**Chemistry 118 B**
**Winter 2010**
**Final**
**Wed. March 17, 2010**
**Instructor: Lievens**

This exam contains ten (10) pages and eleven (11) problems. Please make sure that your copy contains all ten (10) pages. If there is a problem, please tell the exam administrator prior to beginning. Please answer all questions. Remember that UCDavis Code of Academic Conduct applies to this exam and all other graded work in this class.

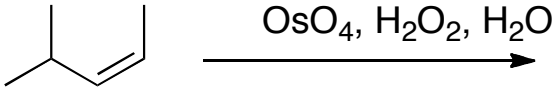
**Name:** _____
Last First MI

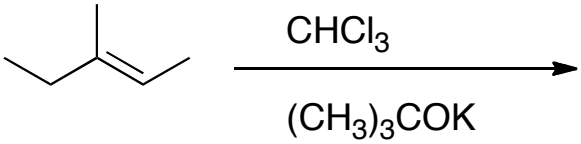
**Student ID. #** _____

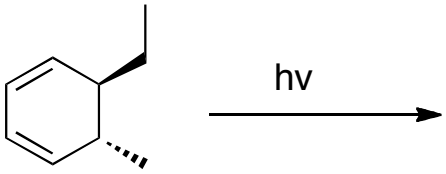
**T.A./ Lab Section:** _____

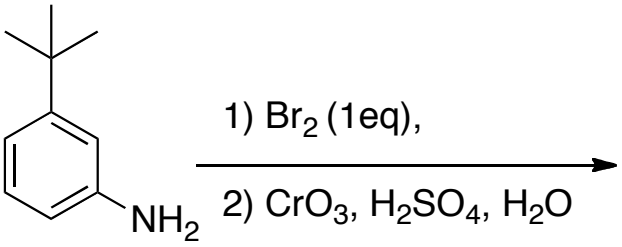
| Page # | Points | Page # | Points |
|---|---|---|---|
| 2 | | 7 | |
| 3 | | 8 | |
| 4 | | 9 | |
| 5 | | 10 | |
| 6 | | Total (217) | |

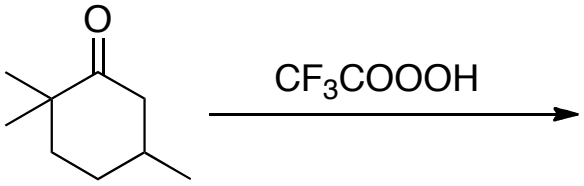
1. **Reactions:** (24 pts). Draw the structure of the expected organic product(s) formed in the following reactions including correct stereochemistry. If the product is racemic write both isomers or write racemic. Assume all reagents listed are present in excess unless otherwise noted. If no reaction occurs, state 'No Reaction'.

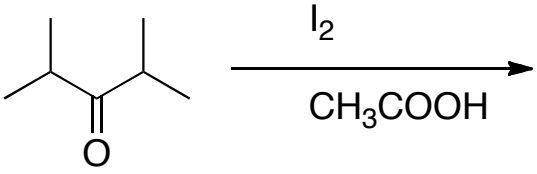
A) 


B) 

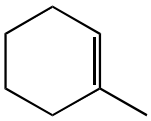

C) 

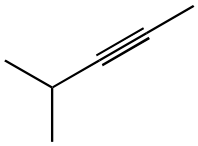

D) 

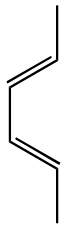
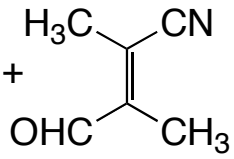

E) 

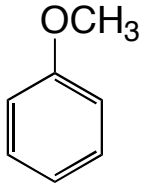

F) 

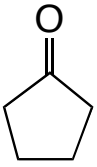
2. **Reactions:** (24 pts). Draw the structure of the expected organic product(s) formed in the following reactions including correct stereochemistry. If the product is racemic write both isomers or write racemic. Assume all reagents listed are present in excess unless otherwise noted. If no reaction occurs, state 'No Reaction'.

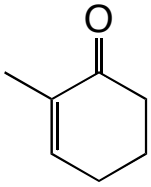
G)  $Br_2$, $CH_3OH$ → 12

H)  Na, $NH_3$ →

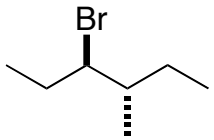
I)  +  heat →

J)  1) $CH_3Cl$ (3 eq), $AlCl_3$ → 2) HI

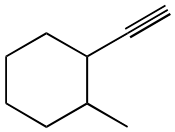
K)  1) $HSCH_2CH_2SH$, $ZnCl_2$ → 2) Raney Ni, $H_2$

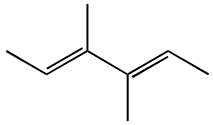
L)  1) $((CH_3)_2CHCH_2)_2CuLi$ → 2) $H_3O^+$

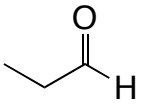
3. **Reactions:** (24 pts). Draw the structure of the expected organic product(s) formed in the following reactions including correct stereochemistry. If the product is racemic write both isomers or write racemic. Assume all reagents listed are present in excess unless otherwise noted. If no reaction occurs, state 'No Reaction'.

M) 

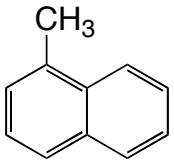
$CH_3O^-Na^+$ → 11

N) 
1) $HgSO_4$, $H_2O$, $H_2SO_4$
2) $NaBH_4$, $CH_3CH_2OH$ → 14

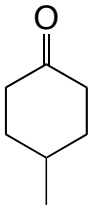
O) 
HBr (1 eq)
$0^o$ C →

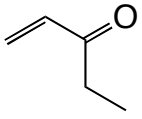
P) 

NaOH
Heat →

Q) 

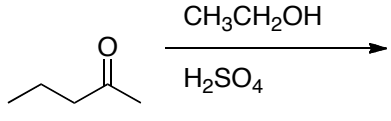
1) $(CH_3)_2CHCOCl$ (1 eq), $AlCl_3$ (xs)
2) $H_3O^+$ →

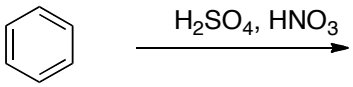
R) 



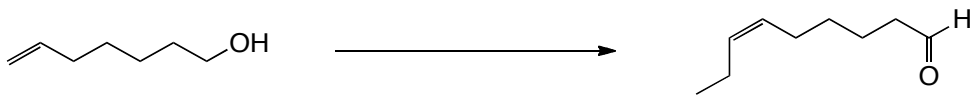
$H_2O$, NaOH →

4. **Mechanisms:** (30 pts). Show the detailed reaction mechanism for each of the following reactions. Include the structure of the expected products and all relevant resonance structures.

A) 


B) 

5. **Synthesis:** (21 pts). Show how you would carry out the following synthesis. Include the reagents you would need for each step and the intermediate products formed in each step.



6. **Vocabulary:** (27 pts.) Fill in the blanks with the appropriate vocabulary word. If two words are given circle the correct one.

A) Under _____ control of a reaction most stable intermediate is utilized. This usually occurs at **high / low** temperatures.

B) Reactions generally proceed **faster / slower** in an allyl system.

C) The _____ elimination uses an unhindered base to give a **less / more** substituted alkene from an alkyl halide.

D) Generally the α-carbon of a carbonyl acts as a good **nucleophile / electrophile** while the carbon in the carbonyl itself acts as a good **nucleophile / electrophile.**

E) Hemicetals can be formed from carbonyls using **base / acid / both / neither** as a catalyst, they are **always / sometimes / never** difficult to isolate as pure compounds.

F) Hydroboration of an alkene proceeds with _____ regioselectivity and a **syn / anti** addition of the new atoms.

G) Halogen substituents in electrophilic aromatic substition donate electrons by _____ but accept electrons by _____ and generally give **fast / slow** substitution with _____ direction.

H) In the electrocyclic opening of 3,4-dimethylcyclobutene with heat, the reaction proceeds in a _____ direction.

I) In general the dienophile of a Diels-Alder reaction is **electron rich / electron poor** and the diene is **electron rich / electron poor.**

J) **True / False.** A benzene generally reacts under the same conditions as an alkene.

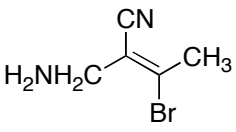
**K) True / False.** Ketones are better electrophiles than aldehydes in aldol reactions.

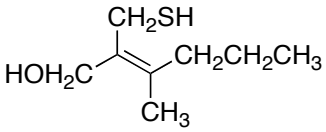
L) In general less substituted alkene is **more / less** stable than a more substituted alkene and is considered to be electron **rich / poor** and will react **faster / slower** with mCPBA than a more substituted alkene.

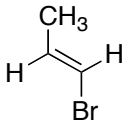
M) **Alcohols / aldehydes / ketones / alkenes** generally have the highest boiling point for their size.

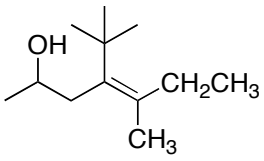
N) In $^{1}$H NMR of alkenes _____ coupling are the largest, _____ couplings are small couplings that occur between hydrogens on the same carbon, and _____ couplings are small couplings that cross four bonds.

7. **Identification:** (4 pts) Label each of the given molecules as E or Z.

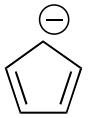


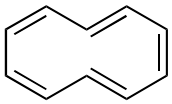



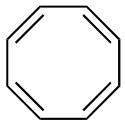



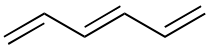

8. **Identification:** (6 pts). Label each of the given molecules as aromatic, nonaromatic, or antiaromatic.

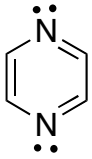




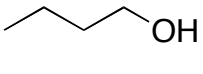


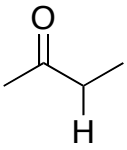


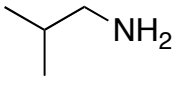


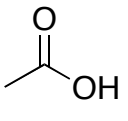


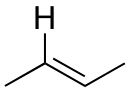

9. **Identification:** (8 pts). Rank the following by pKa of the explicit hydrogen. 1 = most acidic and 8 = least acidic.

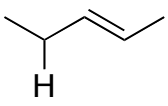


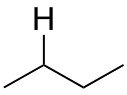



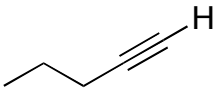



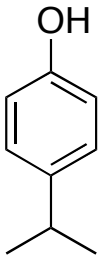



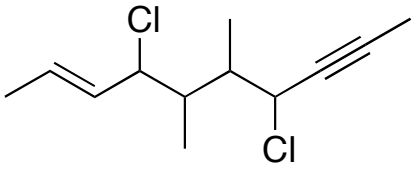
10. **Nomenclature:** (15 pts.). Give the proper (IUPAC) chemical name or draw the structure of each of the following compounds.

A) 5E,7Z-4-bromodec-5,7-diene-1-yn-3-ol

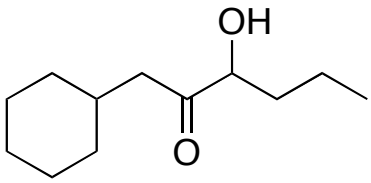
B)



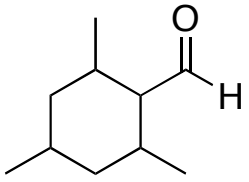

C)




D)

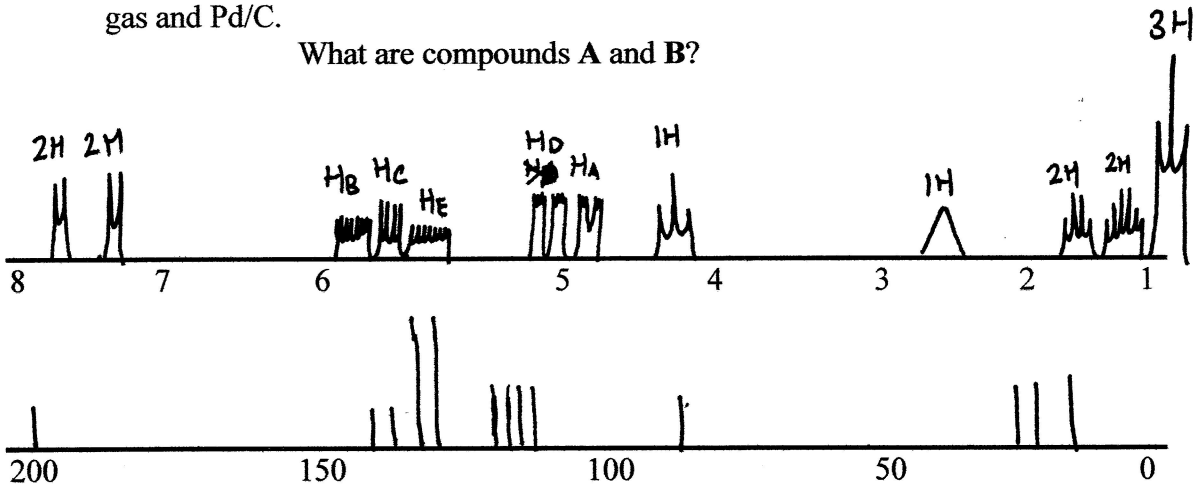



E)



1ϕ. **Spectroscopy:** (34 pts.) The unknown compound **A** ($C_{15}H_{18}O_2$) gives the following proton and carbon NMR spectra. Significant IR peaks were also observed. Compound **B** forms after reacting compound **A** with an excess of $H_2$ gas and Pd/C.

What are compounds **A** and **B**?




IR: ν 3327 (broad), 3050, 2950, 1680, 1590, 1209, 809 $cm^{-1}$.

$H_A$ = 1H J = 9 Hz (d), 3 Hz (d), 1 Hz (d)
$H_B$ = 1H J = 18 Hz (d), 14 Hz (d), 9 Hz (d), 2 Hz (d)
$H_C$ = 1H J = 16 Hz (d), 2 Hz (d)
$H_D$ = 1H J = 18 Hz (d), 3 Hz (d), 1.5 Hz (d)
$H_E$ = 1H J = 16 Hz (d), 14 Hz (d), 1.5 Hz (d), 1 Hz (d)