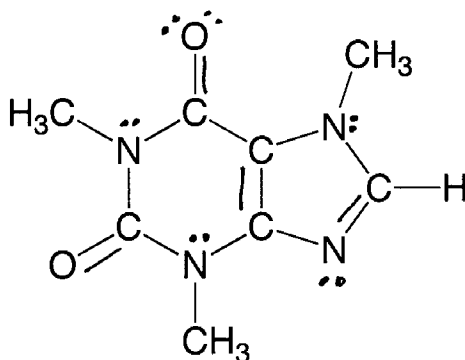


2,2-dimethylpentane

- IV. 12 points. For each pair of resonance forms, draw "curvy arrows" on the left-side structure that show how the electrons move to get to the right-side structure. You will also need to draw in the appropriate lone pairs.



- V. 10 points. Complete the Lewis structure for caffeine, which is illustrated below. *None of the atoms should have a formal charge.* Draw in the appropriate double bonds AND lone pairs. (You do not have to do anything to the CH₃ groups, which I have abbreviated for clarity.)

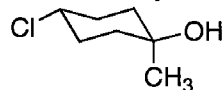


VI. 12 points. Use the cyclohexane templates to answer the following questions.

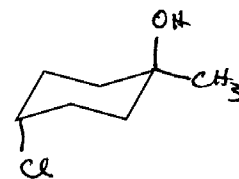
3 pts. Draw the lowest energy conformation of bromocyclohexane



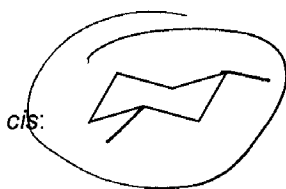
3 pts. Draw the ring-flipped conformation of the following substituted cyclohexane



Draw ring-flipped conformer:



6 pts. Draw the lowest energy conformation (or either one if they are the same) for *cis*-1,3-dimethylcyclohexane and also for *trans*-1,3-dimethylcyclohexane



Circle the lower energy isomer (*cis* or *trans*)

(diequatorial, rather than one axial)

VII. 6 points. Draw an isomer of $C_{10}H_{18}$ that

a) has only sp^3 -hybridized carbons

many answers
must have two rings

eg



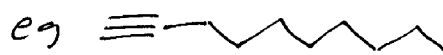
b) has at least one carbon with sp^2 hybridization

must have either
1) 1 double bond and one ring
2) 2 double bonds



c) has at least one carbon with sp hybridization

must have either
1) a triple bond
2) $C=C=C$
 $\begin{matrix} \uparrow & \uparrow & \uparrow \\ sp^2 & sp & sp^2 \end{matrix}$



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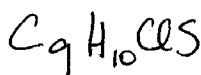
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MIDTERM 1
1 February, 2006

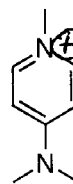
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Total (102)	

I. 30 points. Short answers

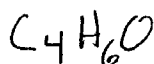
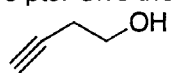
3 pts. Give the molecular formula (e.g., $C_6H_{12}O_6$)



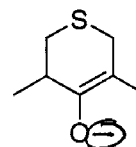
3 pts. Place the formal charge on this cation:



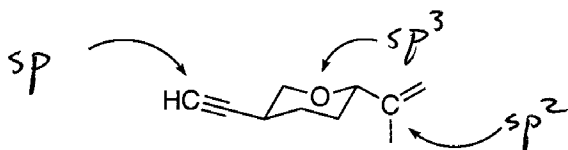
3 pts. Give the molecular formula



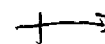
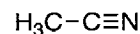
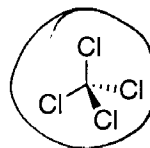
3 pts. Place the formal charge on this anion



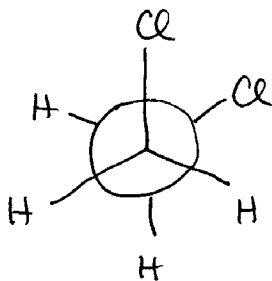
6 pts. Indicate the hybridization (sp , sp^2 , or sp^3) at the indicated atoms:



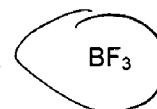
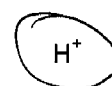
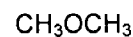
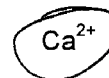
6 pts. Using the standard dipole symbol indicated, draw the direction of the molecular dipole for these molecules. If there is no molecular dipole, circle the molecule.



3 pts. Sketch 1,2-dichloroethane in a gauche conformation, using a Newman projection along the two carbon atoms.



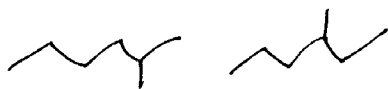
3 pts. Circle all the compounds that are Lewis acids



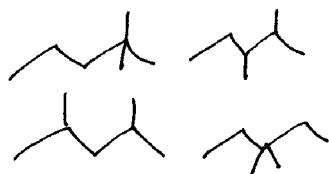
II. 14 points. There are 7 "constitutional" isomers of C_7H_{16} . Draw them all, using "skeleton structures".



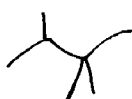
Now the hexanes:



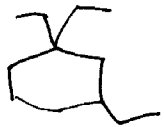
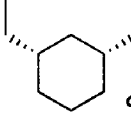

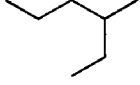
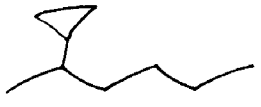
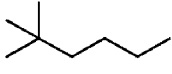
Now the pentanes



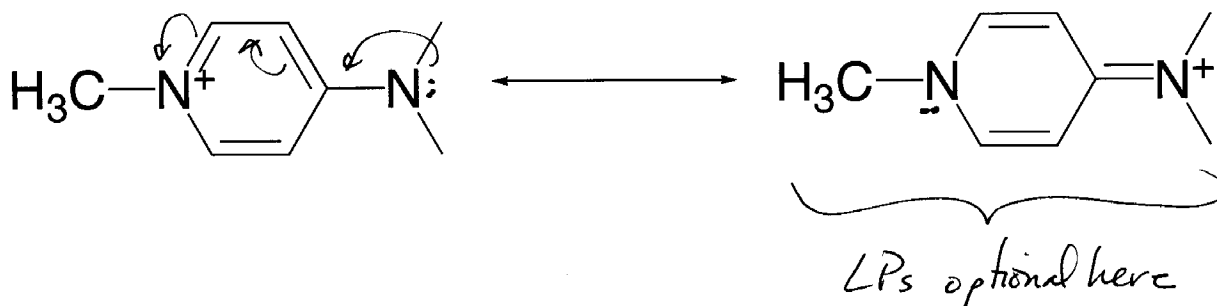
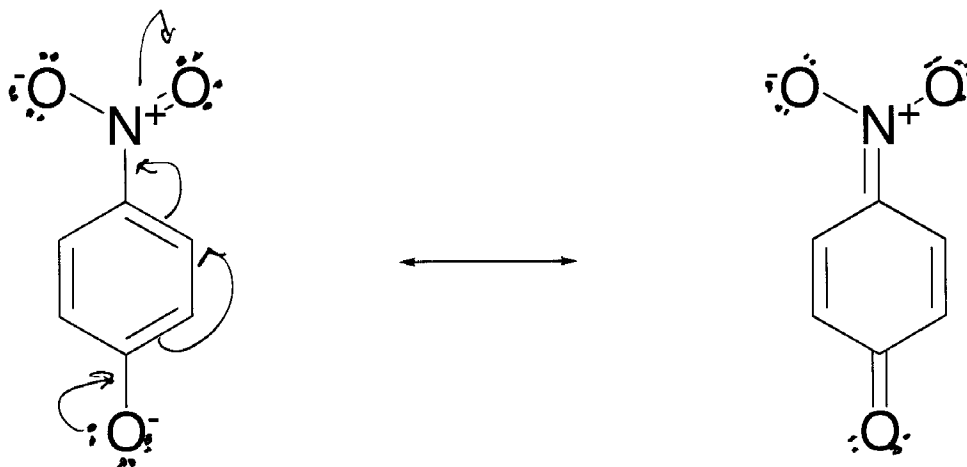
And a bonus butane



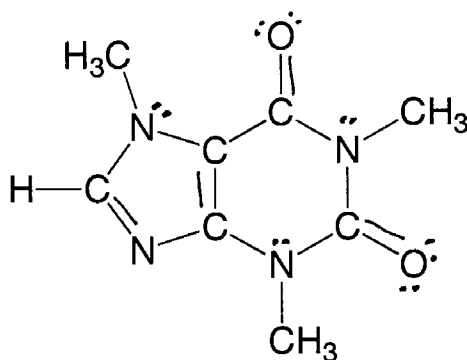
III. Nomenclature (18 points, 3 each). Provide a correct name for the following compounds or draw the corresponding compound, as appropriate.

<p>1,1,3-triethylcyclohexane</p> 	 <p>cis-1,3-di-diethylcyclohexane</p>
<p>3-bromononane</p> 	 <p>3-methylhexane</p>
<p>2-cyclopropylhexane</p> 	 <p>2,2-dimethylhexane</p>

- IV. 12 points. For each pair of resonance forms, draw "curvy arrows" on the left-side structure that show how the electrons move to get to the right-side structure. You will also need to draw in the appropriate lone pairs.



- V. 10 points. Complete the Lewis structure for caffeine, which is illustrated below. *None of the atoms should have a formal charge.* Draw in the appropriate double bonds AND lone pairs. (You do not have to do anything to the CH_3 groups, which I have abbreviated for clarity.)

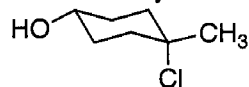


VI. 12 points. Use the cyclohexane templates to answer the following questions.

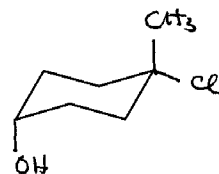
3 pts. Draw the lowest energy conformation of chlorocyclohexane



3 pts. Draw the ring-flipped conformation of the following substituted cyclohexane



Draw ring-flipped conformer:



6 pts. Draw the lowest energy conformation (or either one if they are the same) for *cis*-1,3-dimethylcyclohexane and also for *trans*-1,3-dimethyl cyclohexane

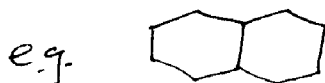


Circle the lower energy isomer (*cis* or *trans*)

VII. 6 points. Draw an isomer of $C_{10}H_{18}$ that

a) has at least one carbon with sp hybridization

must have two rings, no multiple bonds

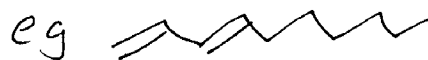


b) has at least one carbon with sp^2 hybridization

must have either

1) 2 double bonds

2) 1 double bond & one ring



c) has only sp^3 -hybridized carbons

must have either

1) triple bond

2) $C=C=C$

