Exam 2 Summer 2016

Name Key Seat Number_____

Student ID_____

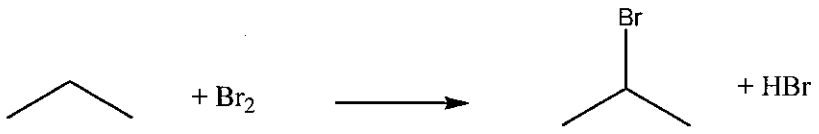
The exam consists of 7 questions worth 105 points on a total of 9 pages, including a BDE chart. It will be scored out of 100 points. The maximum score you may receive is 100 points.

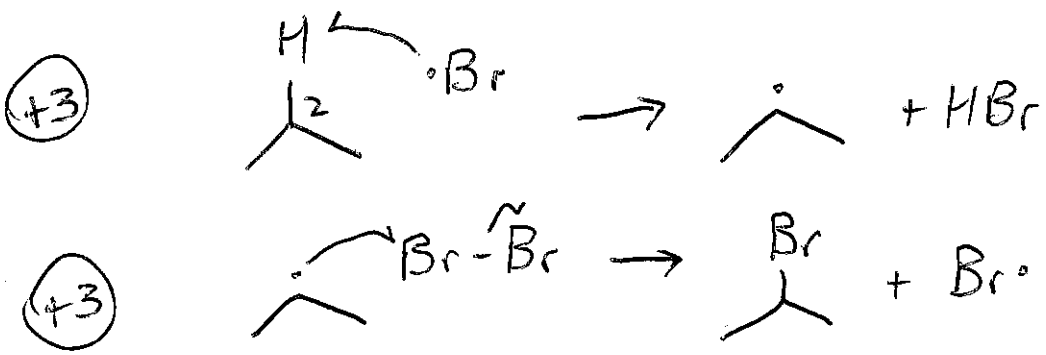
1. _____/ 12
2. _____/12
3. _____/20
4. _____/20
5. _____/12
6. _____/14
7. _____/15

Total:

Regrading: All requests for regrades must be submitted in writing within 48 hours of the return of the exam. You must explicitly state what has been misgraded and why it is an error. The entire exam will be regraded, which could result in points being added or deducted overall.

1. (12pts) Draw the propagation steps for a mechanism that explains this radical halogenation:





Calculate the change in enthalpy for each of the propagation steps and the overall change in enthalpy. Show all work below.

step 1: $+410 \frac{kJ}{mol} + -366 \frac{kJ}{mol}$ (+2) $\Delta H^\circ = +44 \frac{kJ}{mol}$

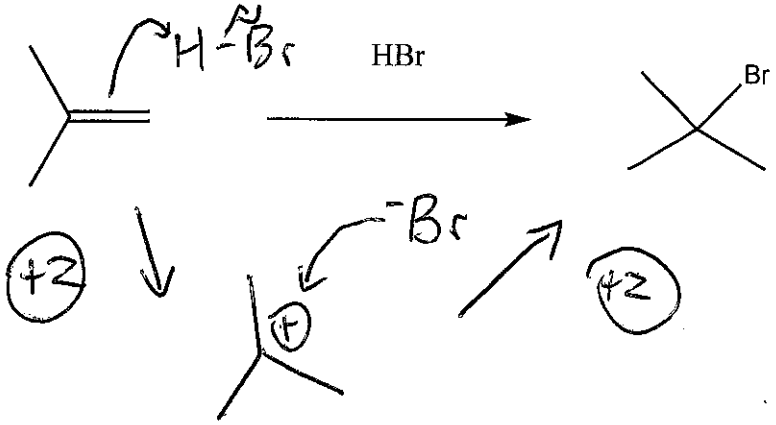
C–H break; H–Br made

step 2: $+194 \frac{kJ}{mol} + -299 \frac{kJ}{mol}$ (+2) $\Delta H^\circ = -105 \frac{kJ}{mol}$

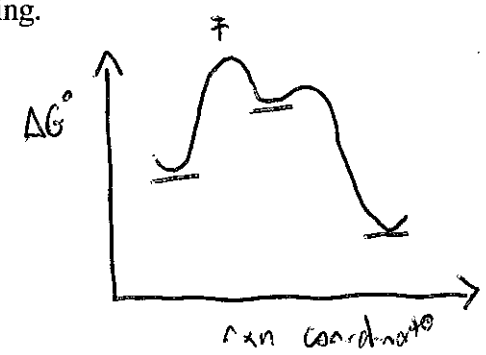
Br–Br break; C–Br made

overall $\Delta H^\circ = -59 \frac{kJ}{mol}$ (+2)

2. (12pts) Draw an arrow mechanism with all intermediates for the reaction below.



Based on your reaction mechanism, draw an energy diagram for this reaction. Assume the first step is rate limiting.



(+1) two steps
(+1) exergonic
(+1) high energy intermediate
(+1) First ‡ RDS

Use the Hammond Postulate to explain why 1-bromo-2-mehtylpropane does not form in this reaction. Writing a long essay in which you have some right and some wrong statements will result in a zero, so don't ramble.

concepts:

(+1) 3° carbocation more stable than 1°

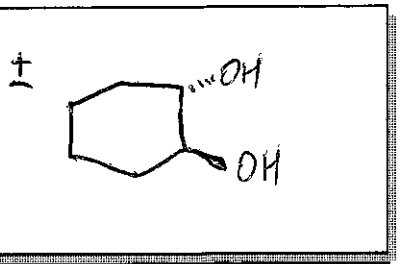
(+2) TS leading to 3° is more stable because it resembles...

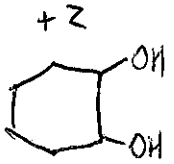
(+1) lower E_A, faster, etc.

3. (20pts) Predict the <u>major</u> product(s) of 5 of the following 6 reactions. Be sure to include proper stereochemistry. Put an "X" in the box you do not want graded, or else the first 5 will be graded.

cyclohexene

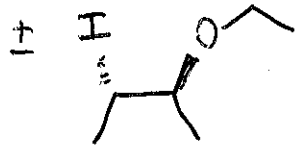
1. mCPBA
2. H_3O^+

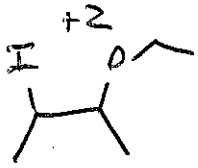


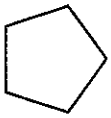


Z-2-butene

I_2, CH_3CH_2OH

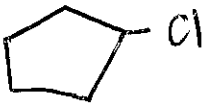


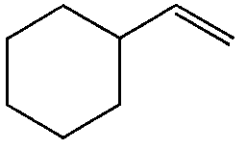




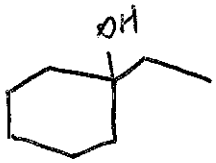
1 equiv. Cl_2

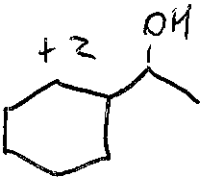
light





H_3O^+





pent-1-ene

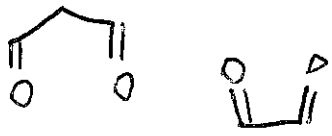
HCl

Write out the name(s) of the pdts:

R 2-chloropentane

S 2-chloropentane

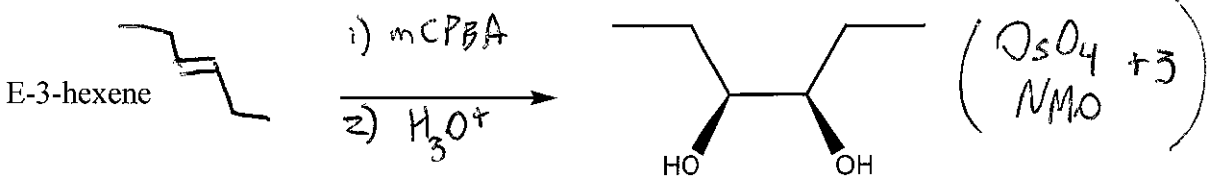
1. O_3
2. DMS



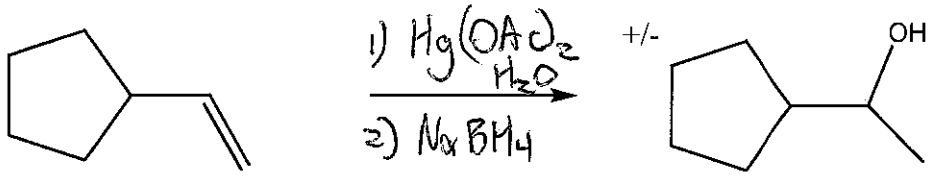
4. . (20pts) Provide reagents or starting materials necessary for 5 of the following 6 transformations. CLEARLY MARK the one you do not want graded or else the first five will be graded. More than one step may be necessary.

+4 each

A. E-3-hexene

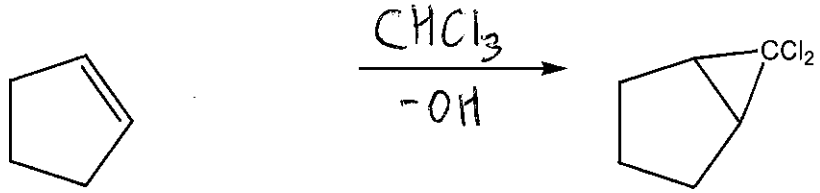


B.

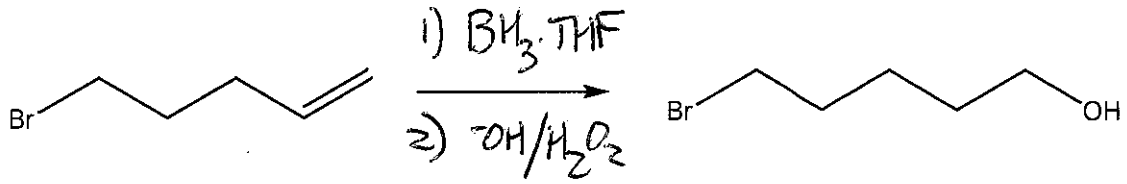


(no rearrangement)

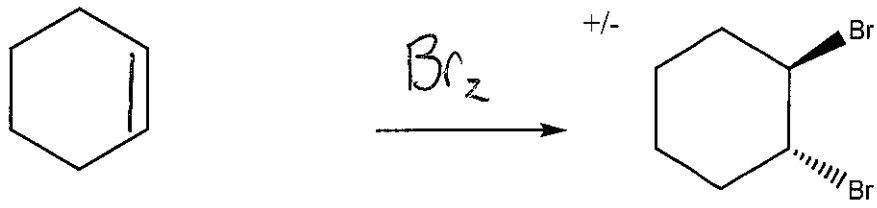
C.



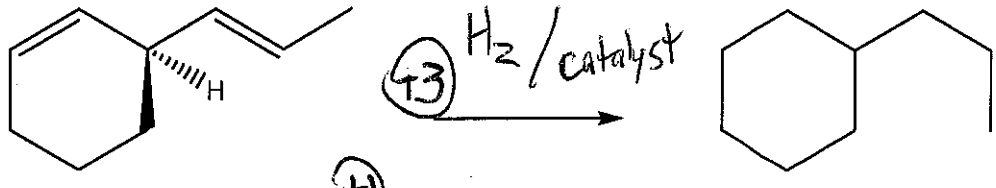
D.



E.



F.



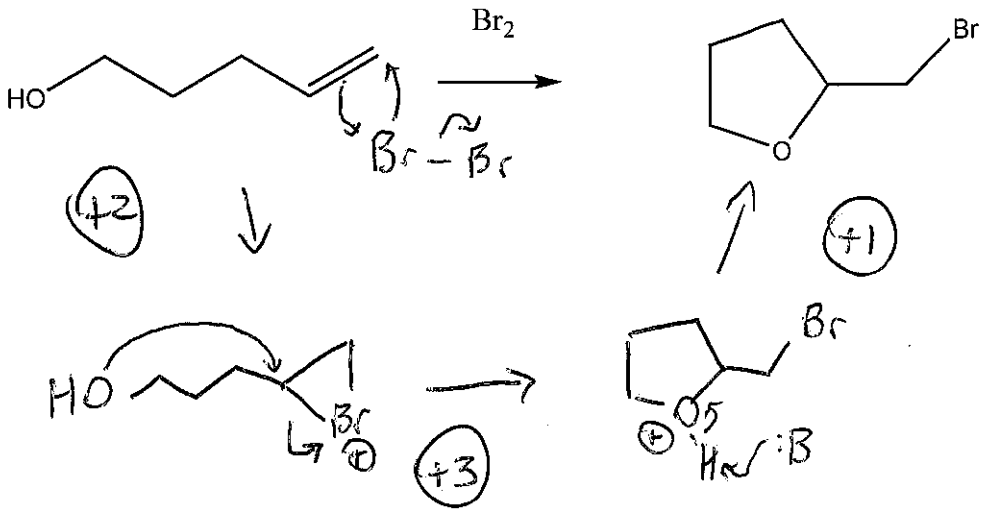
+1

Which of these is true of reaction F?

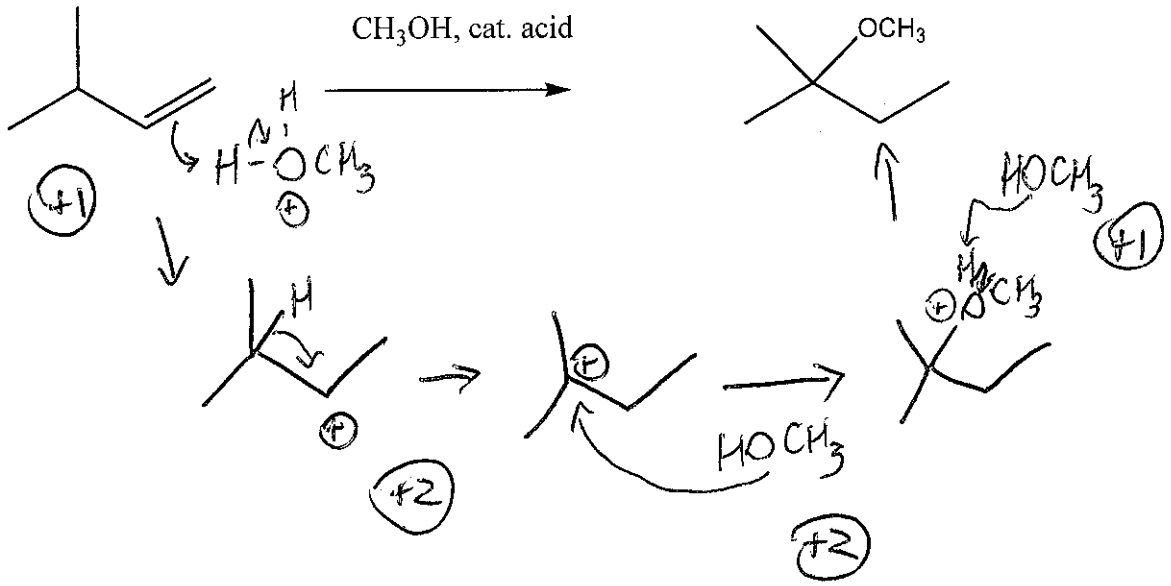
A. Optically active starting material to optically active products
B. Optically active starting material to optically inactive products
C. Optically inactive starting material to optically active products
D. Optically inactive starting material to optically inactive products

5. (12pts) Propose arrow mechanisms for both of these reactions:

A.



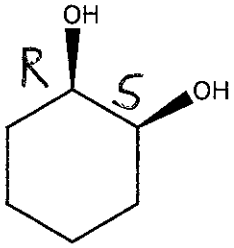
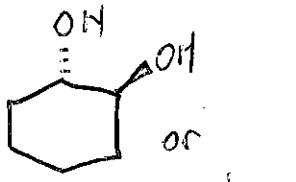
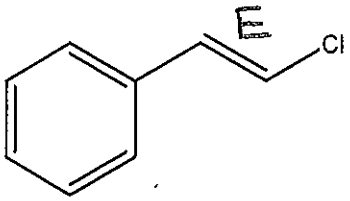
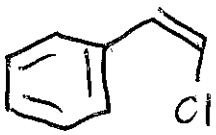
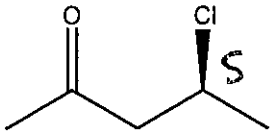
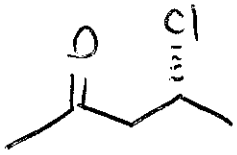
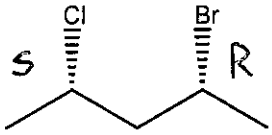
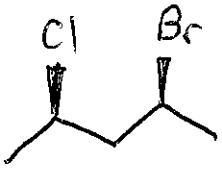
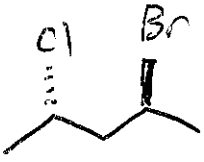
B.



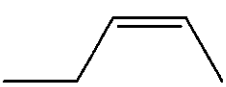
6. (14pts) On the compounds below, mark each center "R/S" or E/Z" as appropriate. In the boxes next to them, draw their enantiomer and draw one diastereomer. If the compound does not have an enantiomer or diastereomer, write "None" in the appropriate box. Blank boxes will be marked incorrect.

+1 each box

+1 each R/S E/Z

	enantiomer	diastereeomer
	None	 or enantiomer
	None	
		None
		 or enantiomer

7. (15pts) Taking into consideration each stereoisomer individually, how many products are formed in each of the reactions below? Draw all of the major products produced in each reaction, and indicate their stereochemical relationships.

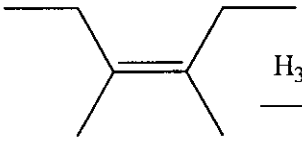


CH_2I_2, ZnCu

How many product are formed: 2 (+2)

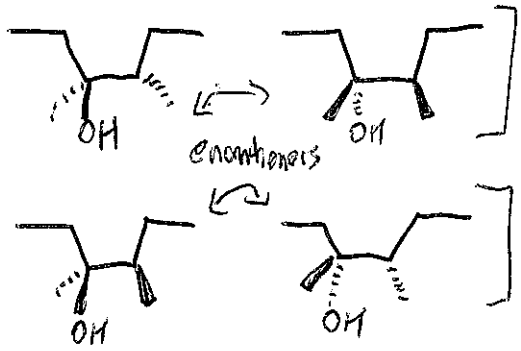
(+2)

enantiomers (+1)



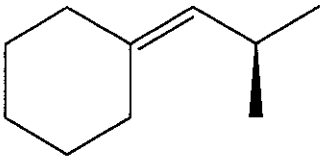
H_3O^+

How many product are formed: 4 (+2)



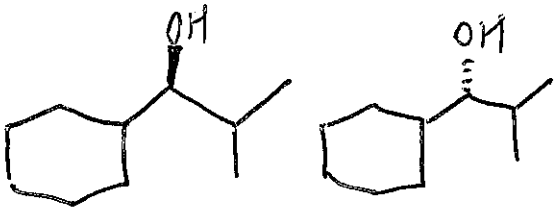
(+2)

Diastereomers (+1)



1. BH_3 THF
2. HO^-, H_2O_2

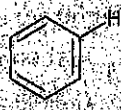
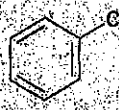
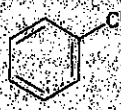
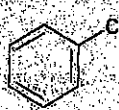
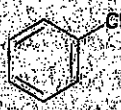
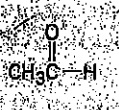
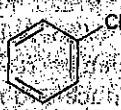
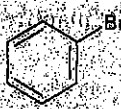
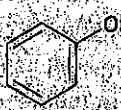
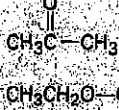
How many product are formed: 2 (+2)



(+2)

enantiomers (+1)

TABLE 6-3 Some Bond Dissociation Energies, *D*

Bond	*D* (kJ/mol)	Bond	*D* (kJ/mol)	Bond	*D* (kJ/mol)
H—H	436	$(CH_3)_3C$—Br	293	C_2H_5—CH_3	370
H—F	570	$(CH_3)_3C$—I	227	$(CH_3)_2CH$—CH_3	369
H—Cl	431	H_2C=CH—H	464	$(CH_3)_3C$—CH_3	363
H—Br	366	H_2C=CH—Cl	396	H_2C=CH—CH_3	426
H—I	298	H_2C=$CHCH_2$—H	369	H_2C=$CHCH_2$—CH_3	318
Cl—Cl	242	H_2C=$CHCH_2$—Cl	298	H_2C=CH_2	728
Br—Br	194		472		427
I—I	152				
CH_3—H	439		400		325
CH_3—Cl	350				
CH_3—Br	294		376		374
CH_3—I	239				
CH_3—OH	385		300	HO—H	497
CH_3—NH_2	386			HO—OH	211
C_2H_5—H	421		336	CH_3O—H	440
C_2H_5—Cl	352			CH_3S—H	366
C_2H_5—Br	293		464	C_2H_5O—H	441
C_2H_5—I	233				352
C_2H_5—OH	391			CH_3CH_2O—CH_3	355
$(CH_3)_2CH$—H	410	HC≡C—H	558	NH_2—H	450
$(CH_3)_2CH$—Cl	354	CH_3—CH_3	377	H—CN	528
$(CH_3)_2CH$—Br	299				
$(CH_3)_3C$—H	400				
$(CH_3)_3C$—Cl	352				