Final Exam
Chemistry 343 (AM)
Professor Gellman
19 December 2011

Last Name Answer

First Name Key

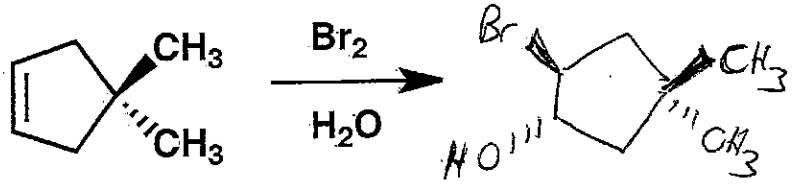
General Instructions:
(i) Use scratch paper at back of exam to work out answers; final answers must be recorded at the proper place on the exam itself for credit. Models are allowed.
(ii) Print your name on each page.
(iii) Please keep your paper covered and your eyes on your own work. Misconduct will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

1. (34 points) Show the major product or products expected from each reaction.

(a) Excess HCl

+5

(b) Br_2, H_2O

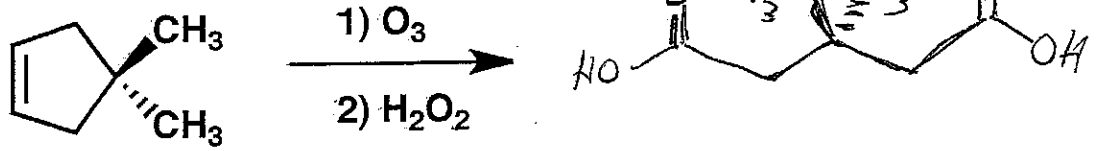


(racemic) <-- [Not required]

(-2 for no stereochem or incorrect)

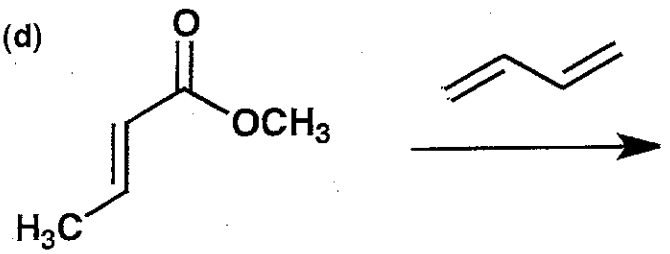
+6

(c) 1) O_3 2) H_2O_2



+6

(d)



(racemic)

+6

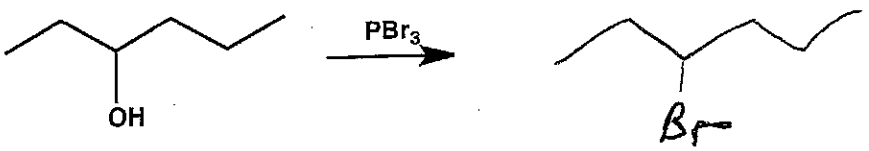
(-2 for no stereochem or cis)

(continued on next page)

Name _____

1. (cont.)

(e)

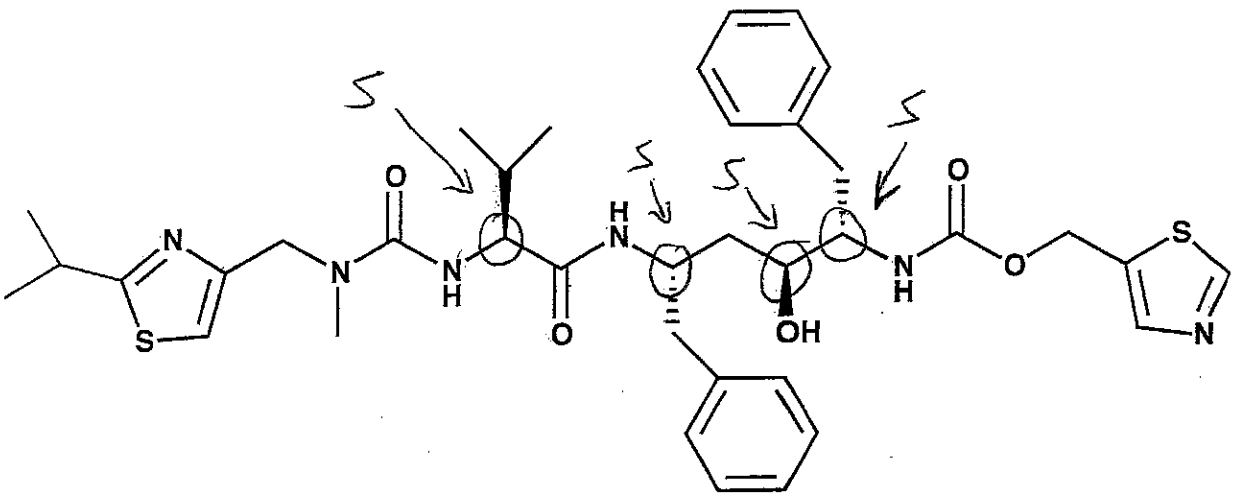


+5

(f)

+6

2. (12 points) Shown below is a drug called ritonavir for patients infected with HIV. CIRCLE all sp^3 stereogenic centers, and indicate whether each configuration is R or S.



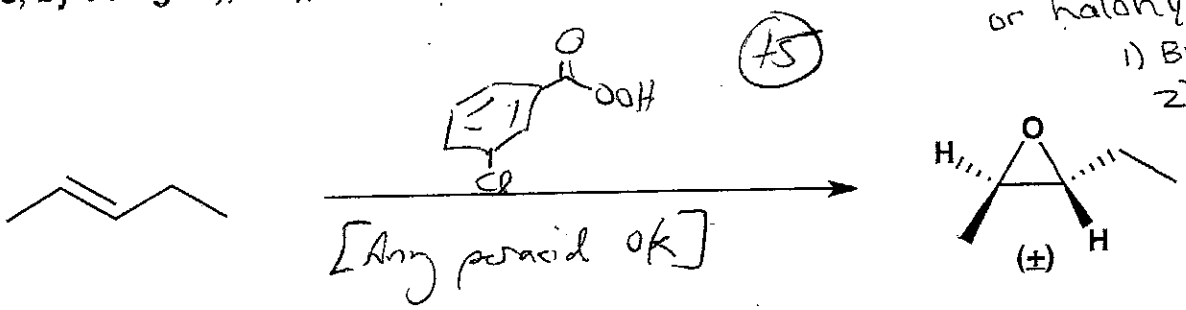
+1 for each correct circle

+2 for each correct S

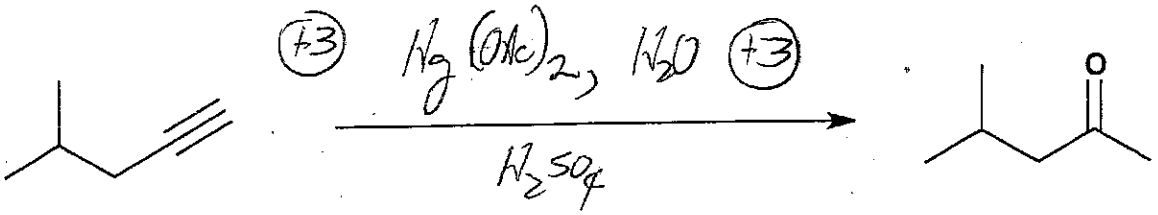
Name _____

3. (23 points) Show the reagents required to convert the starting molecule to the indicated product. If necessary, be sure to differentiate clearly between distinct steps, by using "1)," "2)," etc. over the arrow.

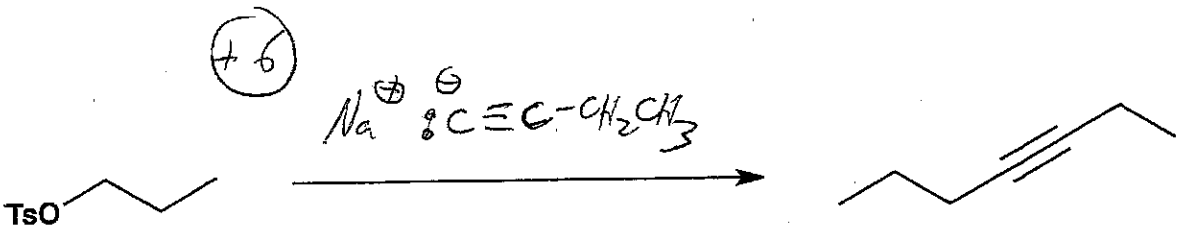
(a)



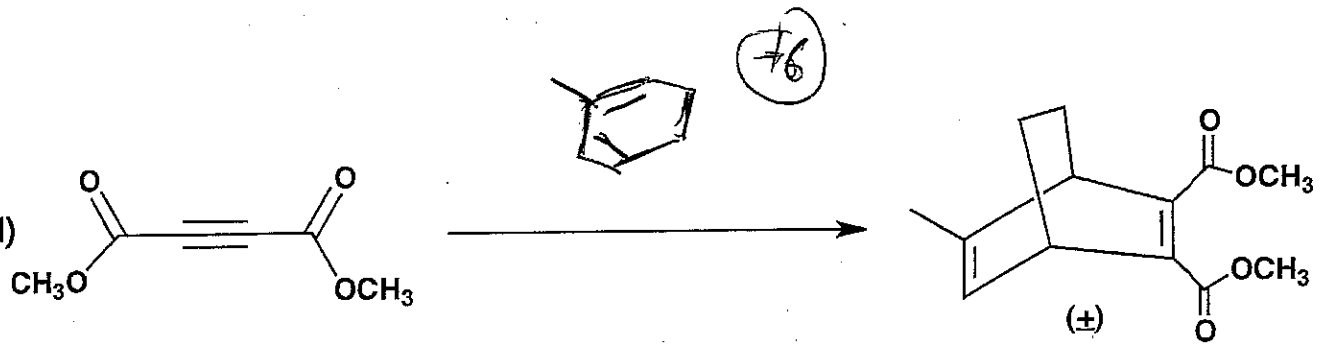
(b)



(c)

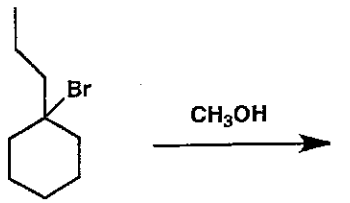


(d)

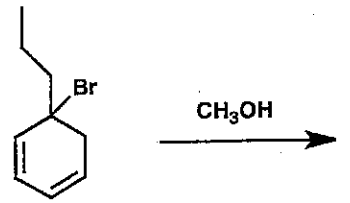


Name _____

4. (24 points) Reaction (i) below produces three products, A, B and C. A and B are isomers, and these compounds each react with one equivalent of H_2 in the presence of Pd/C to produce the same product. Reaction (ii) produces only one product (D).

(i) 

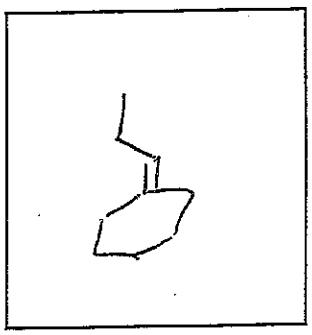
A + B + C

(ii) 

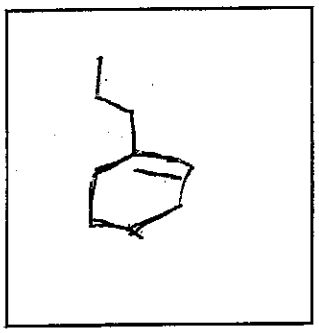
D

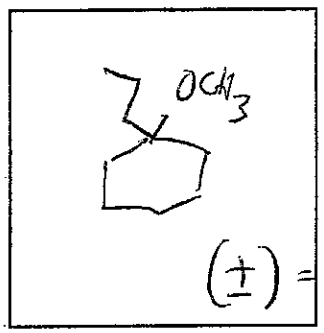
 = 4/5

(a) Draw the products in the indicated boxes below.

A = 

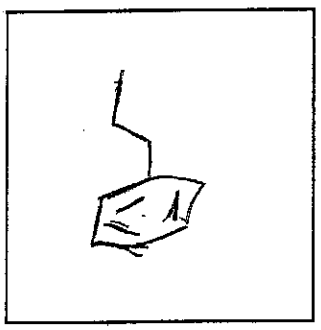
← swap ok →

B = 

C = 

(±) = -1

if C is in A or B, & ~~A~~ B & C boxes have repeats/wrong, total score is 3/15 for A → C.

D = 

±5 each

swap A & C or B → -2 ea. (Sy -4)

(b) Explain in ONE SENTENCE why only one product is formed in reaction (ii).

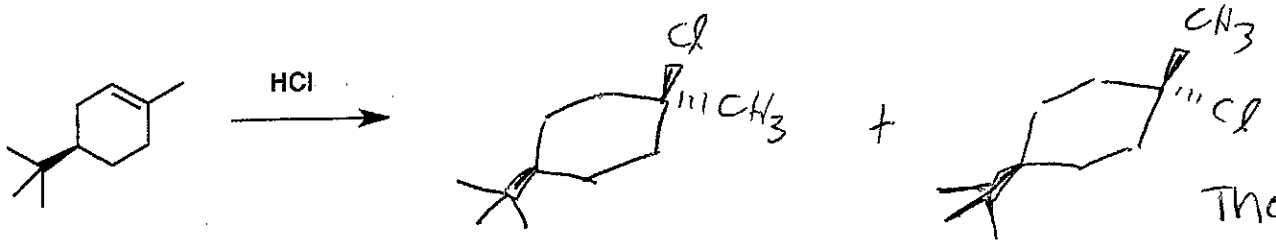
Molecule D is aromatic, while other possible products would be non-aromatic

no mention of benzene or aromatic = 0/4

Name _____

5. (20 points)

(a) The reaction shown below leads to two isomeric products. Draw those products.

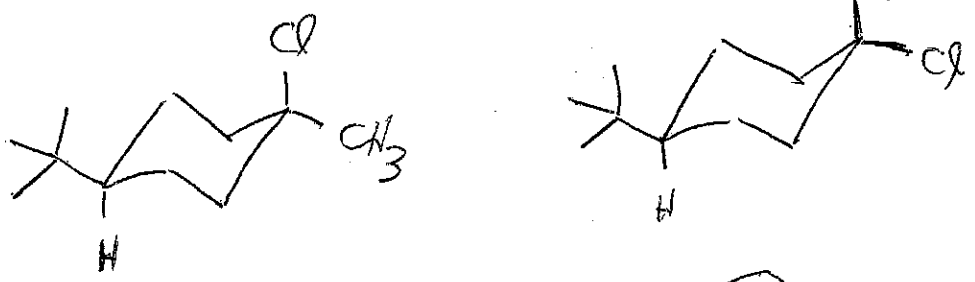


(Single enantiomer)

+4 +4

These + anti-Mark. products = −~~2~~ 1 per (±) indicators −1 ea.

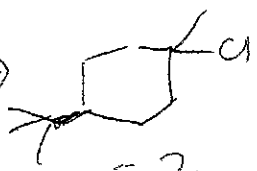
(b) Draw the most stable conformation of each product. C w/o Hs −1



+6 +6

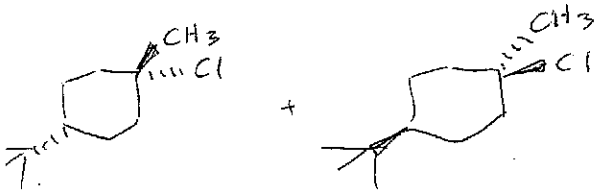
if labeled bckwds, −1 ea.

only 1 Mark prod. w/ stereochem + opp chair 4✓ + 4



+ anti-Mark. = 2

lines w/o Hs −1 ea.



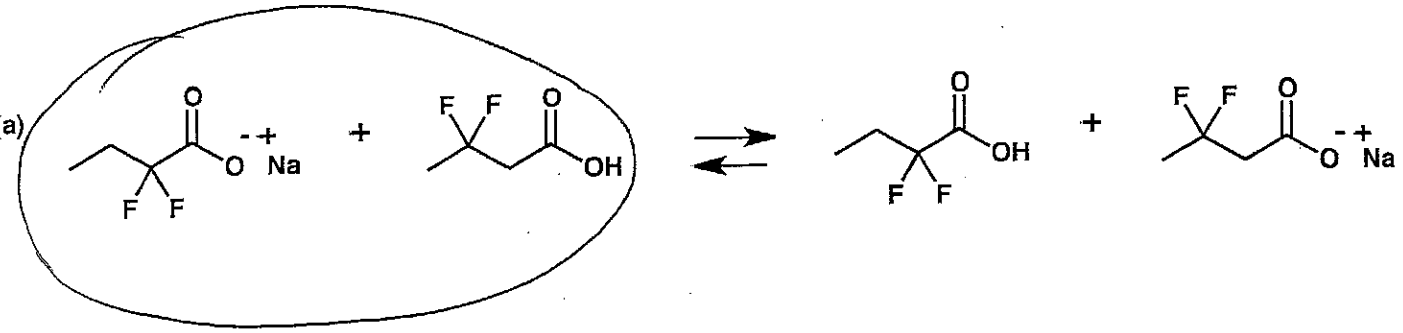
or other same b/c of messing w/ tBu carbon... 4/8 & 6/12 (if chairs correct.

wedges/dashes on otherwise correct chairs = 4/6

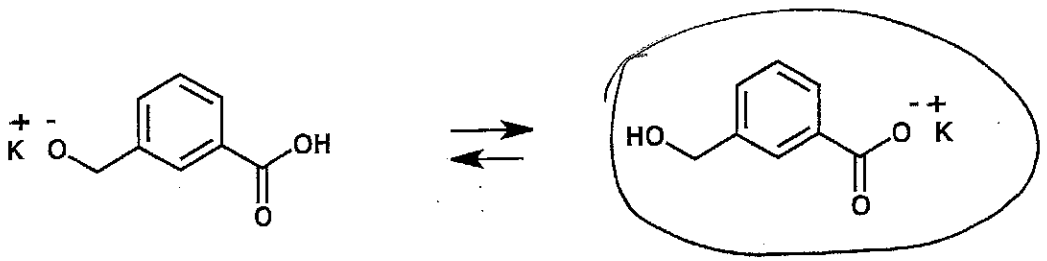
Name _____

6. (8 points) For each equilibrium shown below, CIRCLE the side that you would expect to be favored.

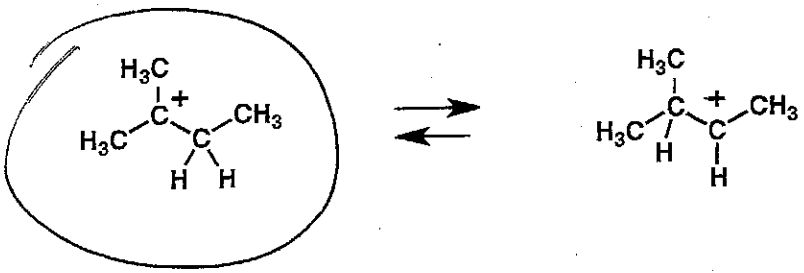
(a)



(b)

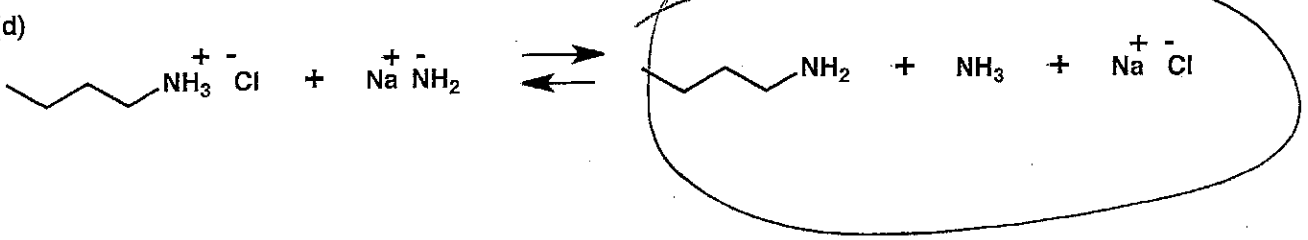


(c)



+2 for each correct circle

(d)

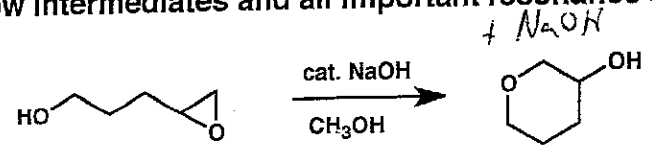


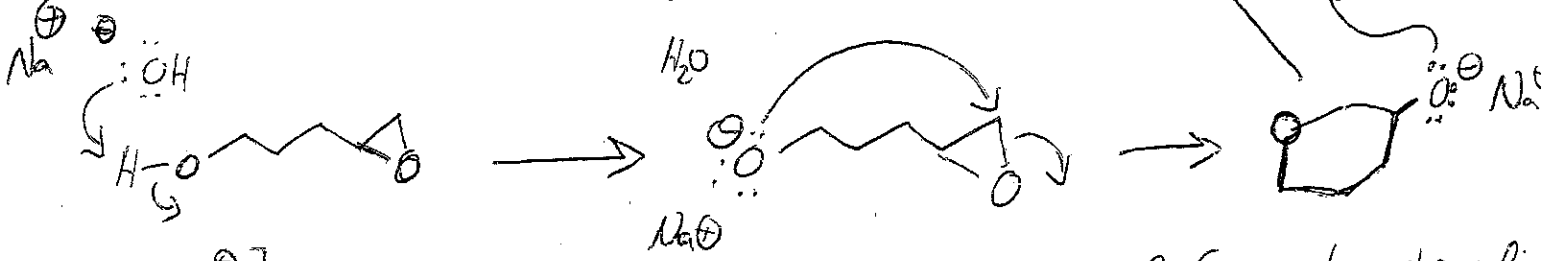
Name _____

[Ok if CH_3OH]

7. (30 points) Provide a mechanism (curved arrows) for each reaction shown below. Be sure to show intermediates and all important resonance structures.

(a)



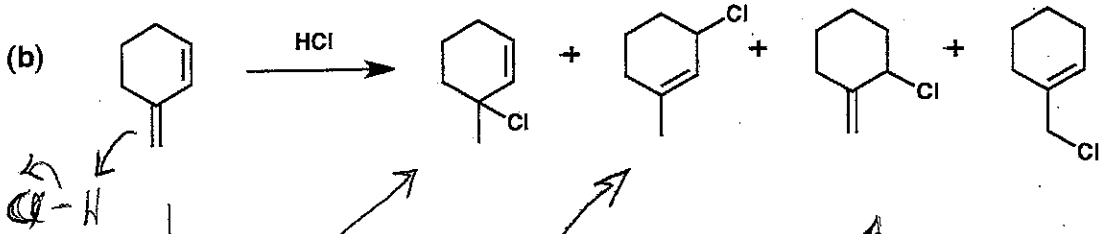


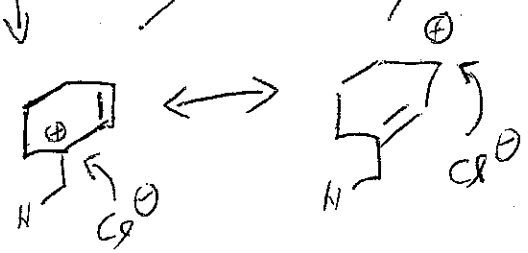
[Ok if $CH_3O^{\ominus}$]

+2 for each intermediate (+4 total)

+1 for each curved arrow (+8 total)

(b)

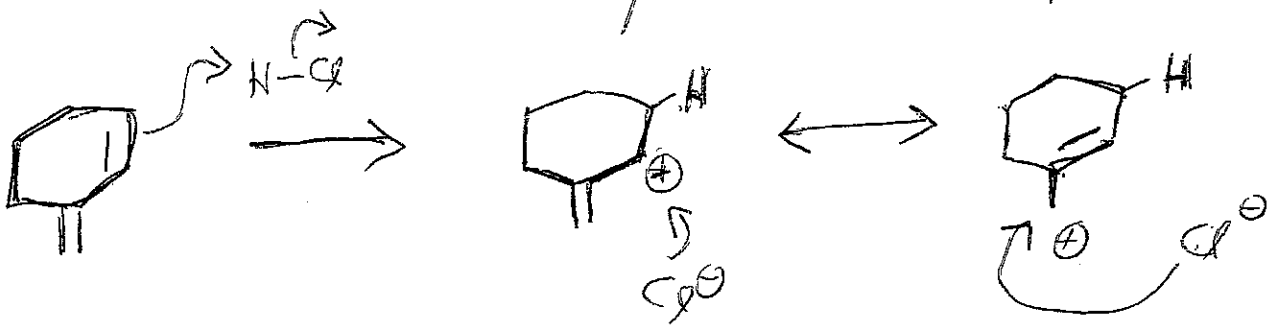




+2 for each $C^{\oplus}$ res. struct. (+8 total)

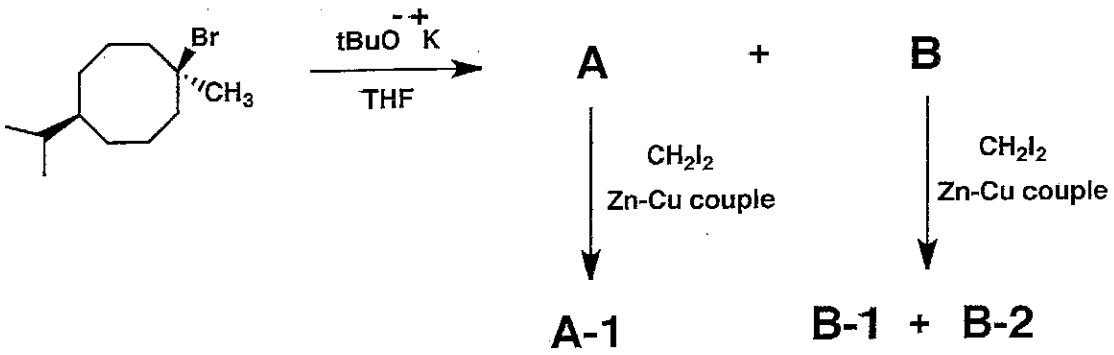
+2 for each curved arrow step (+12 total)

OR

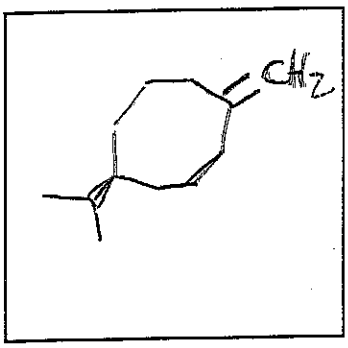


Name _____

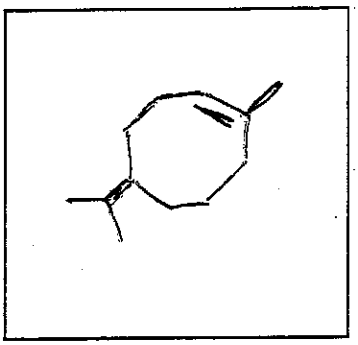
8. (25 points) When the starting material shown below is allowed to react under the conditions shown, two isomeric products result, A and B. B is chiral and racemic, but A is not chiral. Compound A forms only one product, A-1 (not chiral), under the second reaction conditions, but compound B forms two new products under the second reaction conditions, B-1 and B-2. B-1 and B-2 are both chiral and racemic. Draw the structures of all five compounds in the indicated boxes.



A =



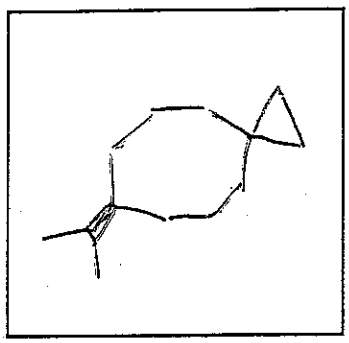
B =



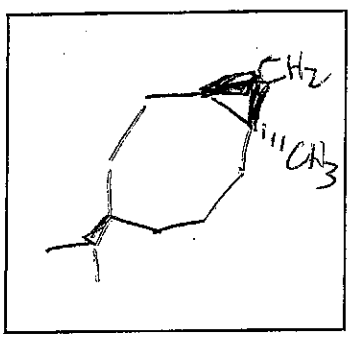
-1 for putting stereochem

+5 each

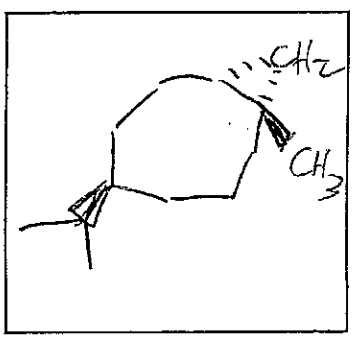
A-1 =



B-1 =



B-2 =



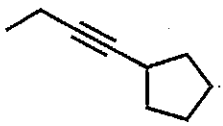
-2 for no stereochem

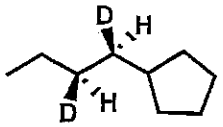
-1 each for no H's on CH2

Name _____

9. (24 points) Devise a synthetic route from the indicated starting material to the indicated target in each of the two cases below. Each route should be as short and as selective as possible. You may use <u>any</u> other organic molecules and any inorganic reagents in your synthetic plans. Show the expected product after each step in each synthetic route. (Do not provide mechanistic information.)

(a)

Starting material = 

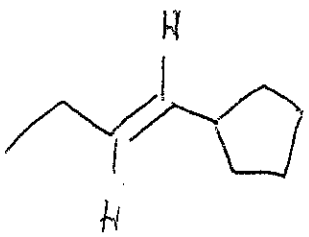
Target = 

(±)

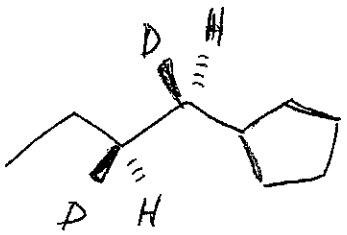
(+4) Na^0, NH_3

+2 for H_2, Poisoned catalyst

(ok to use ND_3 in 1st step, and H_2 in 2nd step)



(+4) D_2, Pd/C (+2 if cis alkene)



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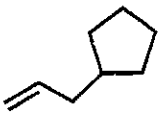
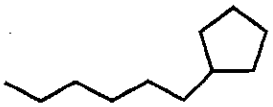
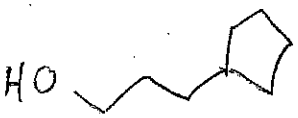
Name _____

9. (cont.)

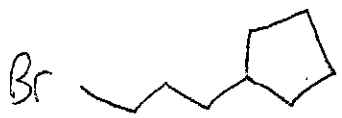
Starting material = 

Target = 

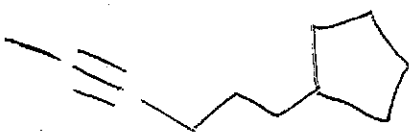
(+4) Δ, HBr, peroxides (+8) ↓ 1) BH_3, THF 2) H_2O_2, $NaOH$, H_2O



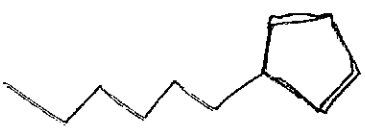
(+4) ↓ PBr_3 ($SOCl_2$ or $TsCl/pyr$ ok)



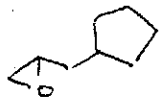
(+4) ↓ $CH_3-C\equiv C:^{\ominus}\ Na^{\oplus}$ −2 if $HC\equiv CH$



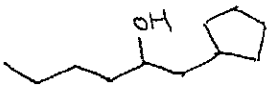
(+4) ↓ H_2, Pd/C



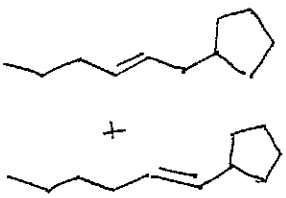
m-CPBA (+4)



1)  2) $H_3O^{\oplus}$ (+4)



(+4) ↓ H_2SO_4, H_2O



(+4) ↓ H_2, Pd/C