CHEM 3311-100 Fall 2007

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 2.5 hours 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
111	Monday	8 am	Noel
151	Monday	2 pm	Noel
191	Monday	5 pm	Noel
113	Tuesday	8 am	Noel
193	Tuesday	5 pm	Noel
112	Wednesday	8 am	Doug
152	Wednesday	11 am	Jon
192	Wednesday	5 pm	Doug
153	Thursday	8 am	Noel

Score

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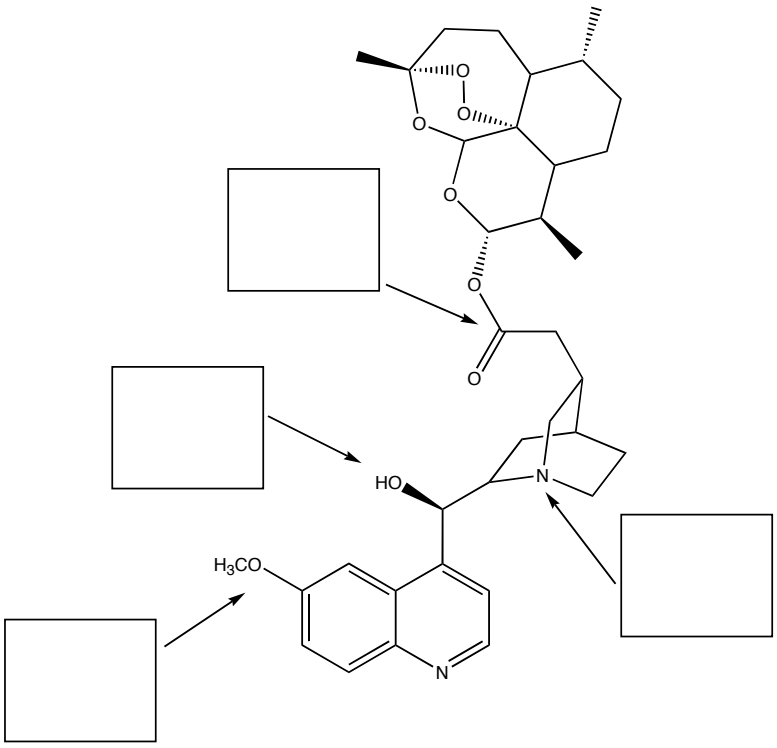
TOTAL_____/250

1. (8 pts) On the third exam, you were shown the structure of a drug hybrid of quinine and artemisinin, two drugs used to treat malaria. In the boxes below, label each indicated functional group. Label any alcohols, amines, or amides as 1°, 2°, or 3°.



2. (6 pts) One or more of the following names do not follow the IUPAC rules. Circle the incorrect name(s) and provide a correct IUPAC name.

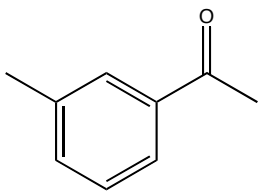
A. (*E*)-4,4,5-trimethyl-5-hepten-2-yne

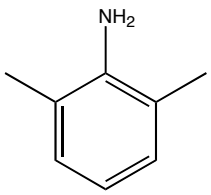
B. (*4R*,*2Z*)-*3*-propyl-2-penten-4-ol

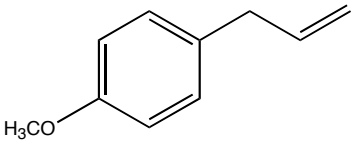
C. 4-*sec*-butylpentane

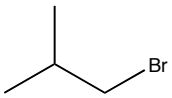
D. *cis*-1,2-dimethylcyclobutane

3. (8 pts) In the box below each compound write the IUPAC acceptable common name.



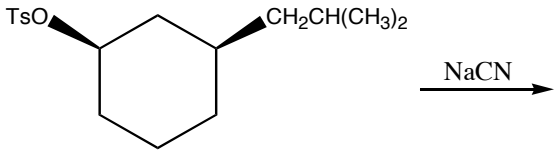




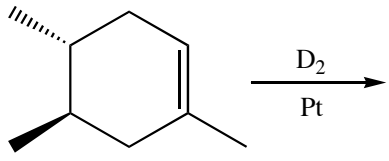


4. (20 pts) Draw the most stable chair conformation of the product(s) for each of the following reactions. If a pair of enantiomers is formed, draw one enantiomer and write "+ enant".

A.

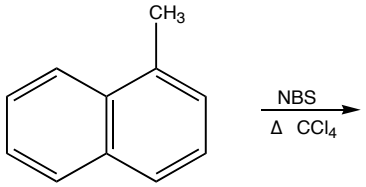


B.

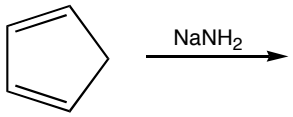


5. (36 pts) Draw the major organic product(s) of each of the following reactions. If necessary, clearly show the stereochemistry of the products. If no reaction occurs, write NR. **Write "meso" under any meso compounds. If a pair of enantiomers is formed, draw one enantiomer and write "+ enant".**

A.



B.



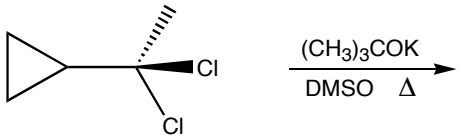
C.

Styrene $\xrightarrow{\text{PhCOOOH}}$

D.

(*2E,4E*)-2,4-hexadiene $\xrightarrow{\text{HCl}}$

E.



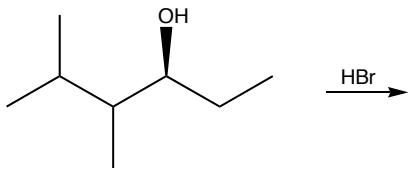
F.

3-ethyl-2-pentene $\xrightarrow[\text{2) HOOH, HO}^-]{\text{1) BH}_3 \cdot \text{THF}}$

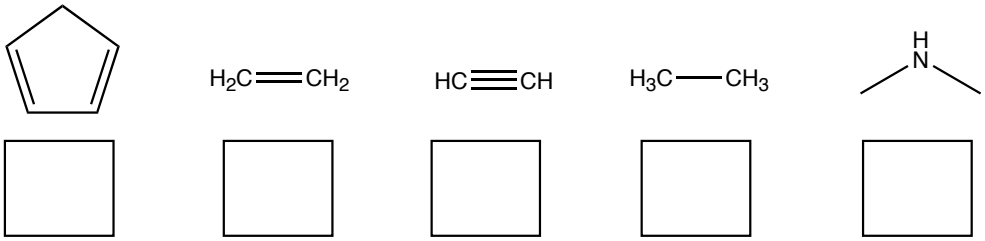
G.

(*R*)-2-bromopentane $\xrightarrow[\text{DMSO}]{\text{NaCN}}$

H.

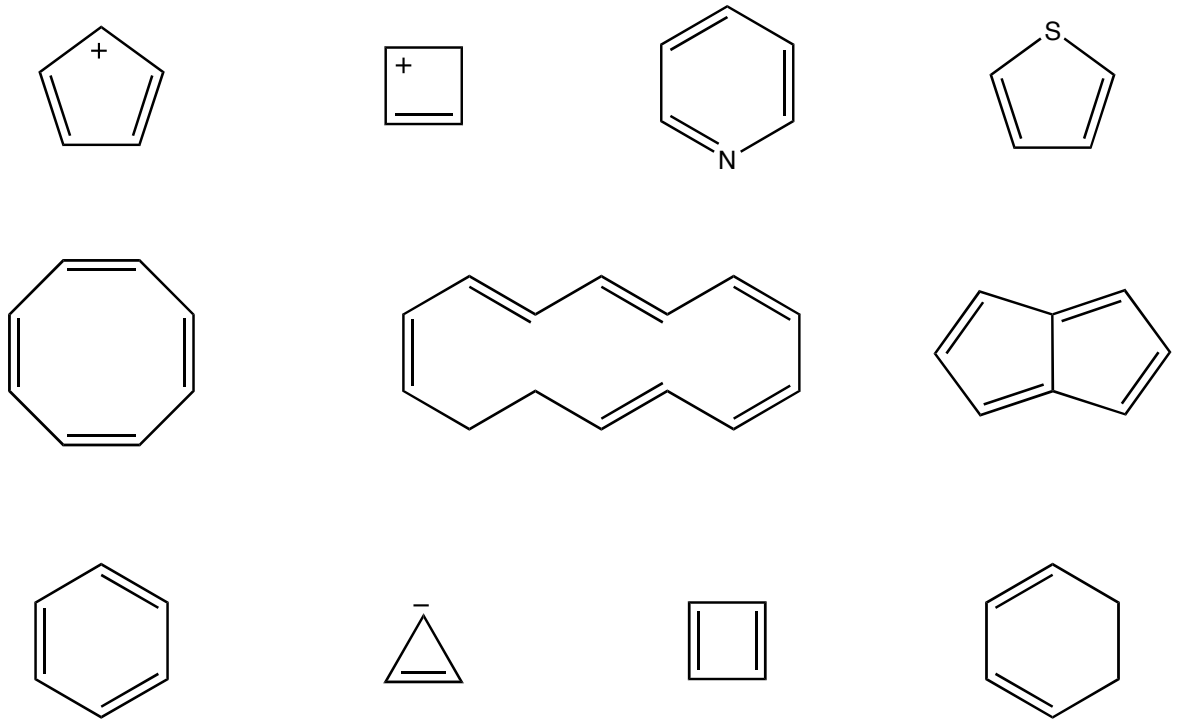


6. (5 pts) Rank the following in terms of increasing acidity (1 = most acidic, 5 = least acidic)

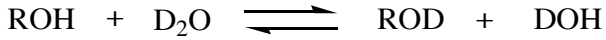


7. (5 pts) Explain your reasoning for problem 6.

8. (8 pts) Circle the aromatic compound(s) below. Draw a box around the anti-aromatic compound(s).

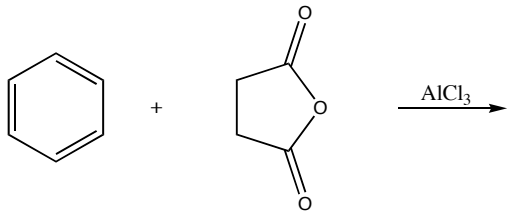


9. (15 pts) Deuterium oxide (D_2O) is water in which the protons (^1H) have been replaced by their heavier isotope deuterium (^2H). When D_2O is added to an alcohol (ROH), deuterium replaces the proton of the hydroxyl group.



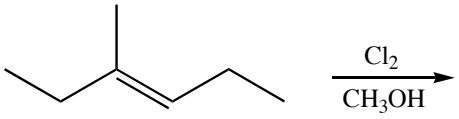
The reaction takes place extremely rapidly, and if D_2O is present in excess, all the alcohol is converted to ROD. This hydrogen-deuterium exchange can be catalyzed by either acids or bases. If DO^- is the catalyst in base, write a reasonable mechanism for the conversion of ROH to ROD under basic conditions.

10. (16 pts) Using curved arrows to show the flow of electrons, draw a mechanism to account for the Friedel-Crafts acylation of benzene with succinic anhydride.



11. (20 pts) Using arrows to show the flow of electrons, draw a mechanism for the hydration of 1-butyne with aqueous sulfuric acid and mercury(II) sulfate. (Do not show $HgSO_4$ in your mechanism.)

12. (16 pts) Fill in the product(s) of the following reaction. Using arrows to show the flow of electrons, draw a mechanism for the reaction. Be sure to show any necessary stereochemistry.



13. (30 pts) Dehydrohalogenation of the diastereomeric forms of 1-chloro-1,2-diphenylpropane with sodium ethoxide is stereospecific. One diastereomer yields (*E*)-1,2-diphenylpropene, and the other yields the *Z* isomer. Which diastereomer yields which alkene? Why? Draw a Newman projection for each of the diastereomers to show the correct orientation of the reaction. Label all chirality centers as *R* or *S*, and all alkenes as *E* or *Z*. (Abbreviate phenyl, C_6H_5, as Ph)

14. (15 pts) Assume that you need to prepare 4-methyl-2-pentyne and you discover that the only alkynes on hand are acetylene and propyne. You also have available methyl iodide, isopropyl bromide, 1,1-dichloro-3-methylbutane, and sodium amide. Which of these compounds would you choose in order to perform your synthesis? Why? Write out each step of your proposed synthesis.

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

A. (16 pts) 1,2-dimethylcyclohexene *starting from* ethene and 2,3-dimethylbutane

B. (10 pts) *meso*-2,3-dibromobutane *starting from* 2-butyne

C. (16 pts) 1-bromo-2-methylpentane *starting from* 3-bromo-2-methylpentane

Extra Credit: (10 pts) Draw a parody of organic nomenclature. For example, below is paraphrase. (You don't have to use elements.)