

CHEM 3311

HARRINGTON

Exam 2 7:00 – 8:30 PM March 14, 2017 in HUMN1B50

Instructions. No notes, books, laptops, phones, calculators, models or drawing stencils.

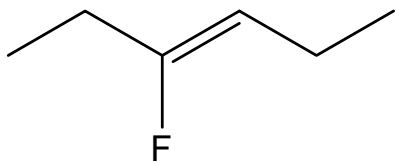
Periodic Table and electronegativity chart and Table of Bond Dissociation Energies are provided.

NAME: KEY

Recitation TA Name:

	Points Possible	Score
1	17	
2	11	
3	14	
4	15	
5	14	
6	16	
7	12	
Exam 2 Total Raw Score	100	
Curve		
Exam 2 Curved Score		
Exam 2 Letter Grade		

1 (18 points) Name each compound using the IUPAC system.

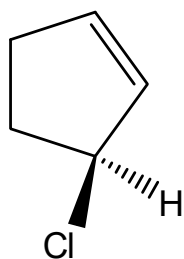


(Z)-3-fluorohex-3-ene

or

(Z)-3-fluoro-3-hexene

1 1 1 1 for correct #s

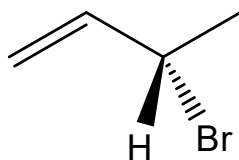


(S)-3-chlorocyclopent-1-ene

or

(S)-3-chlorocyclopentene

1 1 1 1

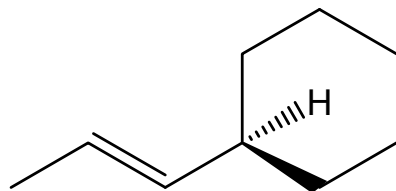


(S)-3-bromobut-1-ene

or

(S)-3-bromo-1-butene

1 1 1 1 for correct #s



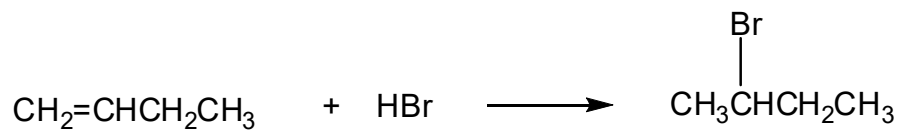
(R,E)-4-ethylhept-2-ene

or

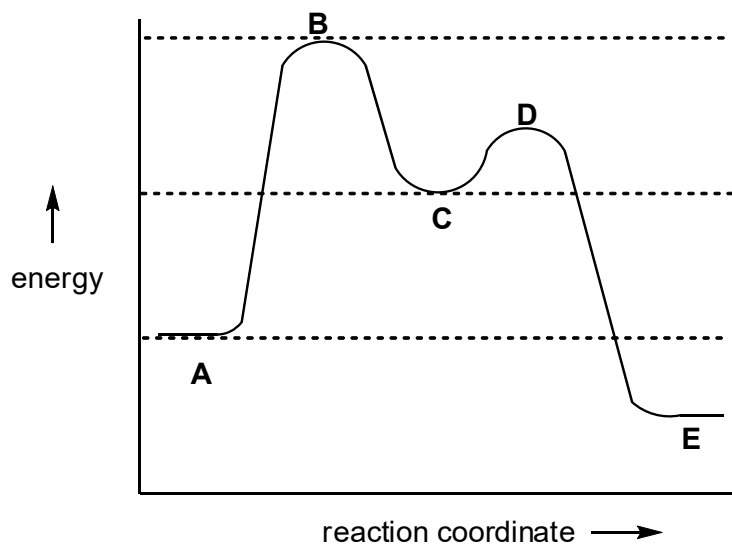
(4R,2E)-4-ethyl-2-heptene

1 1 1 1 1 for correct #s

2. (11 points) For the reaction:



The reaction coordinate-energy diagram is shown below.



How many steps are there in the mechanism? 2

1

Which step is the slow step in the mechanism? first step or A to C

1

NOT A to B...this is not a step

Which location(s) on the diagram correspond to transition states? B and D

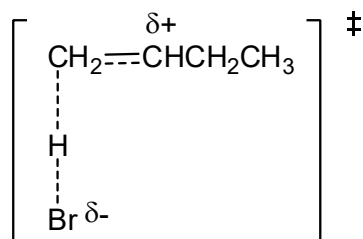
2

Which location(s) on the diagram correspond to intermediates? C

1

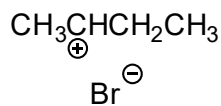
Draw structures which correspond to locations **B**, **C**, and **D** on the diagram.

no partial credit



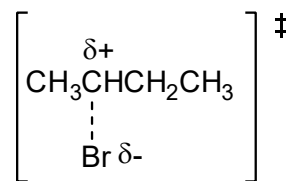
B

2



C

2



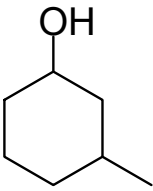
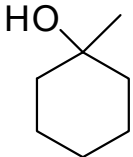
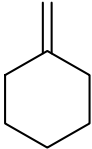
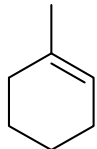
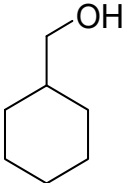
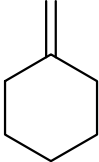
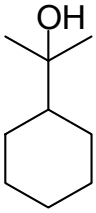
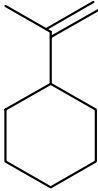
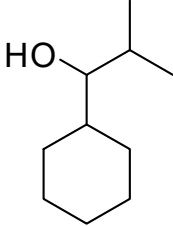
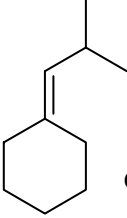
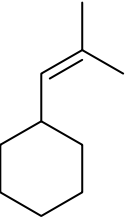
D

2

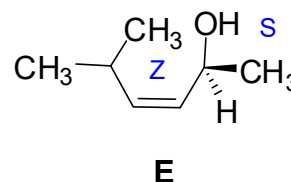
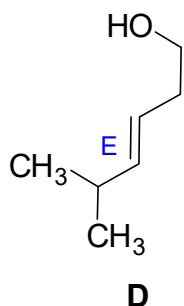
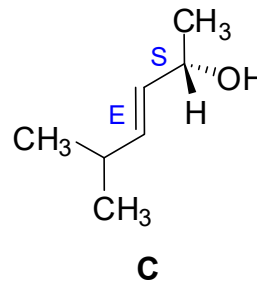
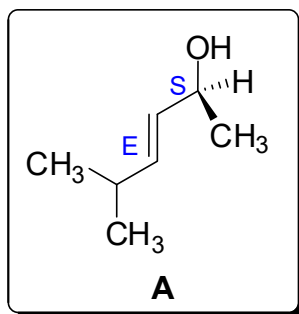
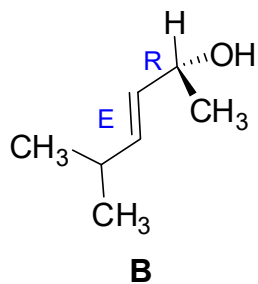
3. (14 points) The objective in the preparation of an organic molecule is to convert a starting material to a single product or to a product contaminated with only trace amounts of side products. Consider the five alcohol products in the Table below.

For each alcohol product which could be efficiently prepared by hydroboration-oxidation [1)BH₃-THF, 2) H₂O₂, NaOH in THF-H₂O] of an alkene, draw the alkene starting material in the box provided. Write **NO** in the box if the alcohol could not be efficiently prepared by this method.

For each alcohol product which could be efficiently prepared by acid-catalyzed hydration [H₂O, H₂SO₄ catalyst] of an alkene, draw the alkene starting material in the box provided. Write **NO** in the box if the alcohol could not be efficiently prepared by this method.

Alcohol Product	Hydroboration-Oxidation Alkene Starting Material	Acid-Catalyzed Hydration Alkene Starting Material
	NO 1	NO 1
	NO 1	 or  2
	 2	NO 1
	NO 1	 2
	 or  2	NO 1

4. (15 points) How are compounds **B**, **C**, **D**, and **E** related to compound **A**?
 (Hint: There are four possible answers: they are identical, constitutional isomers, diastereomers, or enantiomers.)



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	Relationship	
A and B	enantiomers	4
A and C	identical	4
A and D	constitutional isomers	3
A and E	diastereomers	4

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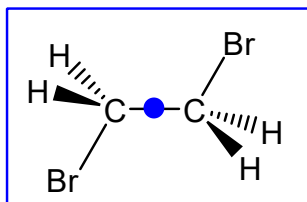
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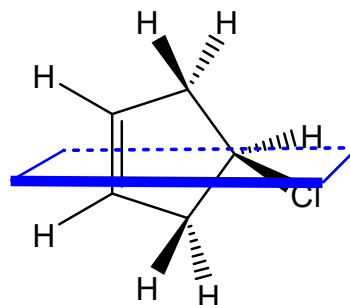
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5. (14 points) For each structure:

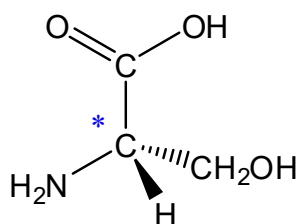
- Label each asymmetric carbon with an asterisk (*).
- Identify all planes of symmetry and centers of symmetry in the conformation shown. Label them as a plane or center. Draw them and/or describe them in ten words or less.
- Label the structure as chiral or achiral.
- Label any meso compounds.



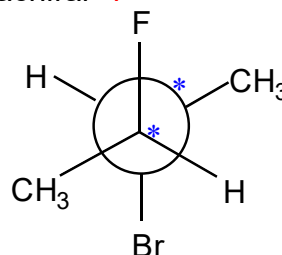
mirror plane is plane of paper or
mirror plane contains Br/C/C/Br nuclei
also center of symmetry
achiral 1



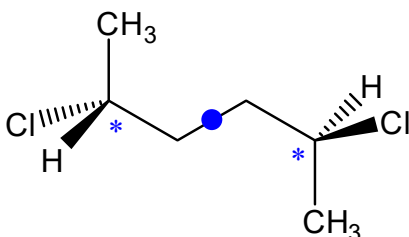
mirror plane contains H/C/Cl nuclei
and cuts through center of C=C or
mirror plane is yz plane
achiral 1



chiral 1



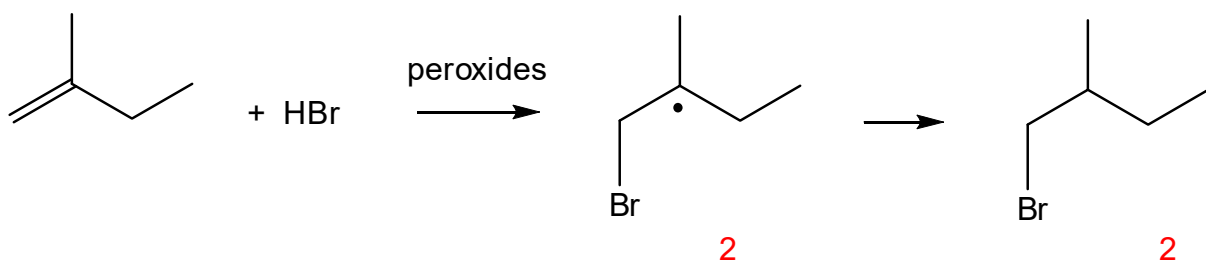
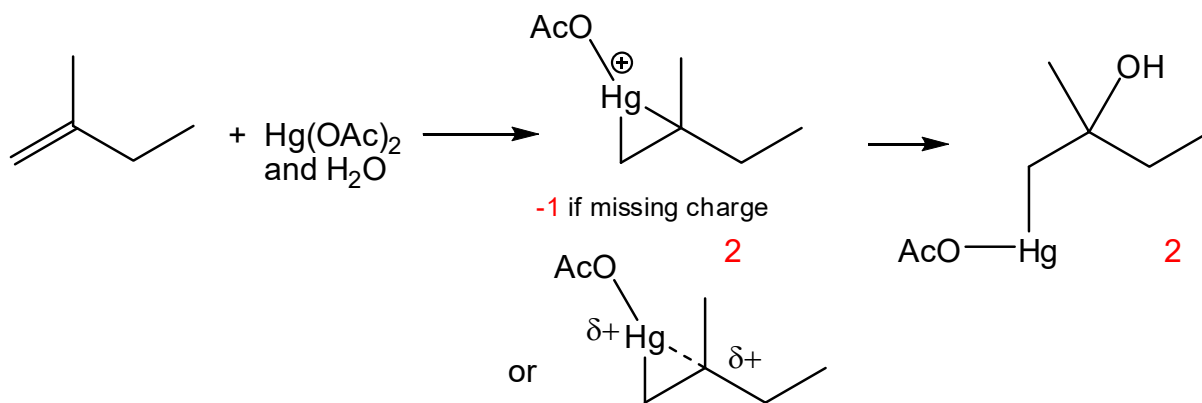
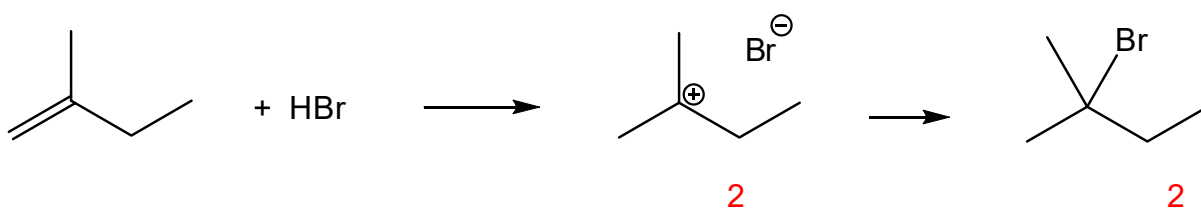
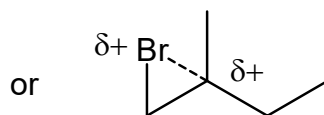
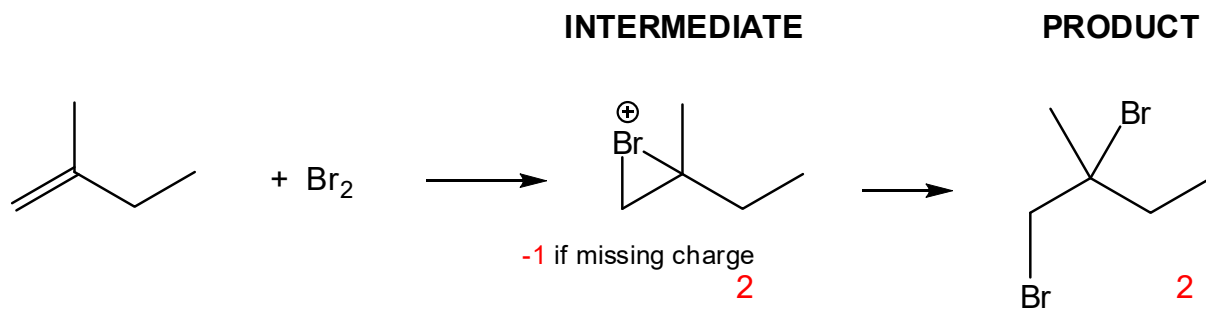
chiral 1



center of symmetry in center of C3-C4 bond 1

5 *	1 point each	each wrong *	-1
3 planes/centers	1 point each	each wrong plane/center	-1
5 chiral/achiral	1 point each		
1 meso	1 point	each wrong meso	-1
14 Total		score cannot be < 0	

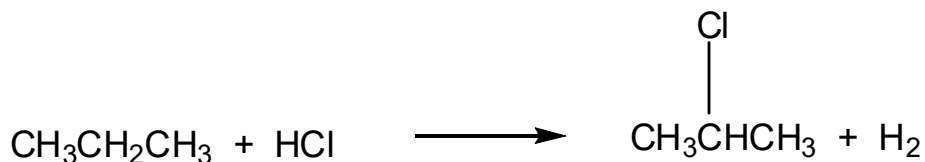
6. (16 points). Give the structures of both the reactive intermediate and the product in each of the following reactions: (Suggested Practice Problem 5.37)



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7. (12 points) Estimate the ΔH° (kJ/mol) for each of the following gas-phase reactions using bond dissociation energies from the **Table** provided. Show your calculations. Is each reaction exothermic or endothermic?



$+ 412$ $+ 843$	$+ 431$	$+ 52$	$- 356$ $- 791$	$- 435$
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$\Delta H^\circ = + 52 \text{ kJ/mol}$	This reaction is endothermic.
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3

1

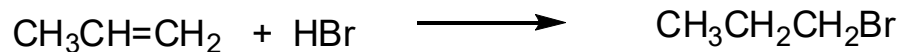


$+ 439$ $+ 593$	$+ 154$	$- 457$	$- 481$ $- 1050$	$- 569$
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$\Delta H^\circ = - 457 \text{ kJ/mol}$	This reaction is exothermic!
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3

1



$+ 243$ $+ 611$	$+ 368$	$- 104$	$- 412$ $- 715$	$- 303$
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$\Delta H^\circ = - 104 \text{ kJ/mol}$	This reaction is exothermic.
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3

1

#