Hour Exam #2
Chemistry 343
Professor Gellman
28 October 2015

Last Name Answer

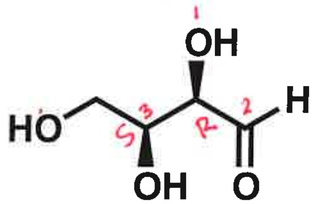
First Name Key

General Instructions:

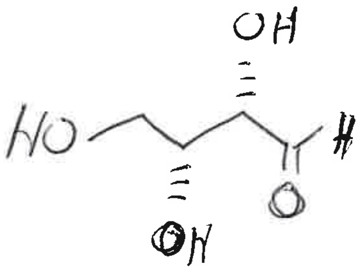
(i) Use scratch paper at back of exam to work out answers; final answers must be recorded at the proper place on the exam itself for credit.
(ii) Print your name on each page.
(iii) Please keep your paper covered and your eyes on your own work. Misconduct will lead to failure in the course.

1. (6 points)

(a) The molecule shown below ("L-threose") has an optical rotation of +13.2°.

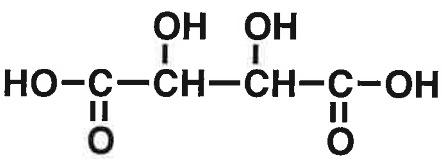


Draw the stereoisomer of L-threose that has an optical rotation of -13.2°.

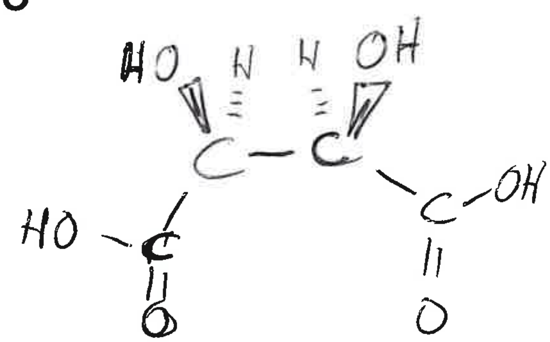


+3

(b) The structure shown below corresponds to the substance "tartaric acid". Provide a drawing that shows the *meso* isomer of tartaric acid.



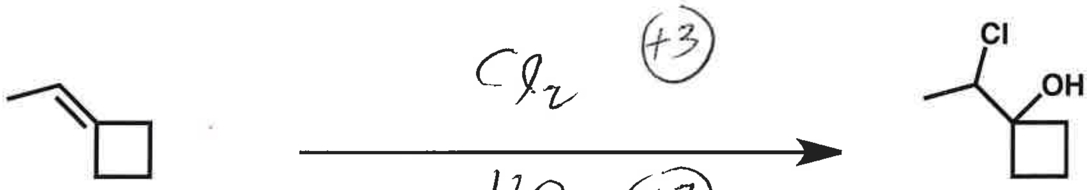
+3



Name ________________

2. (10 points) Show the reagents required to convert the starting molecule to the indicated product. If necessary, differentiate clearly between distinct steps by using "1)", "2)", etc. over or under the arrow.

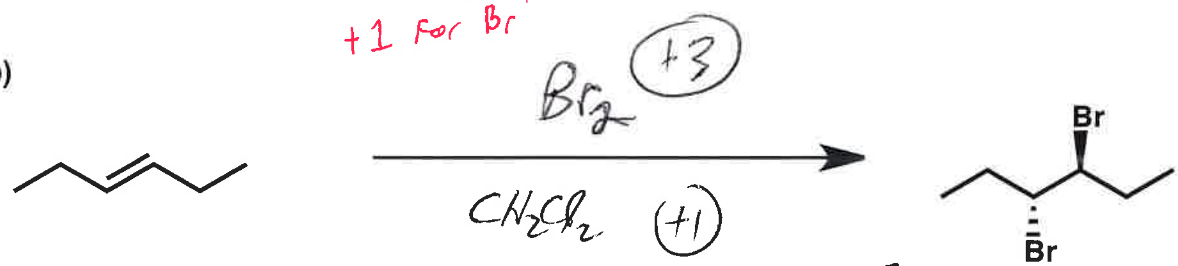
(a)



(racemic)

Cl_2, H_2O, CCl_4 (+3) (+2)
but Cl_2 (+3), H_2O, H_2O_2 or other reagents that are obviously wrong (+0)

(b)

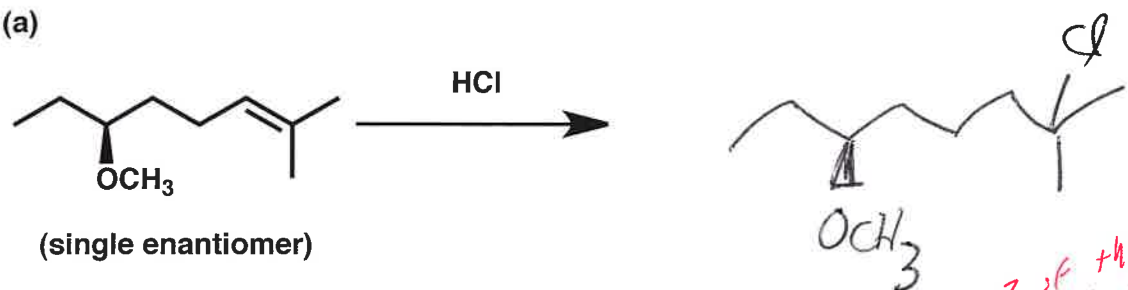


[other inert solvent ok]

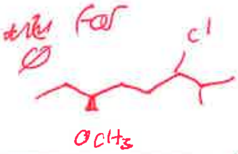
−1 pt each for unnecessary "1), 2)"

3. (13 points) Show the major product(s) expected from the reactions below.

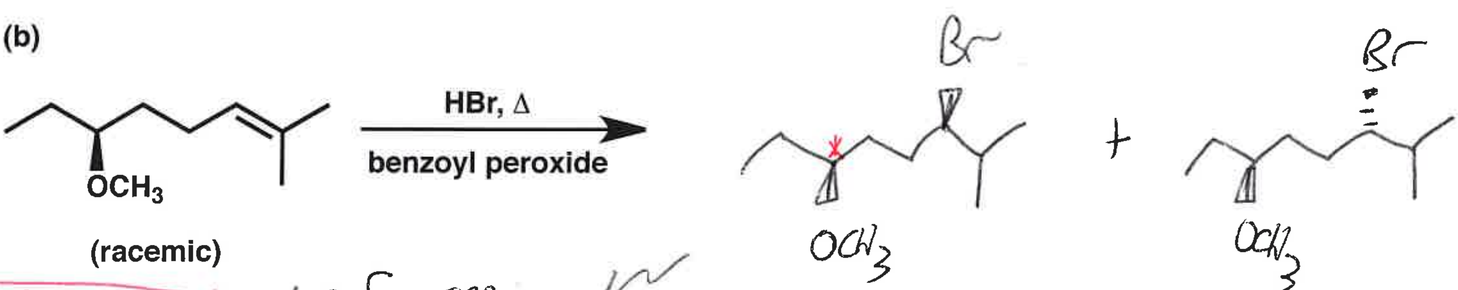
(a)



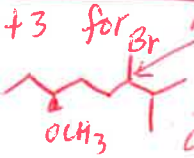
(single enantiomer)

(+5) (−2 for ~~writing~~ repeating the same structure)
(−2 for "racemic")
−2 if this + correct structure (for ∅ )

(b)

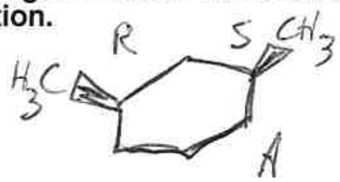


(racemic) (racemic)

+3 for  not indicating that stereochemistry
+5 for one, +8 for both (−2 if lacking "racemic")
+3 for just drawing 1 of 4 w/o indicating racemic
+5 for having 4 structures, w/ * changed
+7 for giving 3 structures out of 4

4. (24 points) Name ________________

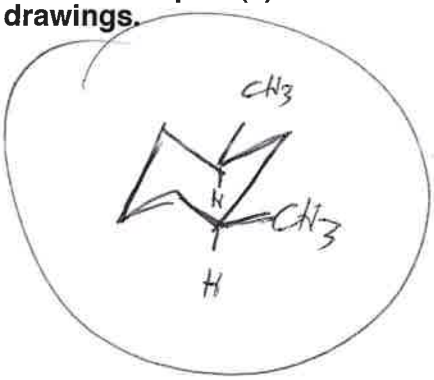
(a) Draw all stereoisomeric forms of 1,3-dimethylcyclohexane, using the 'flat' (hexagon) image for the ring in each case. Label each isomer with A, B, etc.; your labels will be used below. For each stereogenic center in each molecule you draw, indicate whether that center has R or S configuration.

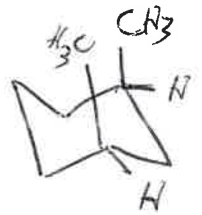


+1 for each correct drawing
+1 for each correct R/S } +9 total

(b) Draw the two chair conformations for each stereoisomer of 1,3-dimethylcyclohexane. Use your labels from part (a) to indicate which chair conformation drawings correspond to which 'flat' drawings.

A:

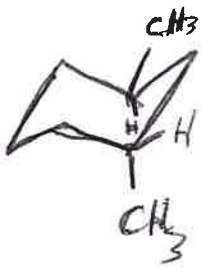


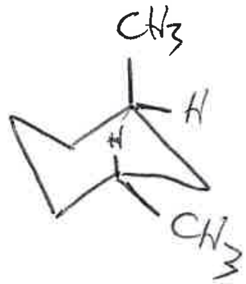


+2 for each correct structure.

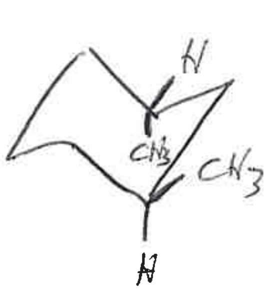
(For chiral isomers, -1 for each incorrect abs. config.)

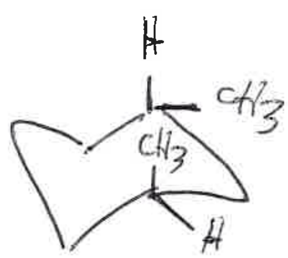
B:





C:





(c) Among ALL of the chair conformations drawn above, put a CIRCLE around the one or ones that you expect to be the most stable (not just most stable for that stereoisomer, but among ALL of the stereoisomers).

+3

Name ________________

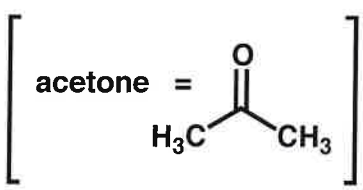
5. (10 points)

(a) Draw the product that can be isolated when the alkene shown below is allowed to react with ozone in methylene chloride (no subsequent reaction).

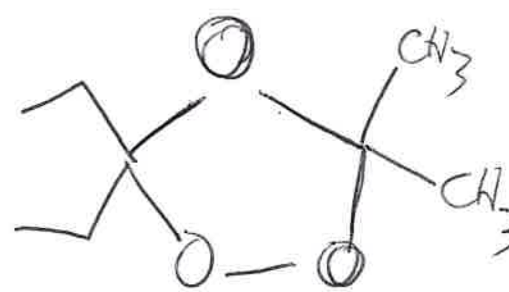
(+5)

(b) When this reaction is allowed to proceed in acetone as solvent rather than methylene chloride, the product mixture includes the molecule from part (a) and a new molecule. <u>Draw the new molecule below</u>.

(<u>Hint</u>: Finding the correct answer requires that you think carefully about the mechanism of this reaction.)

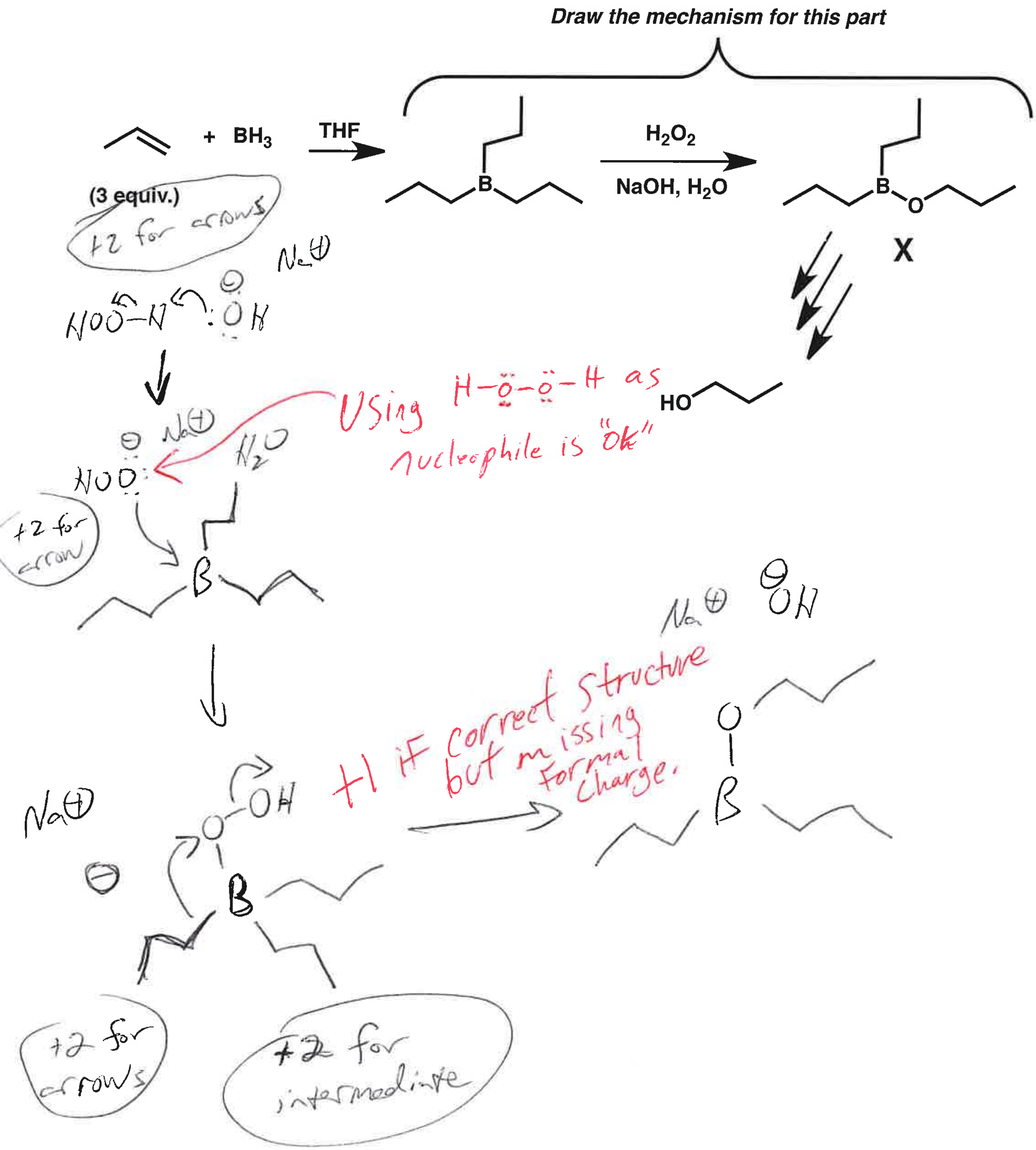


(+5)



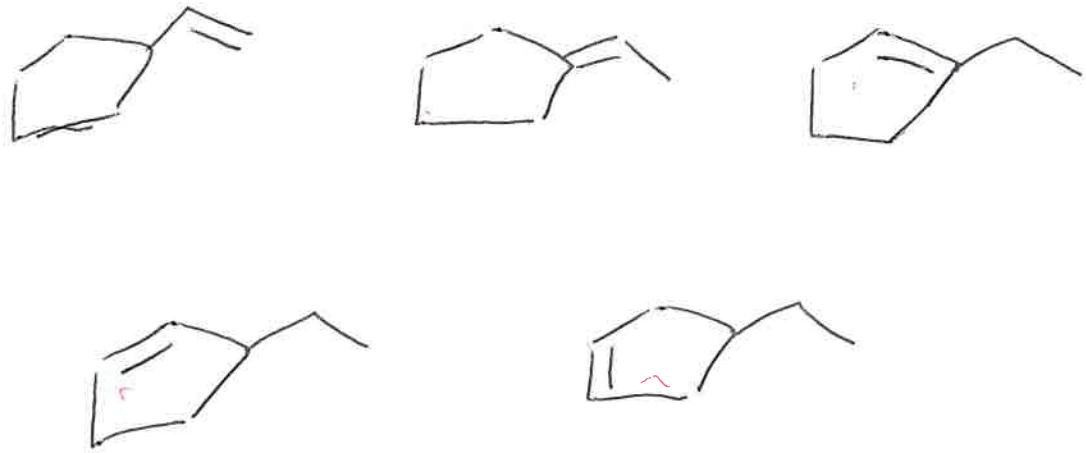
Name ________________

6. (8 points) Shown below is the two-step process for converting propene to 1-propanol. In step 1 propene is allowed to react with BH_3 to form an organoborane, and in step 2 the organoborane is allowed to react with H_2O_2 under alkaline conditions. Draw a mechanism (curved arrows) for the first portion of step two, showing how the organoborane is converted to molecule X. Be sure to draw all intermediates.



7. (29 points) Last Name ______________________

(a) Draw all alkenes with the formula C_7H_{12} that would give ethylcyclopentane as the product upon reaction with H_2 and Pd/C.



+3 each

max −2 total ⇒ tetrahedral alkene geometry

Extra structures −2

Same structure drawn twice = cross out, no extra deduction

(b) Is ethylcyclopentane chiral (that is, are there enantiomeric forms of this molecule)? Circle the correct answer below.

YES **NO** +2

(c) Among the alkene structures you drew for part (a), redraw below any that corresponds to a chiral molecule (that is, to a molecule for which there are enantiomers).

enantiomers ok

+4

(d) Consider the result of taking each of the alkenes you drew for part (a) through the oxymercuration-reduction reaction sequence (step 1 = $Hg(OAc)_2$, THF, H_2O; step 2 = $NaBH_4$, NaOH, H_2O). Redraw below any of these alkenes that would give rise to a product mixture that would include diastereomeric molecules.

+4   +4