

## Final Exam

Professor R. Hoenigman

I pledge to uphold the CU Honor Code:

Signature \_\_\_\_\_

Name (printed) \_\_\_\_\_

Last four digits of your student ID number \_\_\_\_\_

Recitation TA \_\_\_\_\_

Recitation number, day, and time \_\_\_\_\_

You have 2 hours and 30 minutes to complete this exam.

No model kits or calculators allowed.

Periodic table and scratch paper are attached.

**DO NOT TURN THIS PAGE UNTIL INSTRUCTED TO DO SO.**

### Recitation Sections:

#	Day	Time	TA
211	Monday	8 am	Noel
251	Monday	2 pm	Carolynn
291	Monday	5 pm	Heather
252	Tuesday	12 pm	Sam
293	Tuesday	5 pm	Carolynn
212	Wednesday	8 am	Noel
253	Wednesday	1 pm	Tom
292	Wednesday	5 pm	Heather
213	Friday	8 am	Heather

### Score:

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**TOTAL** \_\_\_\_\_/250

1. (10 pts) BenzaClin is a topical antibiotic with the structure shown below.

A. Label the configuration of each indicated chirality center in BenzaClin.

B. Circle **all** of the terms below that describe one or more structural feature of BenzaClin.

Amine

Ketone

Aldehyde

Amide

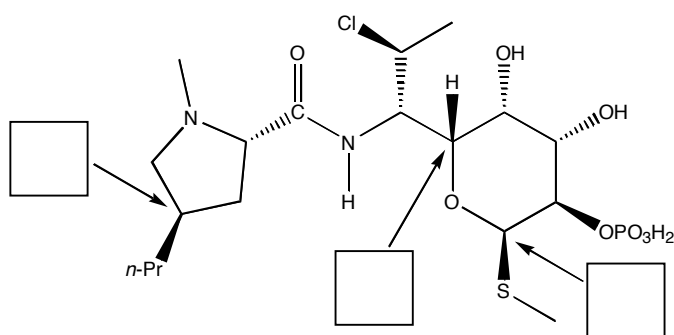
Ester

Sulfide

Nitrile

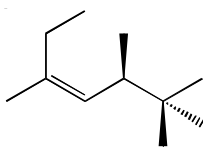
Ether

Thiol

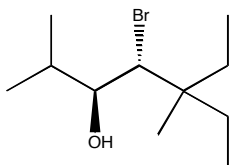


2. (6 pts) Give the IUPAC name for each of the following compounds.

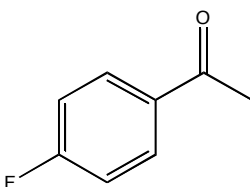
A.



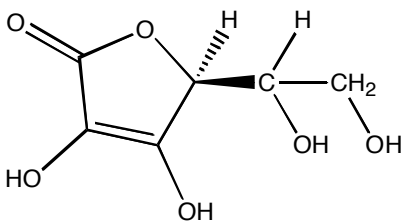
B.



C.



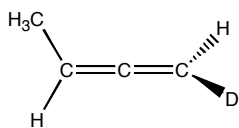
3. (5 pts) Vitamin C, shown below, has a  $pK_a$  of 4.1. Circle the most acidic hydrogen in Vitamin C.



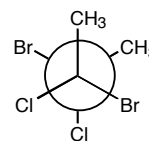
4. (10 pts) Explain why an ester can be both an activating, *ortho/para* director and also a deactivating, *meta* director. Use resonance structures to support your discussion.

5. (15 pts) The bromination of anisole produces two isomeric bromoanisoles. Using curved arrows to show the flow of electrons, give a mechanism to account for the formation of these two products.

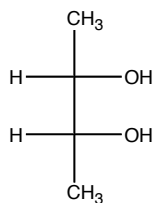
6. (5 pts) Circle the compounds below that are chiral.



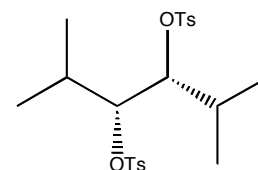
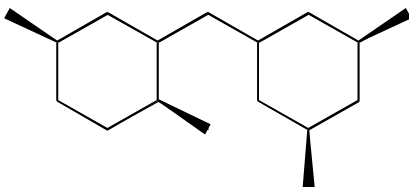
*cis*-3-methylcyclobutanol



(1*R*,2*S*)-1,2-dimethylcyclopentane

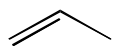
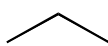


(+)-2-chlorobutane



7. (15 pts) Circle the more acidic compound in the following pairs. Give the reason for your choice in the adjacent box.

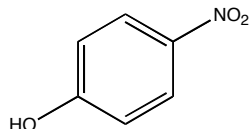
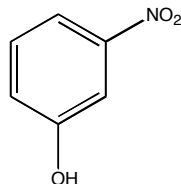
A.

*or*


B.

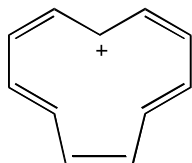
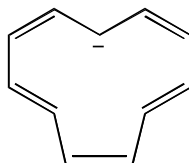
*or*


C.

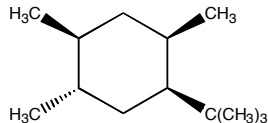
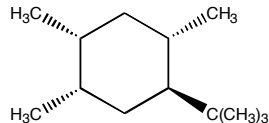
*or*


8. (15 pts) Circle the compound that has the *lower* heat of combustion. Give the reason for your choice in the adjacent box.

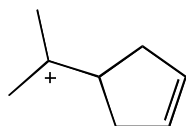
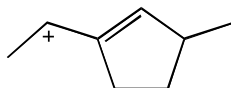
A.

*or*


B.

*or*


C.

*or*

9. (10 pts) Catalytic hydrogenation of 1,4-dimethylcyclopentene yields a mixture of two products. One of these products is formed in a much greater yield than the other (the observed ratio is 10:1). Draw the products of this reaction and circle the major product. Why is there a preference for one of these products?

10. (5 pts) Match the following alkenes with the appropriate  $\Delta H_{H_2}$  value. Heats of hydrogenation: 151 kJ/mol, 122 kJ/mol, 114 kJ/mol, 111 kJ/mol, 105 kJ/mol

\_\_\_\_\_ 1-pentene

\_\_\_\_\_ (*E*)-4,4-dimethyl-2-pentene

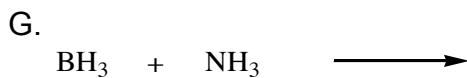
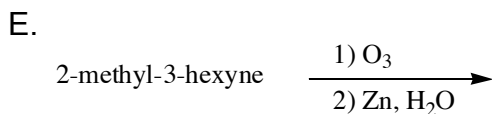
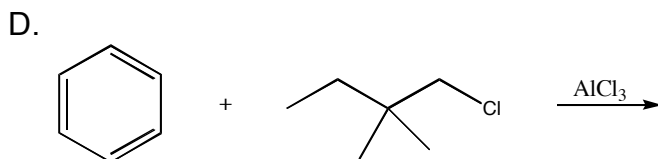
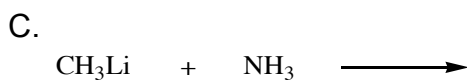
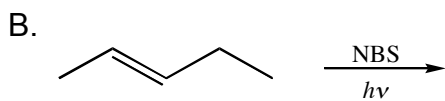
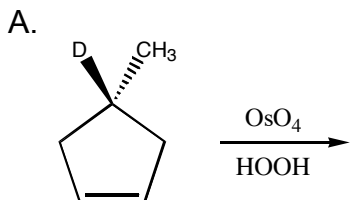
\_\_\_\_\_ (*Z*)-4-methyl-2-pentene

\_\_\_\_\_ (*Z*)-2,2,5,5-tetramethyl-3-hexene

\_\_\_\_\_ 2,4-dimethyl-2-pentene

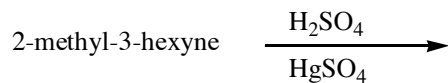
11. (5 pts) Explain why 3-pentanol has a higher boiling point than 3-chloropentane.

12. (80 pts) Give the major organic product(s) of the following reactions. Be sure to clearly show stereochemistry using dashes and wedges. Write NR if no reaction occurs. **Clearly label any enantiomers, diastereomers, and/or meso compounds.** (Note: some problems have more than one step.)

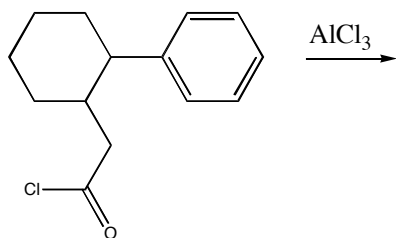


12. continued. [Be sure to clearly show stereochemistry using dashes and wedges. Write NR if no reaction occurs. Clearly label any enantiomers, diastereomers, and/or meso compounds; some problems have more than one step.]

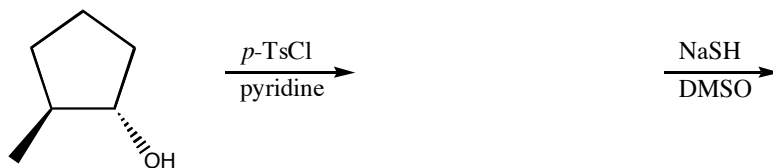
H.



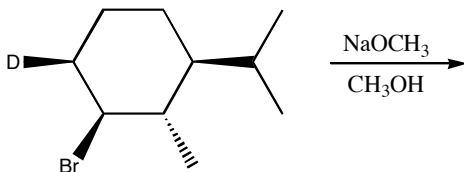
I.



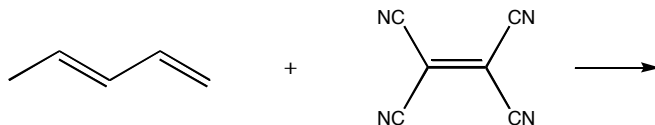
J.



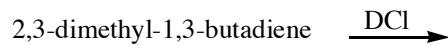
K.



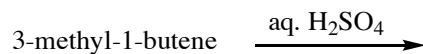
L.



M.



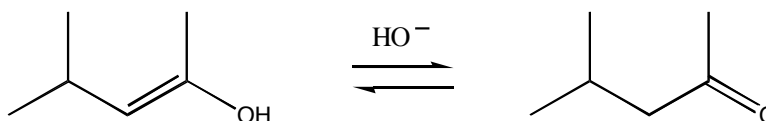
N.





13. (12 pts) Using curved arrows to show the flow of electrons, draw a mechanism for the solvolysis of *tert*-butyl bromide in acetic acid.

14. (12 pts) Using curved arrows to show the flow of electrons, propose a mechanism for the base catalyzed enol-keto tautomerization shown below.



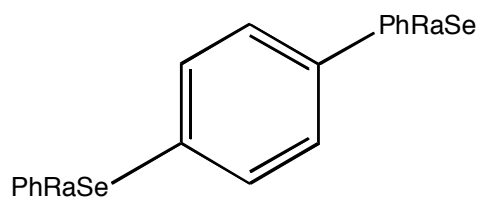
15. (45 pts) Propose an efficient synthesis for the following transformations. You may use any reagents you like. Be sure to show any intermediates. (Do not draw a mechanism.)

A. 1-bromo-2-chloropropane      *starting from*      propene

B. 3-bromo-5-nitrobenzoic acid      *starting from*      toluene

C. 2-butyne      *starting from*      1-butyne

Extra Credit: (10 pts) Draw a parody of aromatic nomenclature. For example, below is paraphrase.



## Scratch Page

## Scratch Page