

Easily Legible Printed Name: \_\_\_\_\_

CHEM 3331, Fall 2017  
Professor Walba  
First Hour Exam  
September 26, 2017

scores:

- 1) 20  
2) 20  
3) 20  
4) 20  
5) 20
- 

CU Honor Code Pledge: On my honor, as a University of Colorado at Boulder Student, I have neither given nor received unauthorized assistance.

Signature: \_\_\_\_\_ *Key*

Recitation TA Name: \_\_\_\_\_

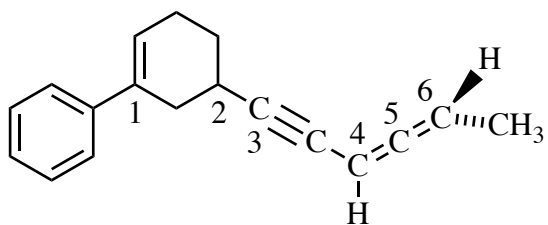
Recitation day and time: \_\_\_\_\_

This is a closed-book exam. The use of notes, calculators, scratch paper, or cell phones will not be allowed during the exam. You may use models brought in a clear Ziploc bag. Please put all your answers on the test in the appropriate place. Use the backs of the pages for scratch (there are two additional blank scratch sheets after the last page of the exam). DO NOT PUT ANSWERS ON THE SCRATCH SHEETS.

*PLEASE read the questions very carefully!*

1A								8A
1 H							2 He	
	2A	3A	4A	5A	6A	7A		
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne	
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	
						35 Br		
						53 I		

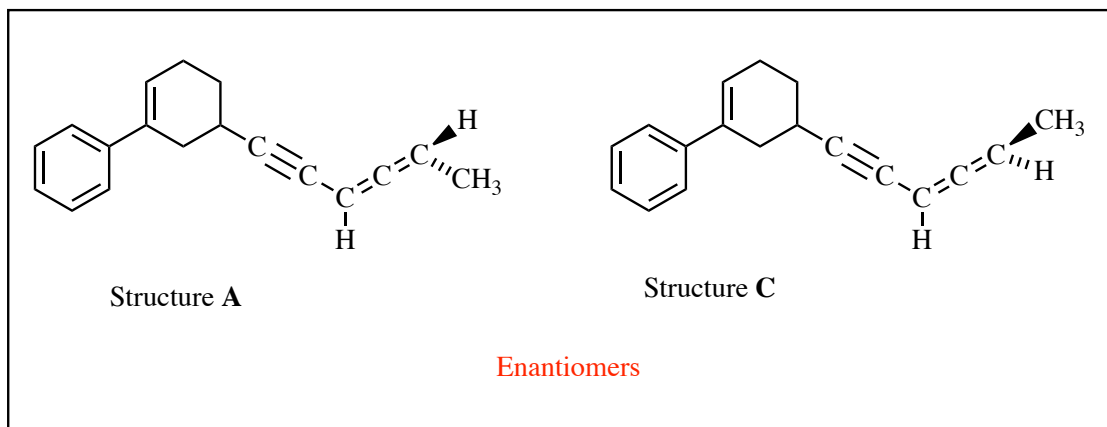
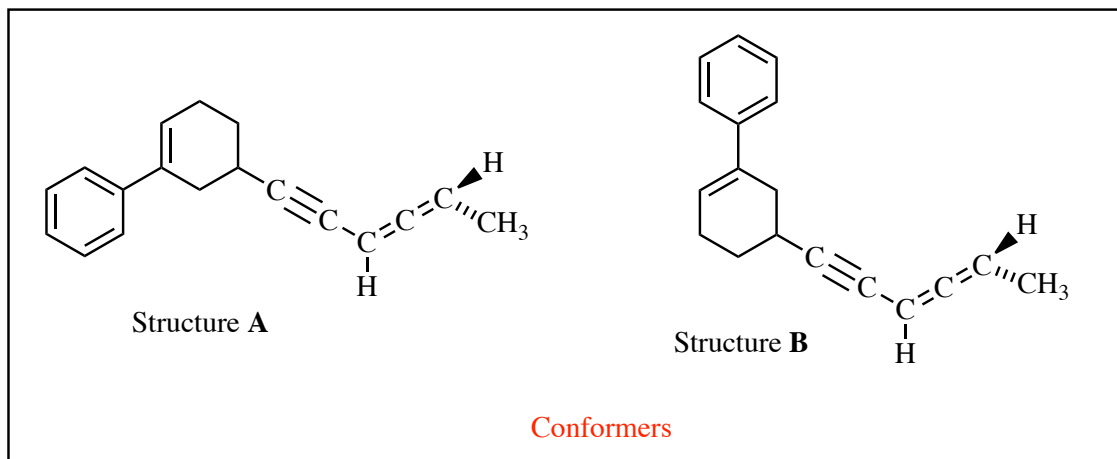
1 (20 pts) a) For the fairly complicated molecule with Structure A below, give the **hybridization** of each numbered carbon in the numbered boxes to the right (write the hybridization of carbon 1 in box 1, etc.).



Structure A

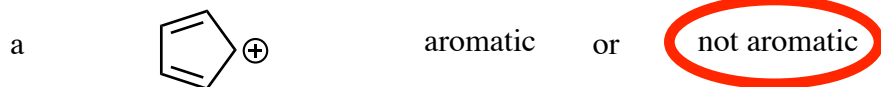
1	$sp^2$	4	$sp^2$
2	$sp^3$	5	$sp$
3	$sp$	6	$sp^2$

b) For the two pairs of structures below (A, B and A, C), indicate their relationship (conformations, enantiomers, diastereomers, or constitutional isomers) inside the box under the structures.

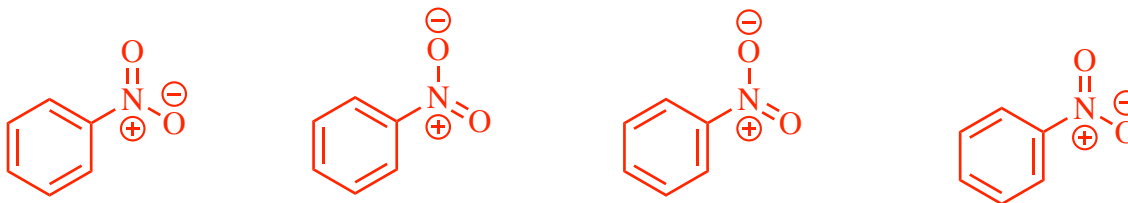


1 – Continued

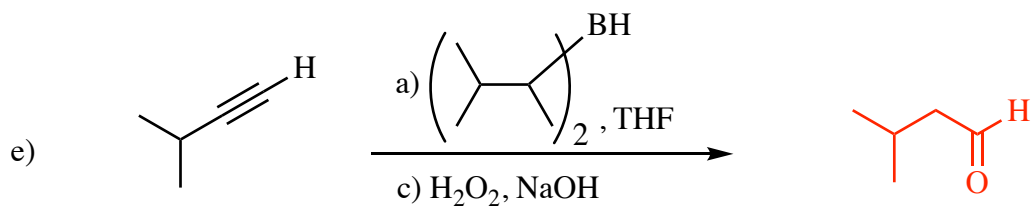
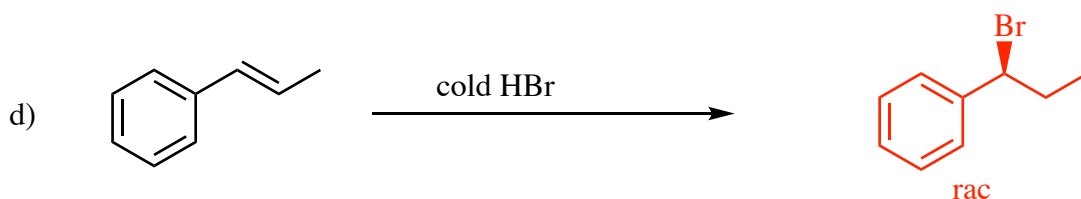
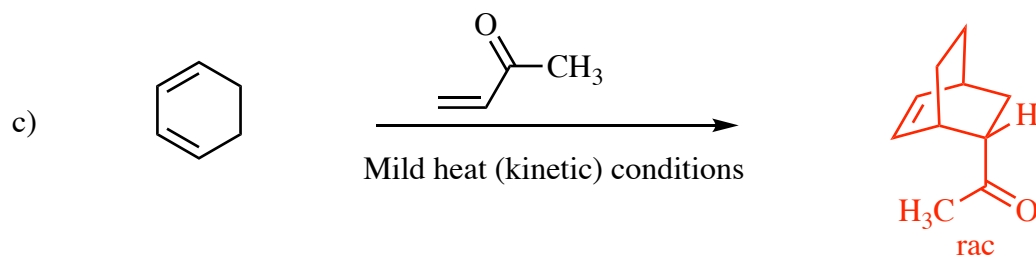
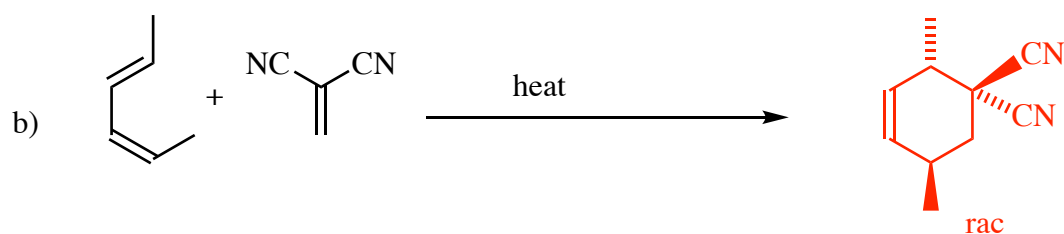
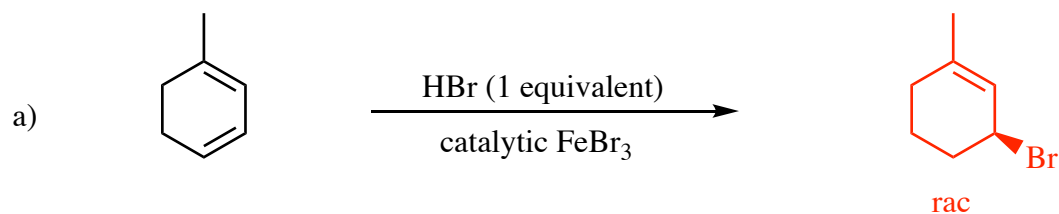
c) For each of the following molecules, indicate whether the molecule is aromatic or not aromatic by circling the appropriate term.



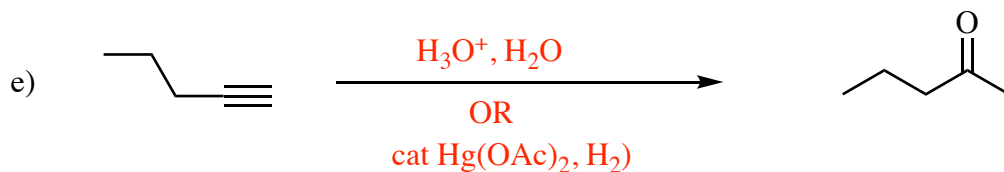
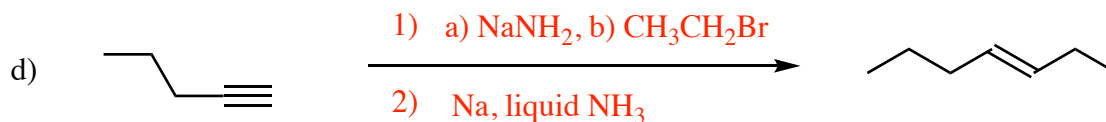
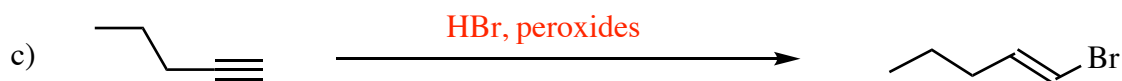
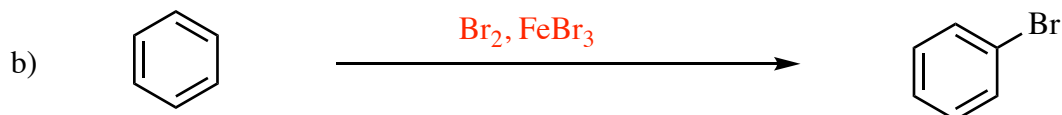
e. In the space below, draw the FOUR major resonance contributors to the structure of compound **d**.



2) (20 pts) Give the **single major product** for each of the following reactions, carefully showing stereochemistry using wedges and dashes if appropriate. If a racemate is formed, show only one enantiomer and label it "rac." Assume chiral starting materials are single pure enantiomers unless they are labeled "rac."

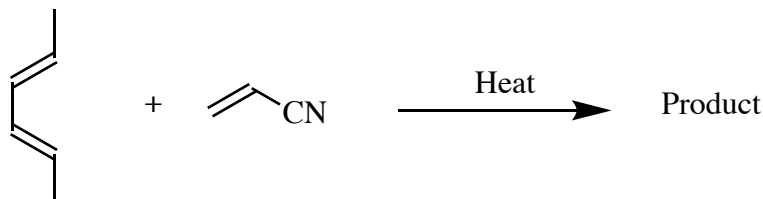


3) (20 pts) Propose reagents for accomplishing each of the following transformations. For reactions involving sequential addition of reagents, label the two parts of the reaction using letters. **Your synthesis may require multiple reactions**, with isolation of intermediate products, to make the target. Use numbers to indicate individual steps in a multi-step synthesis. Make your synthesis efficient (i.e. the target product should be the major product). Assume chiral starting materials and products are single pure enantiomers unless they are labeled "rac."

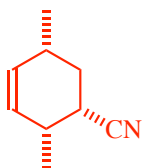


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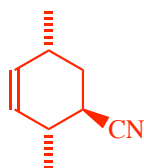
4) (20 pts) a) The following reaction gives different products depending upon whether the reaction is run at a low temperature, with just enough heat to make a reaction happen (irreversible conditions), or at high temperature, where the reaction becomes reversible, but a product is still formed in high yield.



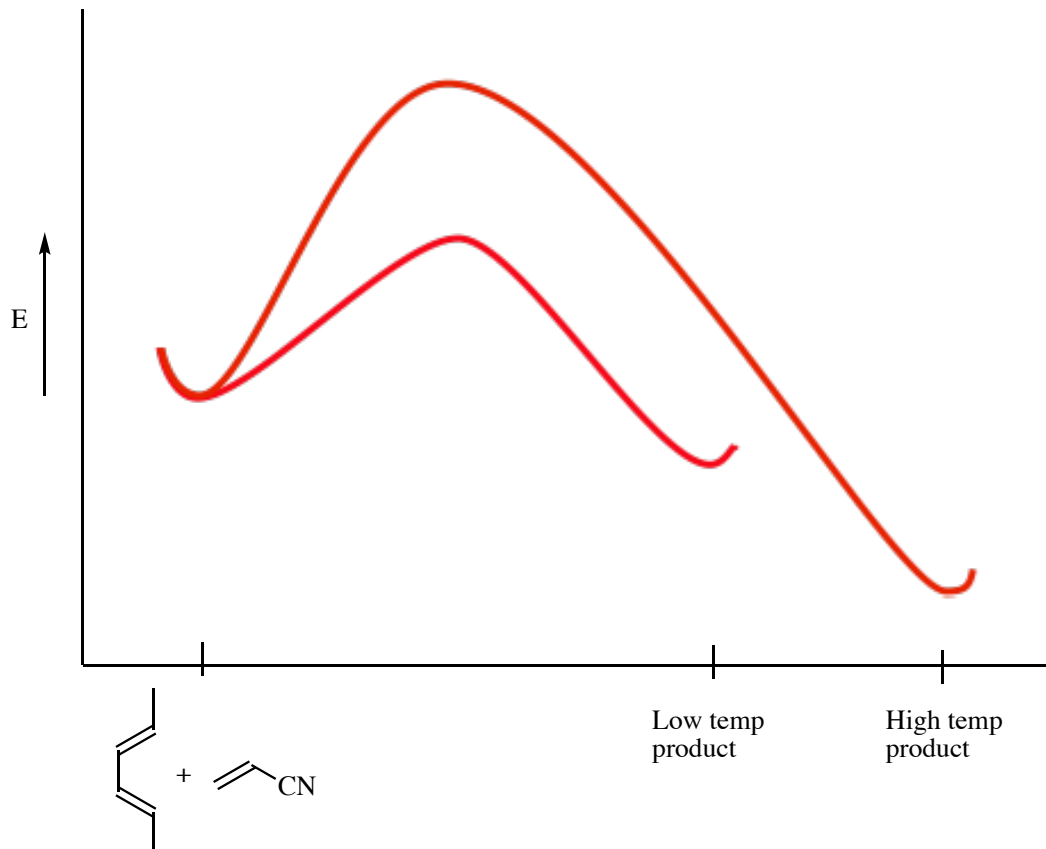
a) Give the major product expected for the reaction run under the low temperature (irreversible) conditions.



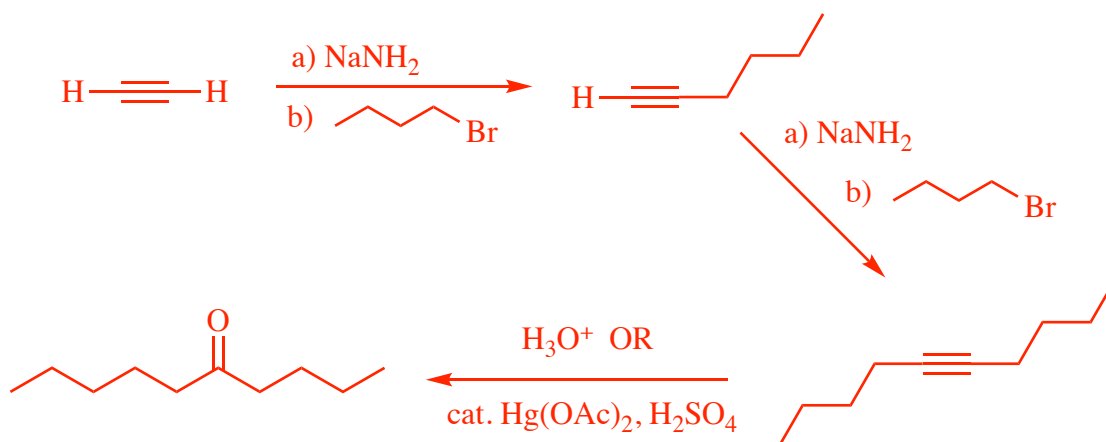
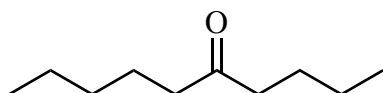
b) Give the major product expected for the reaction run at high temperature (reversible).



c) Complete the energy diagram below, showing both reactions on the same diagram.



5) (20 pts) a) Propose a synthesis of the following ketone target using any organic starting materials with **five carbons or less**. You may use any necessary inorganic reagents. More than one step will be required. Each reaction in the sequence leading to an isolated and purified product should be shown. Please use letters over/under one arrow to indicate sequential addition of reagents in a single reaction. **Do not put multiple reactions over/under one arrow!**



5 – continued

b) Give an arrow-pushing mechanism for the following reaction:

