CHEM 2OA3-2009 ASSIGNMENT 2

NAME: ANSWERS *ID#:*_____

*Lab Station(2-72, exempt write E):*_____ *(On ELM in grade book)*

Please circle your lab section below (Chem Bio students circle L10)

Group	Monday	Tuesday	Wednesday	Thursday	Friday
I	L01	L02	L03	L04	L05
II	L06	L07	L08	L09	L10

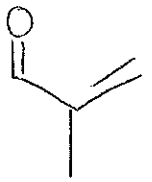
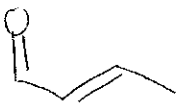
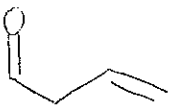
DUE: Tue. Oct. 20th, 2009 AT 2:30 PM.

Students' Responsibility:

1. **Answers to the nine questions must be filled in, in the space provided. Two questions are multiple choice, answer these by circling A, B, C, D or E**
2. **Completed work MUST be placed in the drop-off slots, which are in the corridor opposite to the chemistry office, close to ABB-119. You MUST place your work in the slots designated "CHEM 2OA3/2OB3", in the CORRECT slot, FOR THE CORRECT LAB DAY.**
3. **Any assignment not submitted in the correct place and/or after the due date and time will be graded zero.**
4. **Students who cannot complete the assignment for medical or other reasons MUST seek exemption from the appropriate Dean's office or through other accepted routes. You are responsible for ensuring that your print-out is complete and that all questions are answered.**

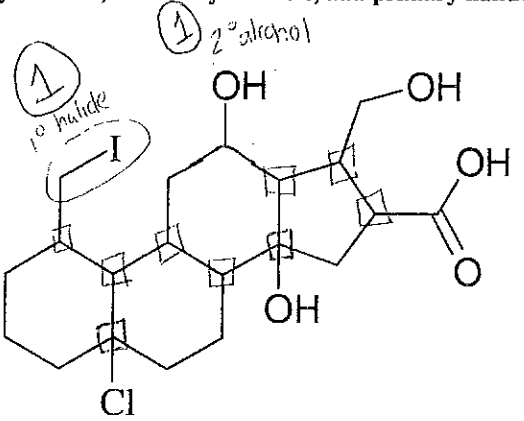
/50

1. **Draw bond-line formulas of all constitutional isomers of aldehydes having the sum formula C_4H_6O (the only hydrogen drawn should be the one of the aldehyde group).**


(4)
(1 each)

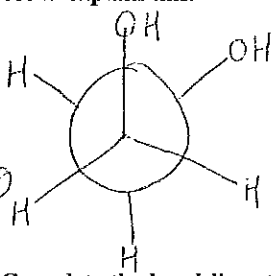
2. **Label all of the tertiary carbons, secondary alcohols, and primary halides in the compound below:**



□ = 3° carbon
↓
2 marks
(all or nothing)

/4

3. **Experimental evidence indicates that the *eclipsed* and *gauche* conformations of 1,2-dihydroxyethane are slightly more stable (lower in energy) than expected just from the sizes of the hydroxyl groups. Draw a *gauche* Newman projection of 1,2-dihydroxyethane, and explain a mechanism or process that could explain this.**



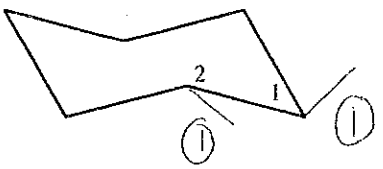
(1)
all or nothing

(2)
(hydrogen bonding between the 2 hydroxyls will help stabalize the conformation

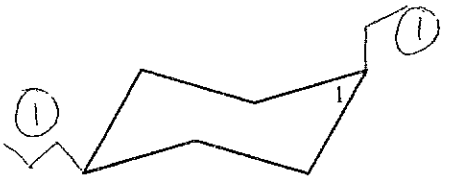
/3

4. **Complete the bond-line structures on the templates below for the most stable conformations of the following compounds:**

trans-1,2-dimethylcyclohexane

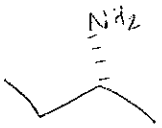
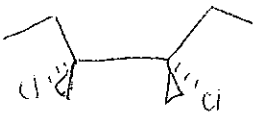


cis-1-ethyl-4-propyl-cyclohexane



/4

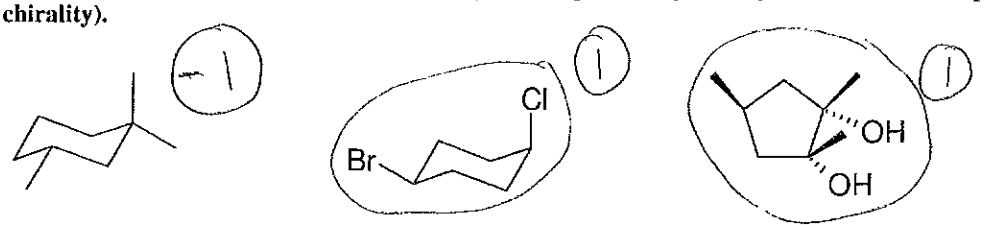
5. **Draw the 3-dimensional bond-line structures using dashes and wedges where appropriate for the following compounds. Circle whether or not the structures possess optical activity.**

2(R)-aminobutane	1-chlorocyclopropene	(*3R, 4S*)-3,4-dimethyl-3,4-dichloro-hexane
		
Optically active? (Y) / N	Optically active? Y / (N)	Optically active? Y / (N)

structures (1)
optical (1)

/6

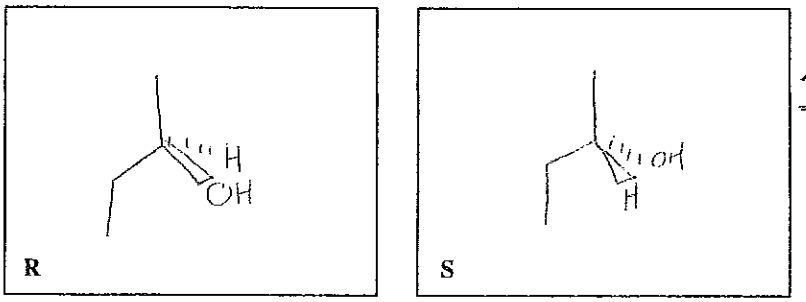
6. **Circle those of the following structures that possess a plane of symmetry (and hence do not possess chirality).**



-1 1 1

/2

7. **Figure out the smallest alcohol (with no double bonds or rings) that can be optically active while only containing carbon, oxygen and hydrogen. Draw the R and S enantiomers of this alcohol in the boxes below using dashed and wedged bonds.**



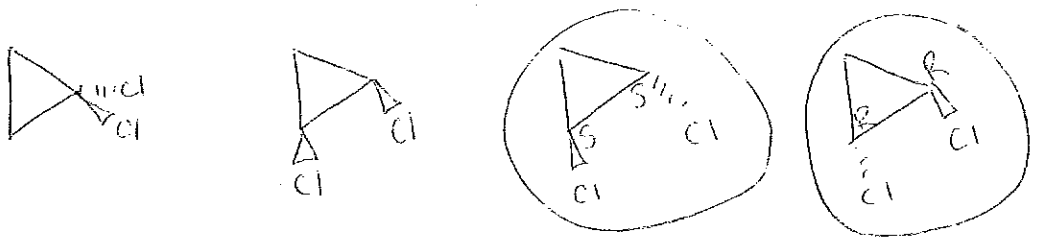
1 - right atom connectivity

2 - stereo chemistry

/3

8. **There are four dichlorocyclopropane isomers.**
A) Draw clear, legible three-dimensional bond line structures for these four compounds, using dashed and wedged bonds to show the 3D positions of the two substituents. Do not draw hydrogens.

- structures



B) Circle the compound(s) above that is/are chiral, and label the chiral centres with R or S.

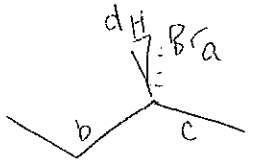
/8

2 - circles (one each)

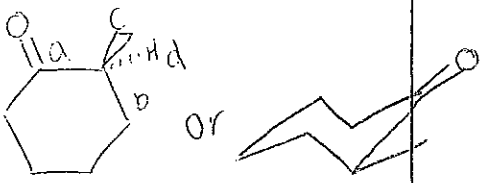
2 - stereochem (1 each molecule)

9. **Draw 3D structures of *R*-2-bromobutane and of (2*S*)-2-methylcyclohexanone, and label the substituents on the chiral carbon with *a*, *b*, *c* and *d* in order of decreasing priority (eg use *d* for H or other lowest priority substituent).**

1 - structure (inc stereochem)
1 - priorities



R-2-bromobutane



(2*S*)-2-methylcyclohexanone

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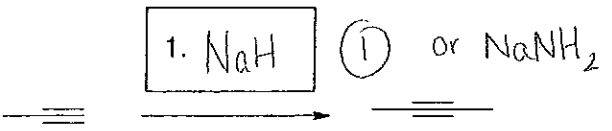
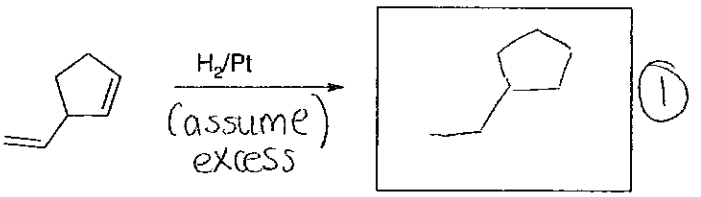
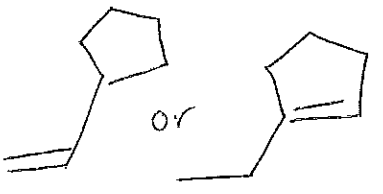
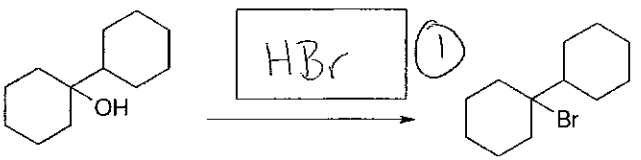
10. **Write or draw the missing reagents or products into the empty boxes in the synthetic schemes below. In some cases more than one regent may be suitable.**

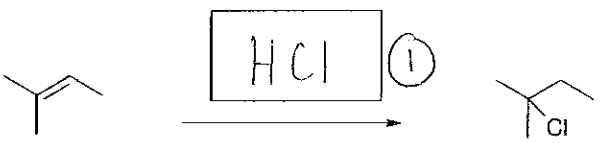


CH_3X (0 marks)



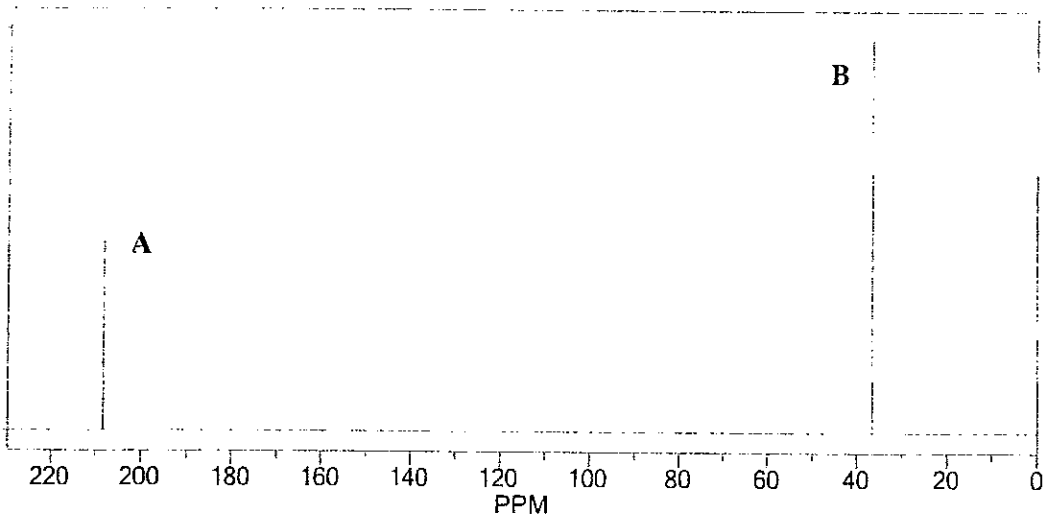
also accept:  or



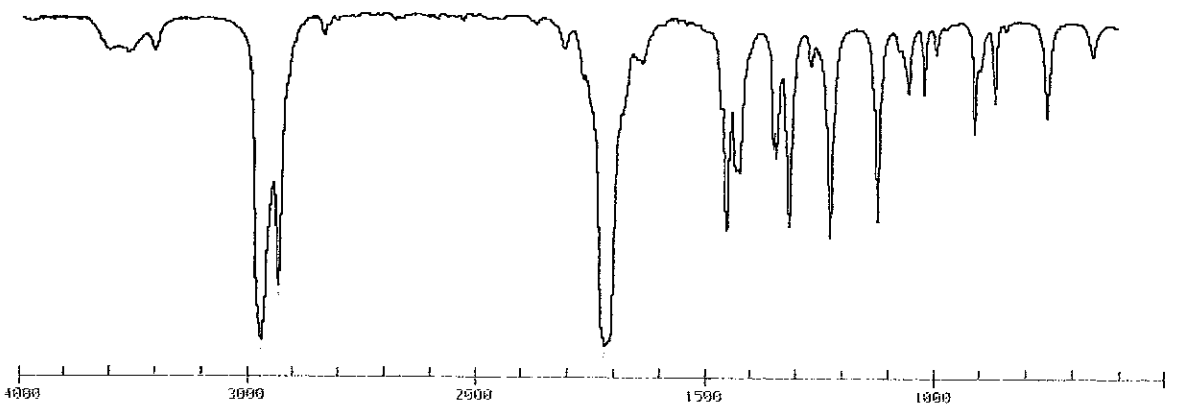


15

11 **A compound of molecular formula $C_6H_8O_2$ has the following IR and ^{13}C spectra.**



^{13}C NMR Spectra



IR Spectra

A) What FUNCTIONAL GROUP causes the IR stretch at ~1700 cm^{-1}?

(C=O) Ketone (1)

if Ketone + aldehyde (0.5)
if C=O (Ø)
if Ketone + others (besides just aldehyde) Ø

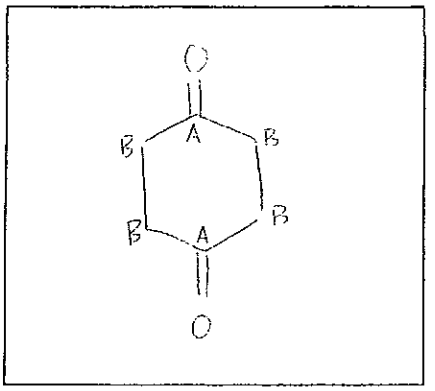
B) What FUNCTIONAL GROUP causes the IR stretch at ~2950 cm^{-1}?

(C-H) alkyl (1)

C) How many unique carbon environments are there in the molecule?

2 (1)

D) Draw the structure of the molecule (using bond line format) in the box below:



structure (2)
all or nothing

E) On the above structure from D, label all the carbon atoms **A** and **B** based on the signals assigned in the ^{13}C NMR spectra

(2) all or nothing

/8 total