CHEMISTRY 3311, Fall 2002
Professor Walba
Third Hour Exam, November 21

scores:

1)

2)

3)

4)

5)

_____

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

Name (printed): _____

Signature: _____

Recitation TA Name: _____

Recitation day and time: _____

This is a closed-book exam. The use of notes, models, calculators, and other paraphernalia will not be allowed during the exam. Please put all your answers on the test. Use the backs of the pages for scratch.

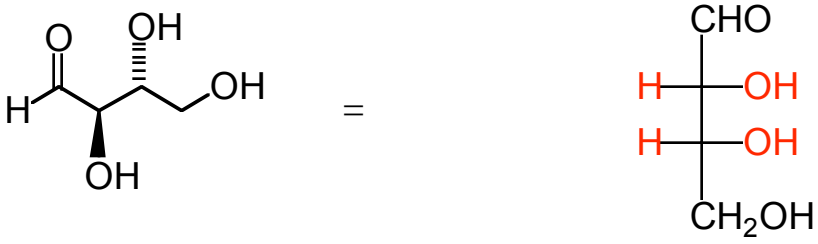
PLEASE read the questions carefully!

Partial Periodic Table

1A							8A
1 H	2A	3A	4A	5A	6A	7A	2 He
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	

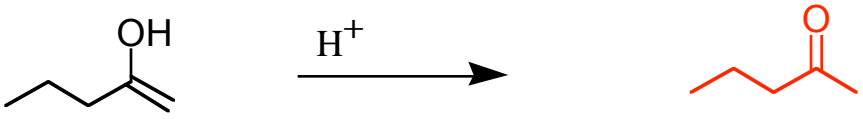
Name:_____

1 (20 pts) a) A wedges and dashes structure of D-erythrose (**1**), is given below. Fischer determined the structure of this four-carbon sugar as part of his amazing proof of the structure of glucose. Complete the Fischer projection structure of D-erythrose.



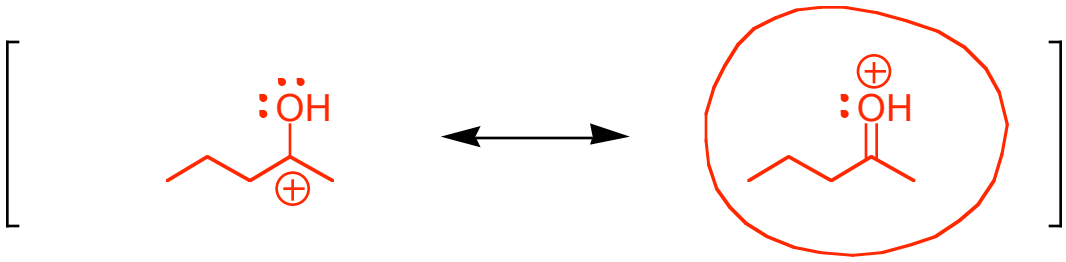
1

b) In the presence of tiny traces of protic acid (H^+), the enol **2** is converted extremely rapidly to a more stable isomeric compound **3**. Give the structure of compound **3**.



2 **3**

c) The isomerization of **2** to **3** involves the intermediacy of a cation with molecular formula $(C_5H_{11}O)^+$. The structure of this cation cannot be represented by a single valence-bond structure. But, the cation's structure is well represented as a resonance hybrid of two valence-bond structures. Give the two resonance structures for this cation, and **circle the structure that is the most important contributor to the structure of the cation**.

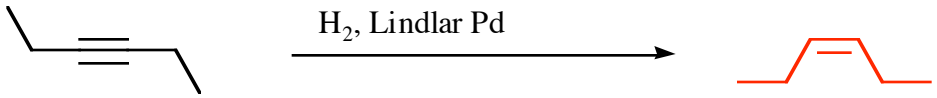


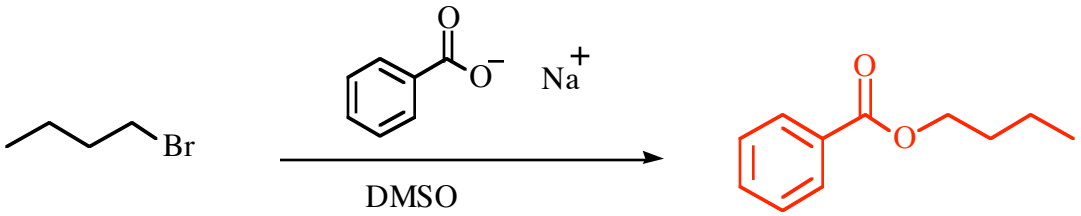
d) Give a one word explanation of the fundamental reason why the resonance structure you circled is the most important contributor.

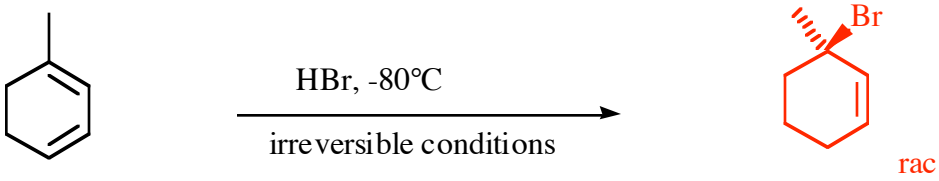
Octets

Name:_____

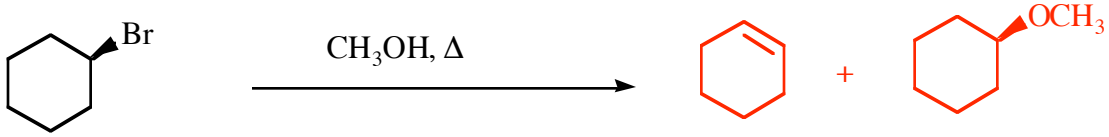
2) (20 pts) Give the single major organic product of each of the following reactions, unless you are specifically asked for more than one product. Carefully indicate the stereochemistry of the product(s) if appropriate. If a racemate is formed, show only one enantiomer, and label it "rac."

a) 

b) 

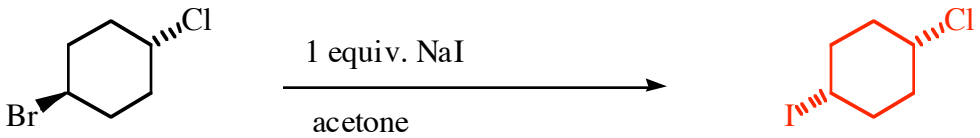
c) 

rac

d) 

Give **2** major products for reaction d.

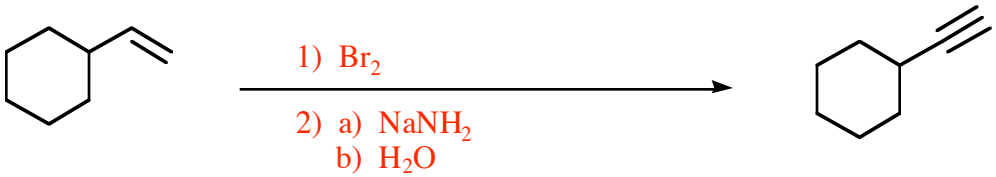
---

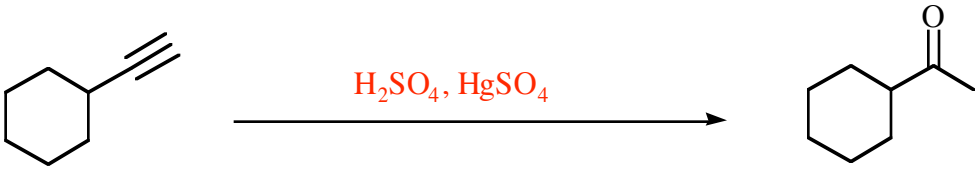
e) 

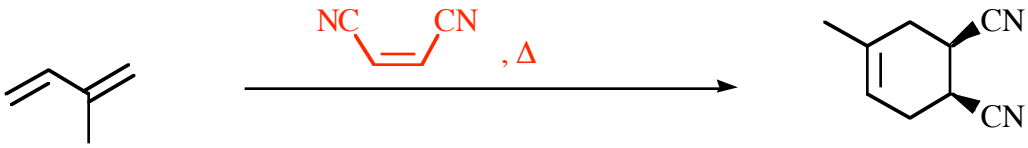
Name:_____

3) (30 pts) Propose reagents for accomplishing the following transformations. NOTE: more than one step may be required! Try to make your synthesis efficient (i.e. the desired product should be the major product). You must use the starting material given; you may use any other reagents you need.

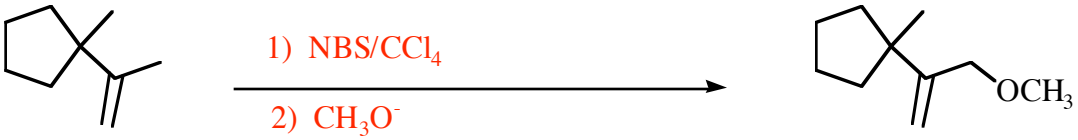
a) 

b) 

c) 

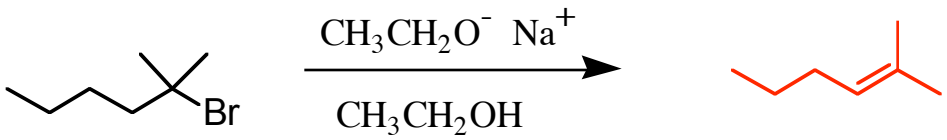
d) 

rac

e) 

Name:_____

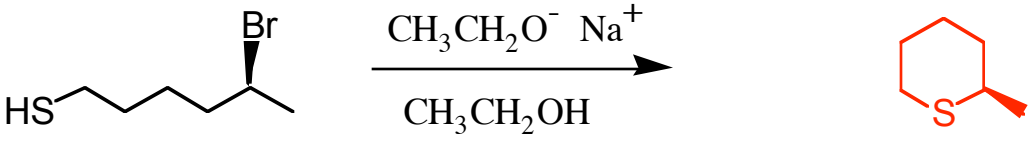
4) (20 pts) a) When 2-bromo-2-methylhexane is allowed to react with sodium ethoxide in ethanol, one major product is formed. Give the structure of the major product of this reaction.



1

b) Give the name of the mechanism by which the major product in part 4a is formed. E2

When the bromo-thiol **2** is allowed to react with sodium ethoxide in ethanol, a single new product is formed in high yield, with the molecular formula indicated. Spectroscopy shows that this product has NO DOUBLE BONDS! To understand this reaction, it is helpful to know that the pKa of RSH is about 10, while the pKa of ROH is about 16.

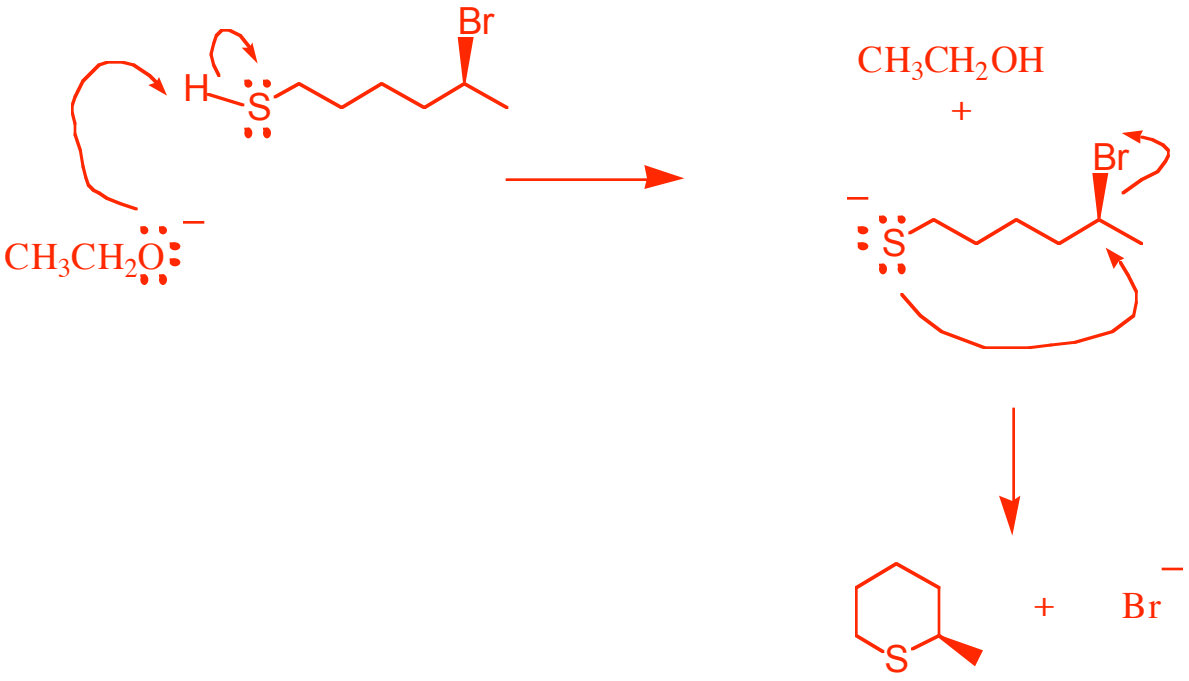


2

$C_6H_{12}S$

c) Give the structure, carefully showing stereochemistry, of the product of this reaction.

d) Propose an arrow-pushing mechanism for the formation of this product.



Name:_____

5) (10 pts) Propose a synthesis for the following target using any organic starting materials with FIVE carbons or less, and any inorganic reagents you need. NOTE: Your starting materials can have elements in addition to carbon and hydrogen! Try to make your synthesis efficient (that is, the desired product in each step should be the major product).