PRACTICE EXAM No. 1 answer key

Department of Chemistry
University of Vermont

Your real exam No. 1 will have NO stereochem on it, but will have acid-base theory and rxn mechanisms.

Chem 141
Fall, 1998
Exam 1

Name:

Score:_____

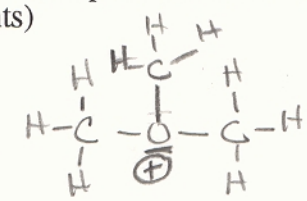
Key 2

Problem	points (total)	Grader
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____

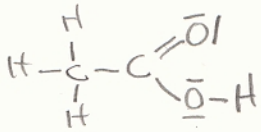
1. Define organic chemistry. (2 points)

2. Write a proper Lewis structure for each of the following compounds. Include lone pairs and indicate the formal charge on any charged atoms in the structure you propose. Formulas (a) (b) and (d) do not represent molecular formulas. They represent condensed structural formulas. (4 points)

(a) $(CH_3)_3O$

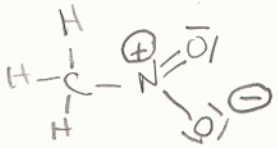


(b) CH_3CO_2H

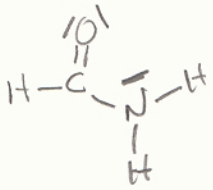


lone pairs are dashes

(c) H_3C-NO_2

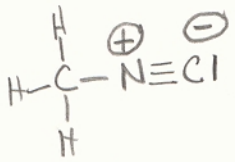


(d) $HCONH_2$

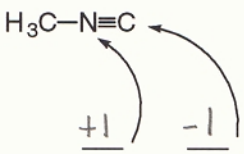


3. (a) Methyl isonitrile has an overall formal charge of zero. Draw a proper Lewis structure for methyl isonitrile (shown below). (1 point)

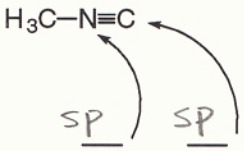
$H_3C–N\equiv C$



(b) On the line provided, give the formal charge for the specified atoms. (2 points)

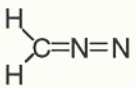


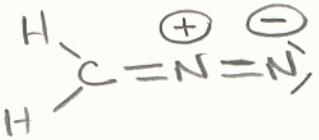
(c) On the line provided, give the hybridization for the specified atoms. (2 points)



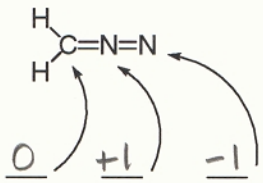
(d) Use the curved arrow method to depict the electron flow that would result in a contributing resonance structure for which all atoms have a formal charge of zero and provide that resonance structure. (3 points)

4. (a) Draw a proper Lewis structure for diazomethane (shown below). (1 point)

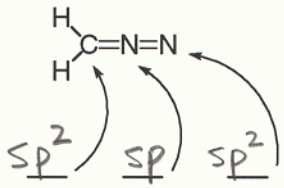




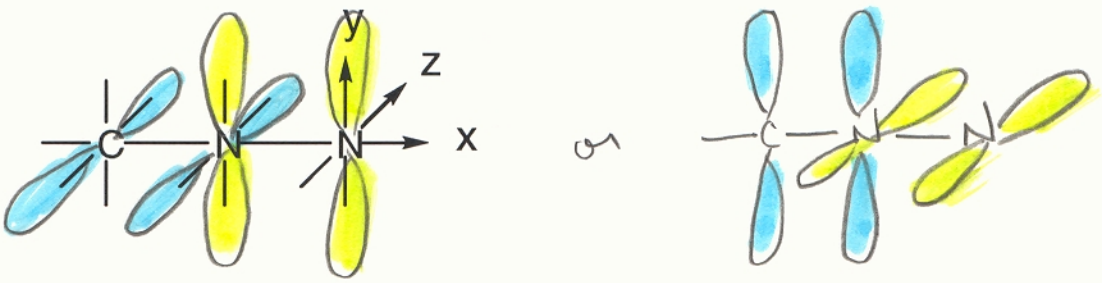
(b) On the line provided, give the formal charge for the specified atoms. (3 points)



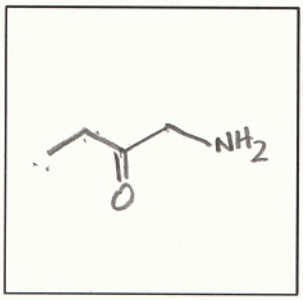
(c) On the line provided, give the hybridization for the specified atoms. (3 points)

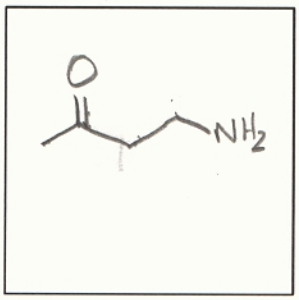


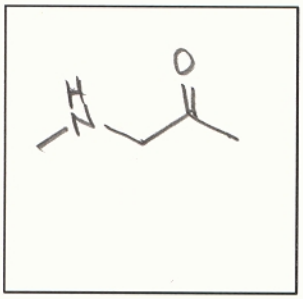
(d) Draw on the appropriate axes **only** the p-orbitals involved in π-bonds. (2 points)

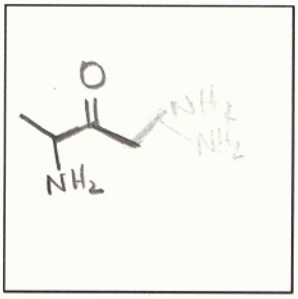


4. Using bond line formulas, draw 4 constitutionally isomeric ketones that have the formula C_4H_9NO. (4 points)

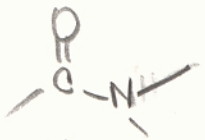








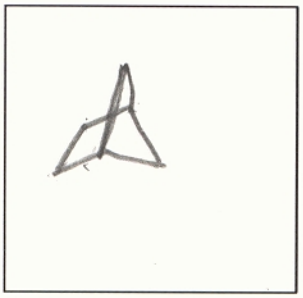
remember that

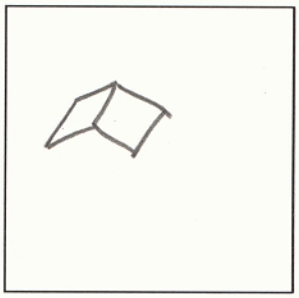


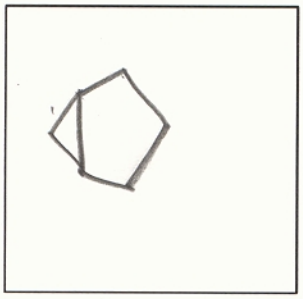
is an amide

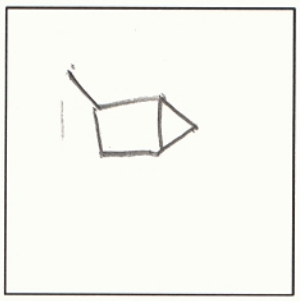
5. Using bond line formulas, draw 4 constitutional isomers that have the formula C_6H_{10} and do not have a double bond or a triple bond. (4 points)

C_nH_{2n-2} must have 2 rings



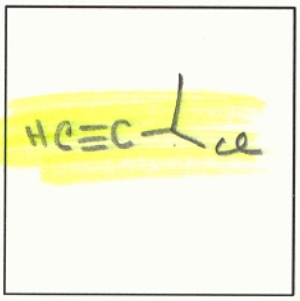


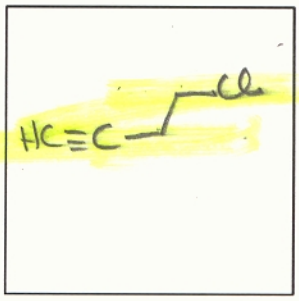


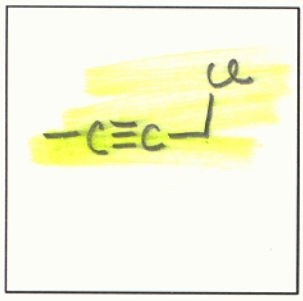


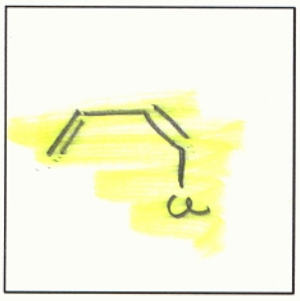
Others are possible

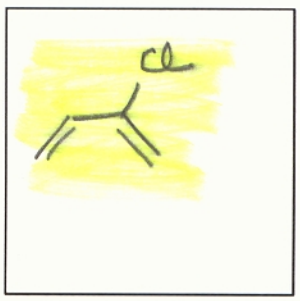
6. Using bond line formulas, draw 9 constitutional isomers that have the formula C_4H_5Cl. (9 points)

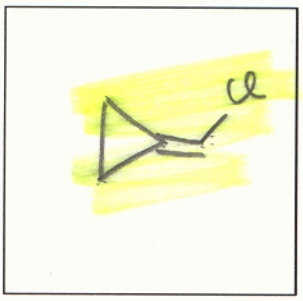


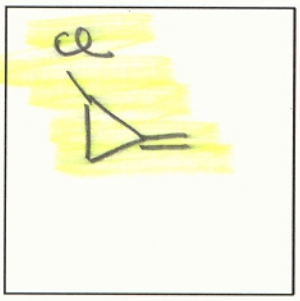


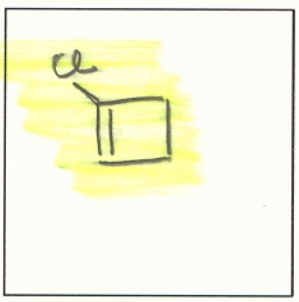






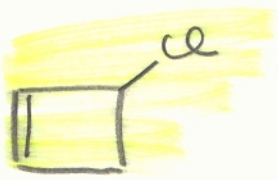






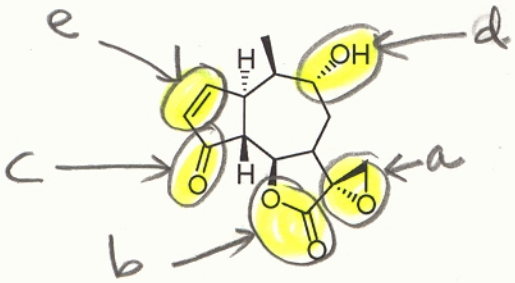
others are possible —

i.e.

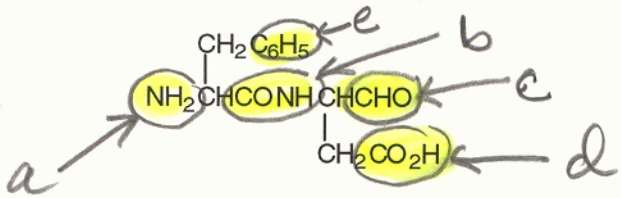


etc.

7. For the following compounds, circle each of the functional groups, label each of the functional groups with a letter (a, b, c, ...) and in the space below the structure give the names of the functional groups that are present in the molecule. (10 points)

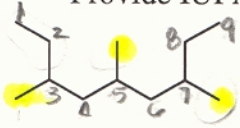


a epoxide (cyclic 3 ring ether)
b lactone (cyclic ester)
c ketone
d sec. alcohol
e alkene



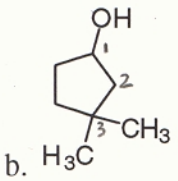
a primary amine
b amide
c aldehyde
d carboxylic acid
e aromatic ring

8. Provide IUPAC names for the following compounds. (8 points)

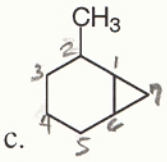
a. 

symmetrical
nonane (9C) longest chain
with Me groups on C_3, C_5, C_7

3,5,7-trimethylnonane

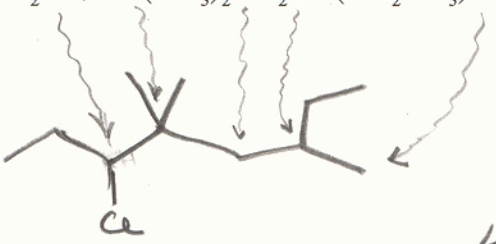
b. 

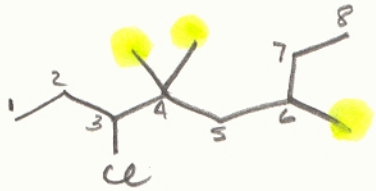
3,3-dimethylcyclopentanol

c. 

2-methylbicyclo[4.1.0]heptane

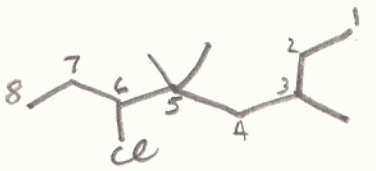
d. $CH_3CH_2CHClC(CH_3)_2CH_2CH(CH_2CH_3)CH_3$





lowest substituent #'s

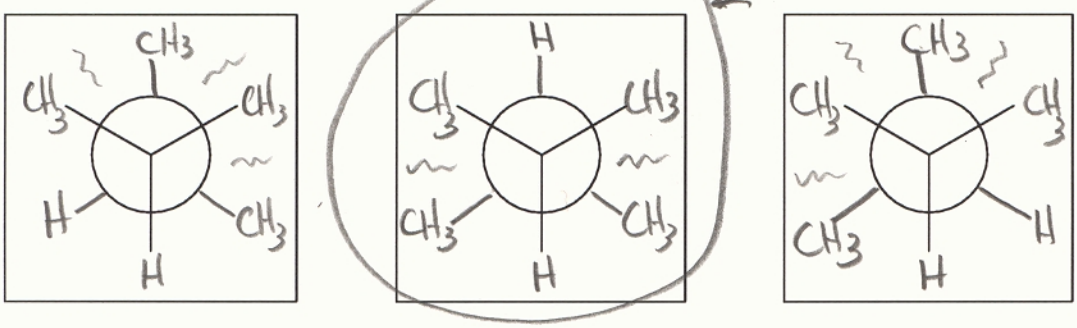
3-chloro-4,4,6-trimethyloctane

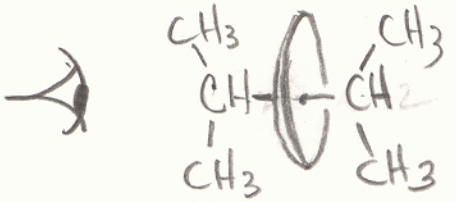


higher substituent #'s

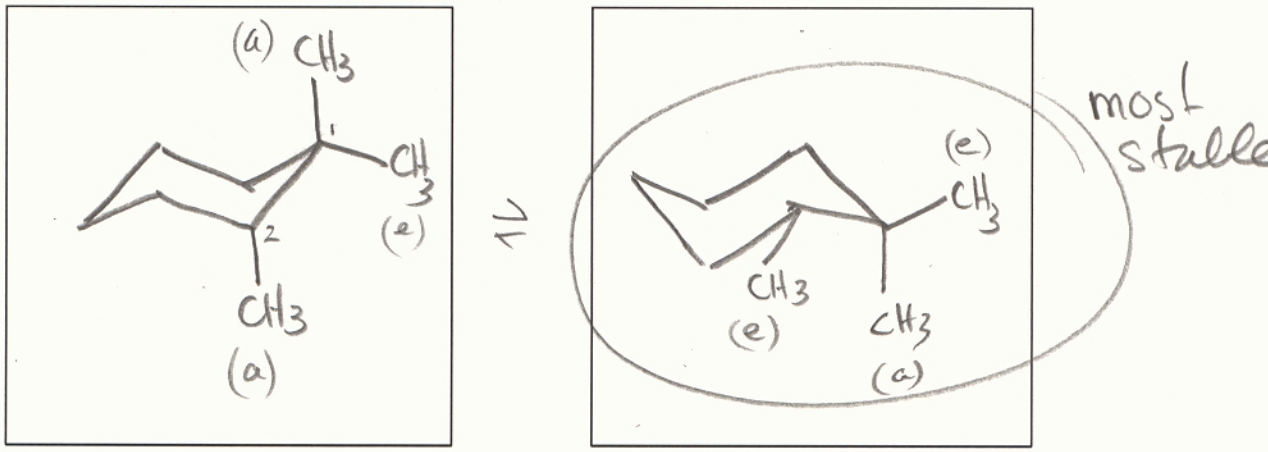
9. Draw Newman projection formulas for the three conformational energy minima of 2,3-dimethylbutane as viewed through the C2-C3 bond and circle the most stable of these conformations. (4 points)

most stable

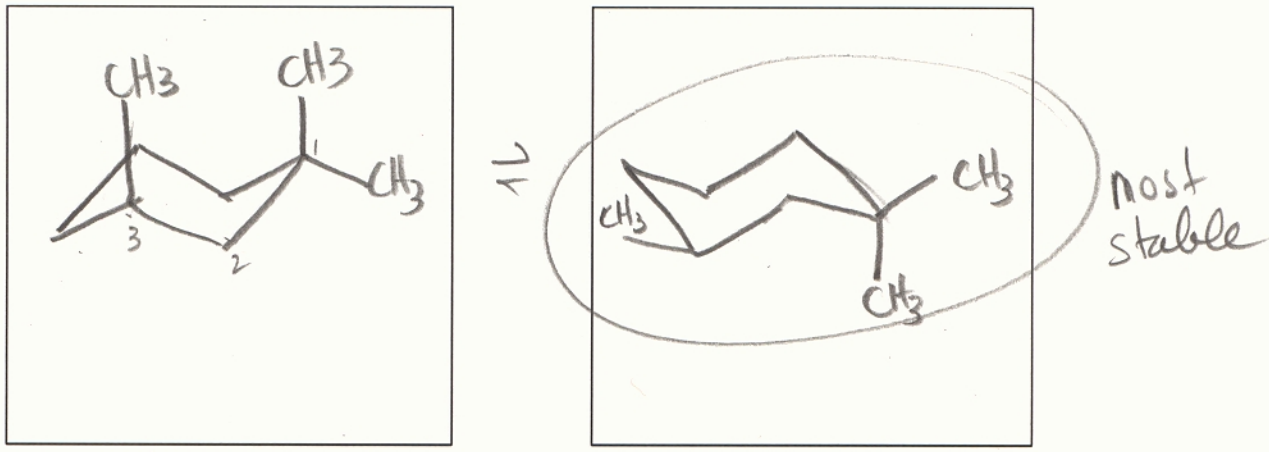




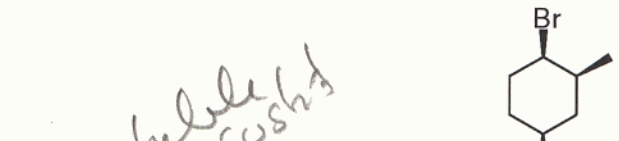
10 Draw the two possible chair conformations for 1,1,2-trimethylcyclohexane. Clearly indicate whether the substituents are axial (a) or equatorial (e). Circle the most stable of the two. (6 points)



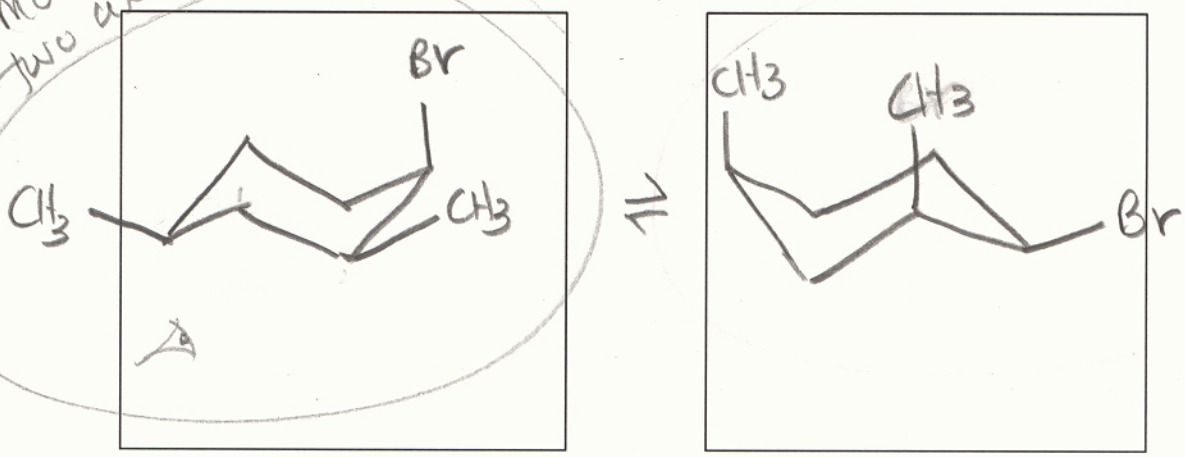
11. Draw the two possible chair conformations for 1,1,3-trimethylcyclohexane. Clearly indicate whether the substituents are axial (a) or equatorial (e). Circle the most stable of the two. (6 points)



12. (a) Draw the two possible chair conformations for the tri-substituted cyclohexane shown below. Clearly indicate whether the substituents are axial (a) or equatorial (e). Circle the most stable of the two. (6 points)



more stable! two axial subs!



(b) Using Newman projection formulas, draw the two possible chair conformations for the trisubstituted cyclohexane shown below such that they are viewed through the axes indicated by arrows and with the *-carbons in the front. (6 points)