CHEM 203

Midterm Exam 1
October 15, 2015

ANSWERS

Your name: _____

This a closed-notes, closed-book exam

You may use your set of molecular models

This exam contains 6 pages

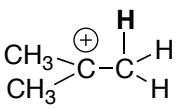
Time: 1h 30 min

1. _____ / 15
2. _____ / 15
3. _____ / 15
4. _____ / 15
5. _____ / 20
6. _____ / 20

TOTAL _____ / 100

This exam counts for 18.75% of your CHEM 203 final grade

1. (15 pts) Indicate the approximate pKa's for the Bronsted dissociation of the proton in boldface in the following molecules (write your answers in the appropriate boxes)



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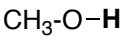

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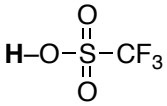

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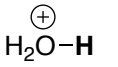

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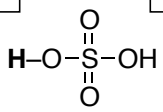


– 5

– 7

2. (15 pts.) Draw accurate structures of (write your answers in the appropriate boxes):

a. An achiral alkene containing at least 3 carbon atoms that produces a chiral bromohydrin upon treatment with Br_2/H_2O, and an achiral alkene, also containing at least 3 carbon atoms, that produces an achiral bromohydrin under the same conditions

produces a chiral bromohydrin

e.g. 

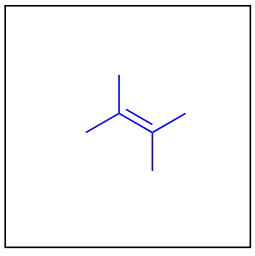
produces an achiral bromohydrin

e.g. 

other answers may be acceptable

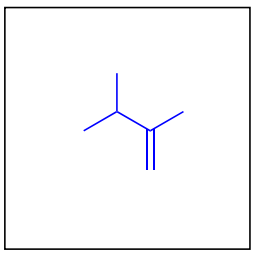
b. Three isomeric alkenes, **A**, **B**, and **C**, that produce ether **D** upon reaction with CH_3OH and HBF_4

alkene A



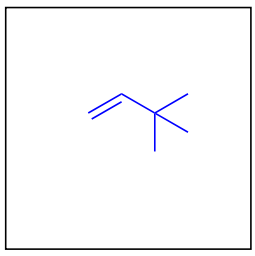
or

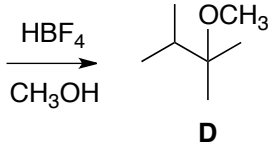
alkene B



or

alkene C





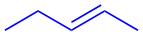
D

c. An alkene that yields only 1 product when treated with O_3 followed by Zn/H^+, and one alkene that affords two products when treated under the same conditions:

yields one product

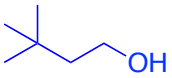
e.g. 

yields two products

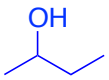
e.g. 

d. An alcohol that is likely to undergo rearrangement upon dehydration with hot H_2SO_4, and one that is unlikely to undergo rearrangement under the same conditions:

likely to rearrange

e.g. 

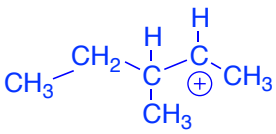
not likely to rearrange

e.g. 

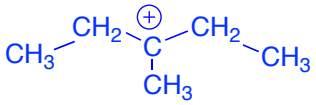
other answers may be acceptable

e. A carbocation stabilized by 4 hyperconjugative interactions with C–H bonds, which is likely to rearrange to give a new carbocation stabilized by 7 hyperconjugative interactions with C–H bonds

starting carbocation stabilized by 4 C–H hyperconjugations

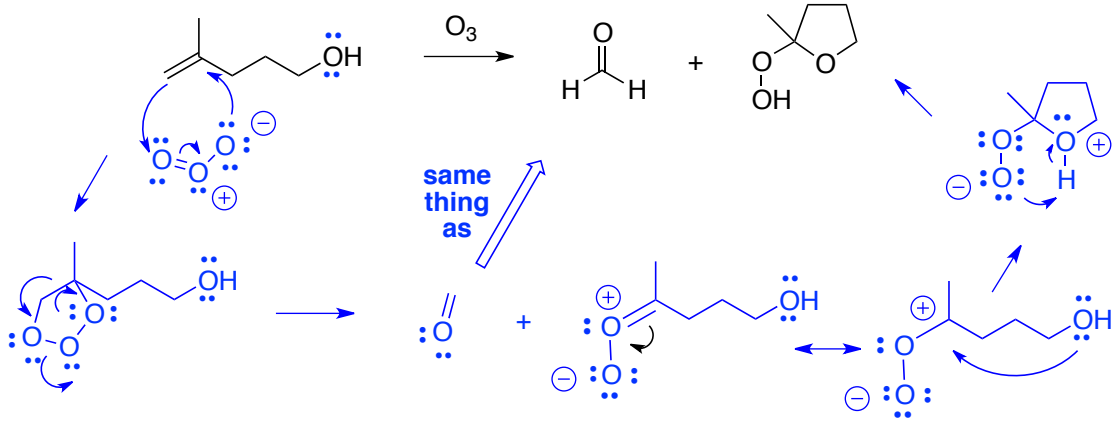


rearranged carbocation stabilized by 7 C–H hyperconjugations

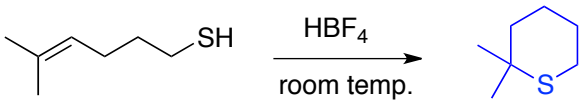


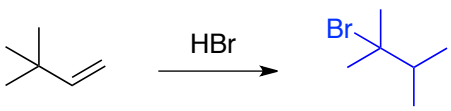
other answers may be acceptable

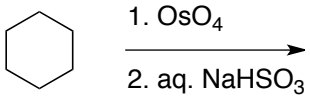
3. (15 pts.) Draw an accurate mechanism (curved arrows, electron dots, formal charges, etc.) for the following known reaction:



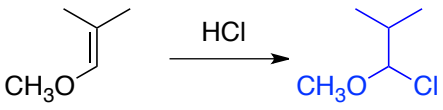
4. (15 pts.) Provide the structure of the major product(s) expected from the following reactions. If no reaction is expected, answer "NO REACTION". **Important**: compounds incorporating multiple stereogenic centers must be drawn with the correct relative configuration.

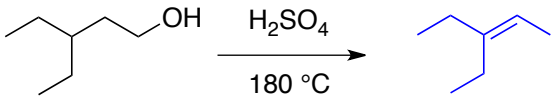
a. 

b. 

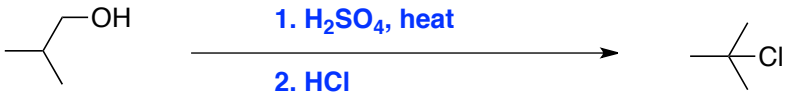
c. 

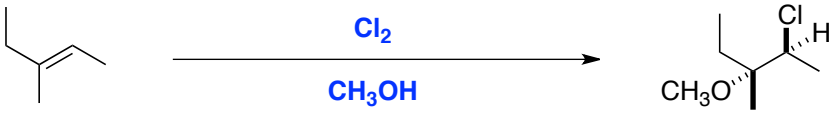
no reaction

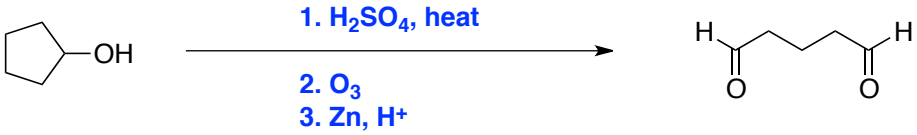
d. 

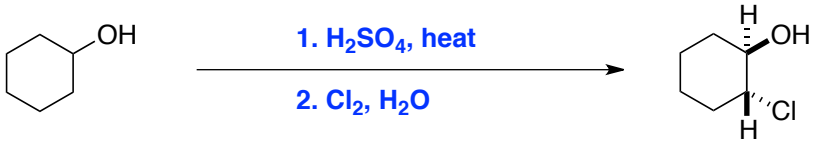
e. 

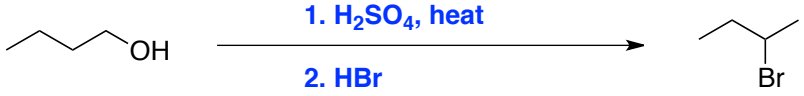
5. (20 pts.) Complete the following chemical equations by indicating all reagents / catalysts, in the correct order, that are required to convert the substrates into the products. More than one reaction may be needed to achieve the desired transformation. Provide your answer as a numbered list drawn above / below the reaction arrows. If you should conclude that a product cannot be obtained from the starting compound shown by any method known to you, write "INACCESSIBLE" on the reaction arrow.

a. 

b. 

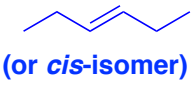
c. 

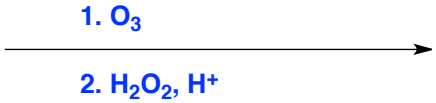
d. 

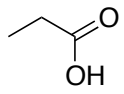
e. 

6. (20 pts.) Propose a method for the preparation of compounds a. – e. below starting from appropriate olefinic materials. Draw a clear structure of your proposed starting alkene on the left side of the reaction arrow. Above/below the reaction arrow, list all reagents / catalysts, in the correct order, that are required to induce the desired transformation. **Important**: the desired compound must be the major product of your reaction(s). If a product does not appear to be available by any reaction known to you, write "INACCESSIBLE" on the reaction arrow.

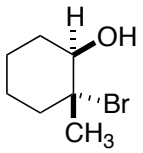
Note: it is understood that chiral compounds will be obtained as racemic mixtures.

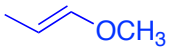
a.  (or *cis*-isomer)

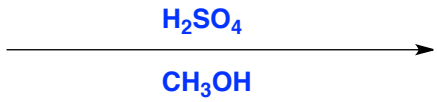


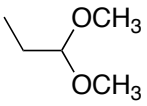


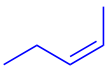
b.

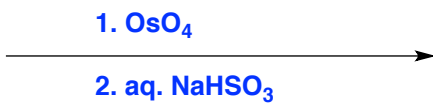


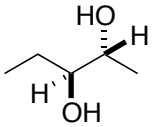
c.  (or *cis*-isomer)





d. 





e.