CHEM 310 Final Exam

Dr. Hanna

April 30, 2007

Honor Pledge:

In Part V of the Winthrop University Student Conduct Code, it is stated that "A fundamental tenet of all institutions of higher learning is academic honesty. … Misrepresentation of someone else's work as one's own is a most serious offense in any academic setting. … Academic misconduct includes but is not limited to providing or receiving assistance in a manner not authorized by the professor in the creation of work to be submitted for academic evaluation including papers, projects, and examinations …"

By my signature below, I pledge that I did not commit academic misconduct (cheat) on this examination.

KEY _____ _____

Printed Name Signature

Part 1 _____/35

Part 2 _____/35

Part 3 _____/30

Part 4 _____/60

Part 5 _____/20

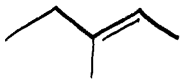
Part 6 _____/20

Total _____/200

Part 1: Nomenclature and Functional Groups (35 pts):

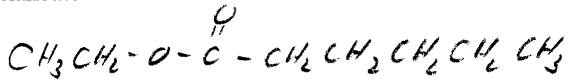
1A. Draw structures corresponding to the following IUPAC names (4 pts each):

i) (E)-3-Methylpent-2-ene

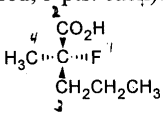


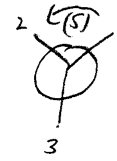
ii) 1,3-Diphenylpropan-2-one

iii) Ethyl hexanoate

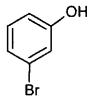


1B. Write IUPAC names for the following compounds (indicate stereochemistry where required, 5 pts. each):

i) 



(S) - 2-Fluoro-2-methylpentanoic acid

ii) 

m-Bromophenol

(3-Bromophenol)

iii) $CH_3-O-C(CH_3)_3$

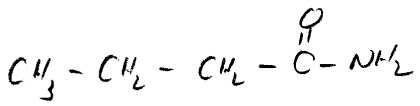
t-Butyl methyl ether

(2-Methoxy-2-methylpropane)

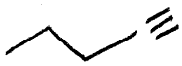
1C. Propose ~~structures~~ for molecules that fit the following descriptions (2 pts. each):

Examples

i) An amide containing 4 carbons

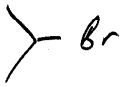


ii) An alkyne containing 5 carbons



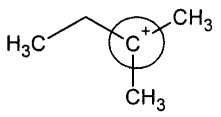
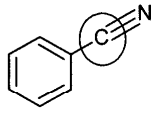
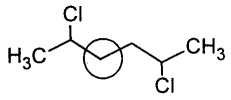
iii) A cycloalkene with a trisubstituted double bond

iv) A secondary alkyl halide

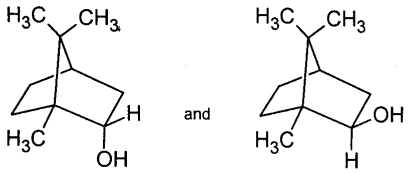


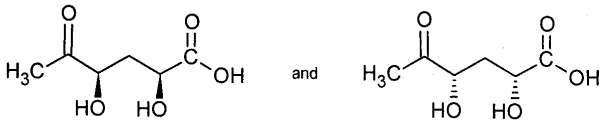
Part 2: Structure, Bonding, Stereochemistry, Conformational Analysis (35 pts):

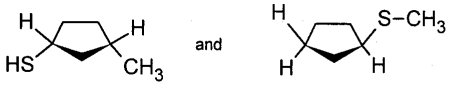
2A. Provide the hybridization of *and* the approximate bond angles around the circled atom in the following molecules or ions: (4 pts each):

		Hybridization	Bond Angle
i)		sp^2	120°
ii)		sp	180°
iii)		sp^3	109.5°

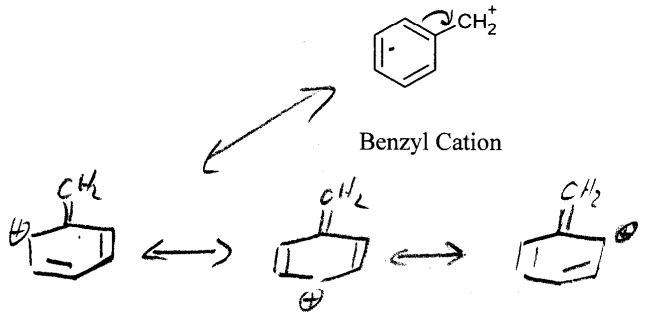
2B. Indicate whether the compounds in each pair are identical, constitutional isomers, enantiomers, or diastereomers. (3 pts. each):

i)  DIASTEREOMERS

ii)  ENANTIOMERS

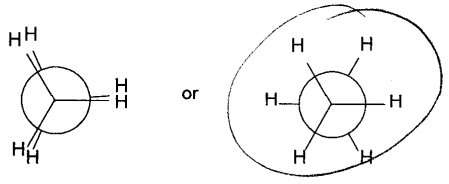
iii)  CONSTITUTIONAL ISOMERS

2C. The benzyl cation is a resonance stablized intermediate in many organic reactions. Draw three additional resonance forms for the benzyl cation (6 pts):



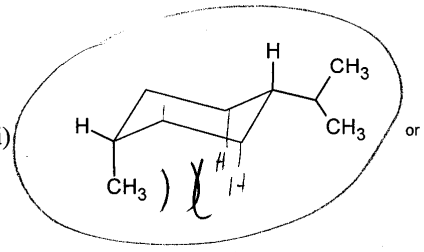
2D. Circle the more stable conformation in each pair and explain your answer (4 pts each):

i)



↖ HYDROGENS ARE FARTHER APART, LESS STERIC INTERACTION.

ii)

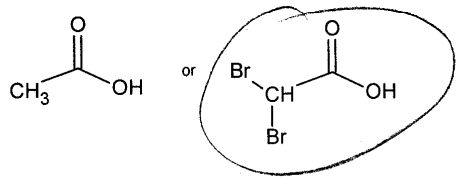


LARGER 1,3-DIAXIAL INTERACTIONS

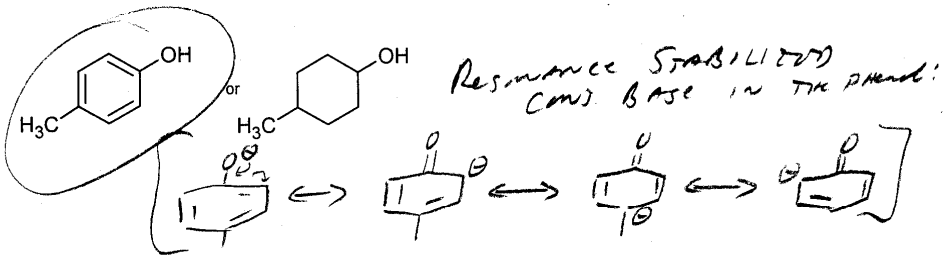
↑ LARGER ALKYL EQUATORIAL, LESS 1,3-DIAXIAL STERIC INTERACTIONS.

Part 3: Acids and Bases; Structure/Reactivity Relationships (30 pts):

3A. Circle the stronger acid in each pair and explain your answer: (4 pts each):

i) 

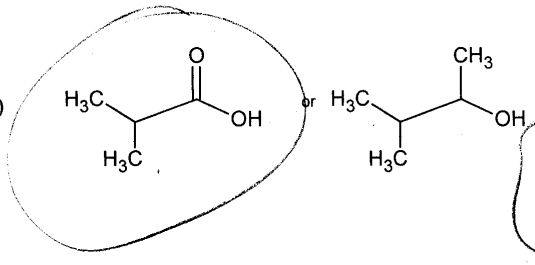
Br is e⁻/withdrawing relative to H ⇒ inductively stabilized conj. base.

ii) 

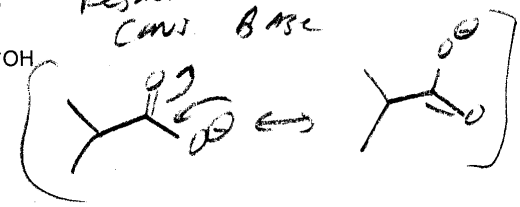
Resonance stabilized conj base in the phenol:

iii) HCl or 

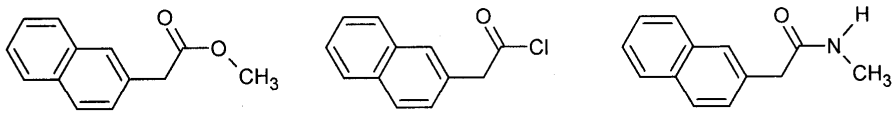
$I^{\ominus}$ is larger, more stable ion than $Cl^{\ominus}$

iv) 

Resonance stabilized conj base

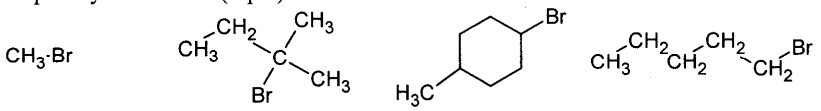


3B. Rank the following compounds in order of reactivity toward nucleophilic acyl substitution (1 = fastest, 3 = slowest) (4 pts):



A: 2 B: 1 C: 3

3C. Rank the following compounds in order of S_N1 reactivity (1 = fastest, 4 = slowest). Explain your answer (5 pts):

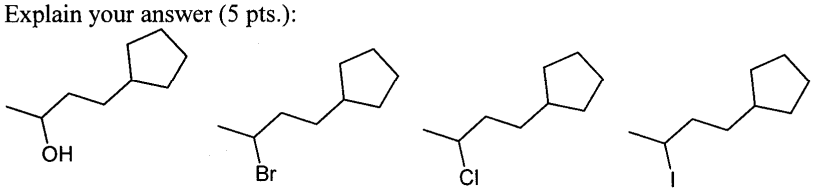


A (4) B (1) C (2) D (3)

3° CATION MORE STABLE THAN 2°, & 2° >> 1° >> METHYL.

∴  FORMS FASTEST;  IS NEXT, etc

3D. Rank the following compounds in order of S_N2 reactivity (1 = fastest, 4 = slowest). Explain your answer (5 pts.):

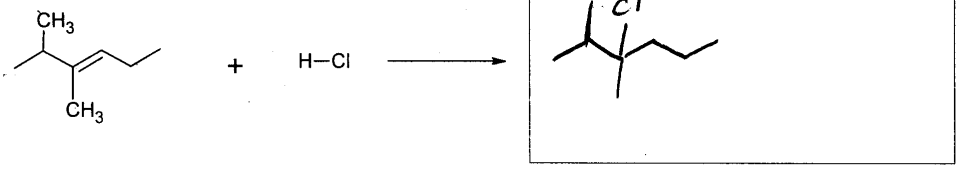


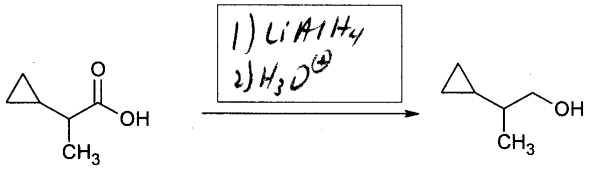
A (4) B (2) C (3) D (1)

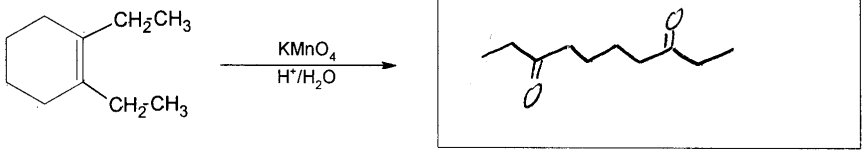
BETTER LG ⇒ FASTER S_N2

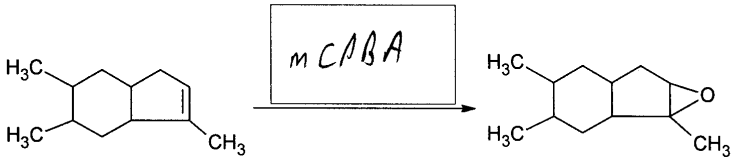
I > Br > Cl >> OH IN LG ABILITY

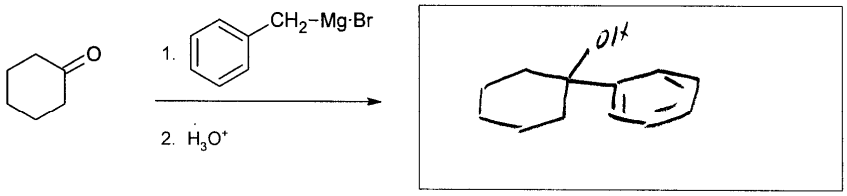
Part 4: Provide the Reagent(s) or Product(s) (60 pts):

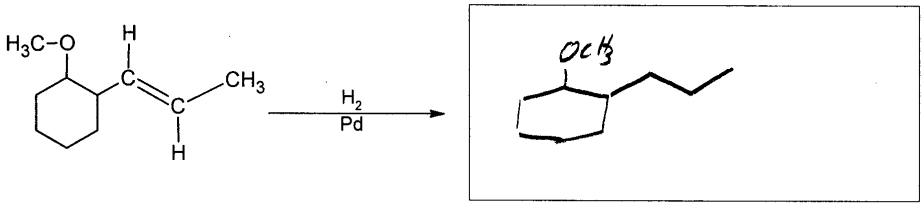
i) 

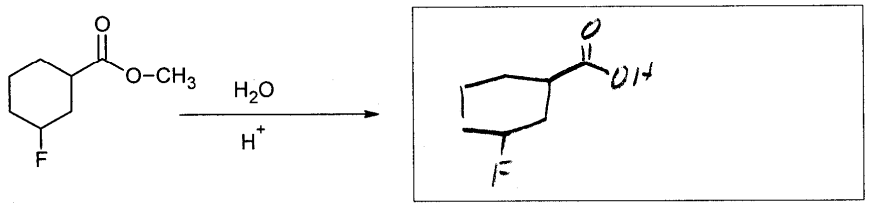
ii) 

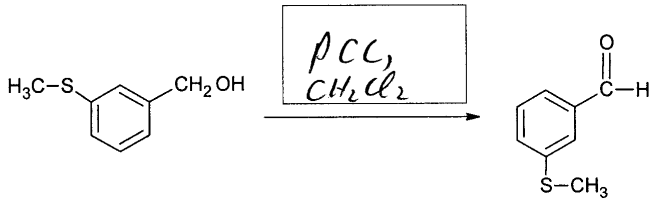
iii) 

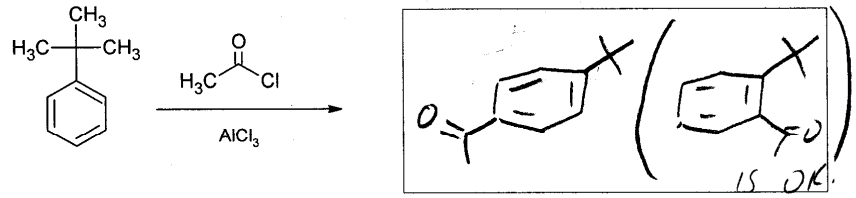
iv) 

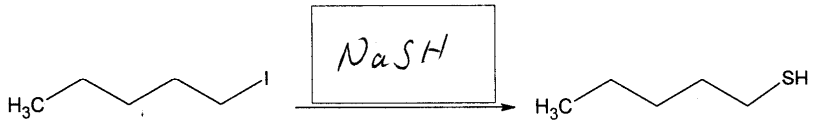
v) 

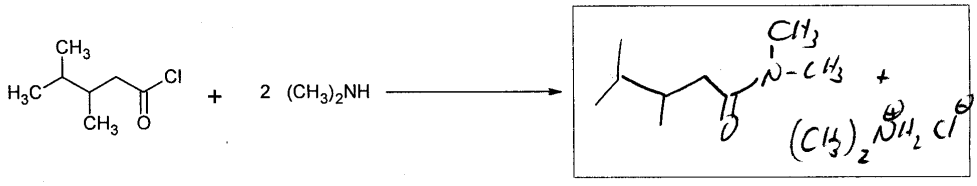
vi) 

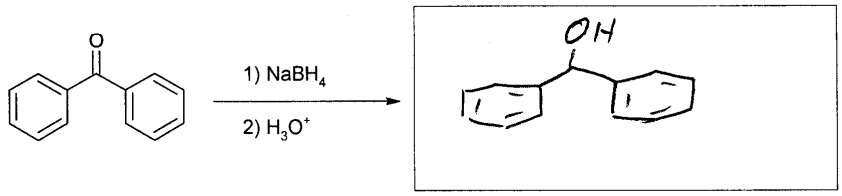
vii) 

viii) 

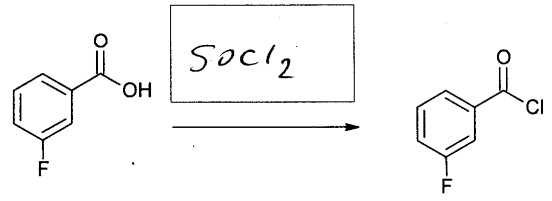
ix) 

x) 

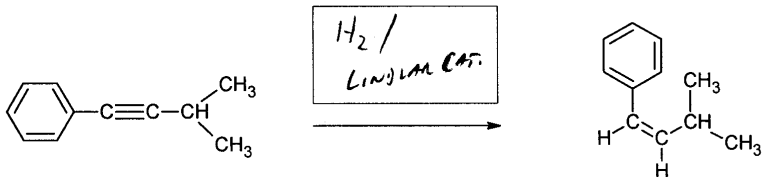
xi) 

xii) 

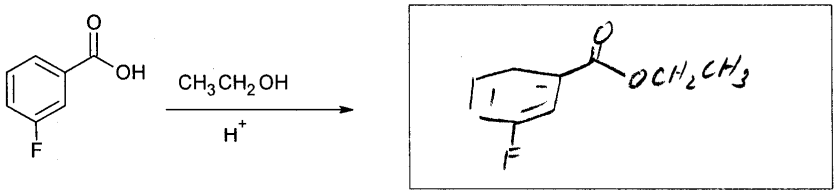
xiii)


O
OH
F
SOCl2
O
Cl
F

xiv)


C≡C–CH
CH3
CH3
H2 / LINDLAR CAT.
CH3
CH
CH3
H
C
C
H

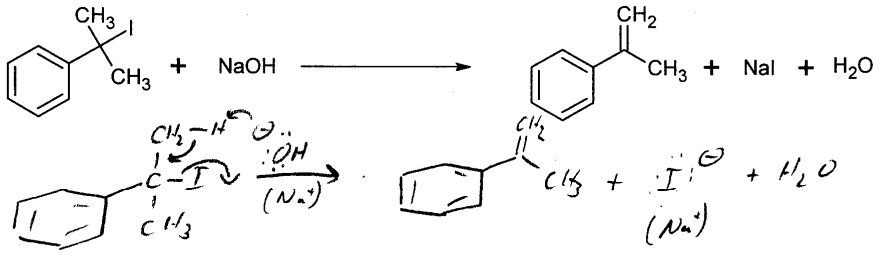
xv)


O
OH
F
CH3CH2OH
H+
O
OCH2CH3
F

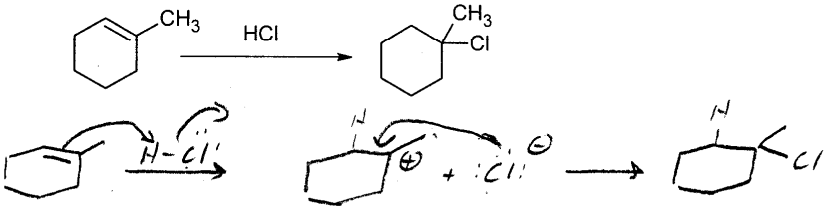
Part 5: Reaction Mechanisms (20 pts):

5A. Provide complete arrow-pushing mechanisms for the following transformations (5 pts. each):

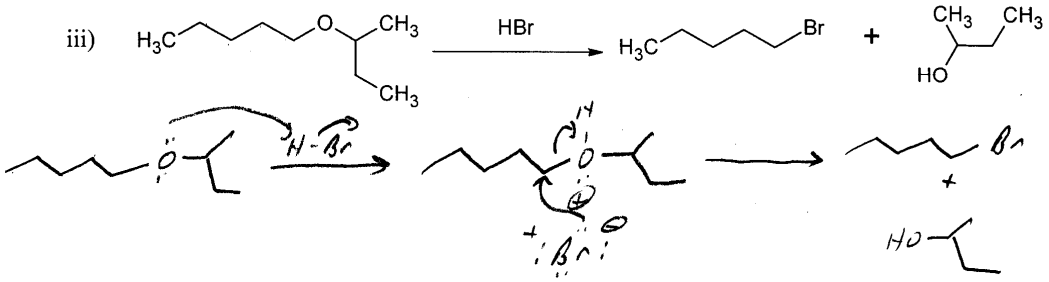
i)



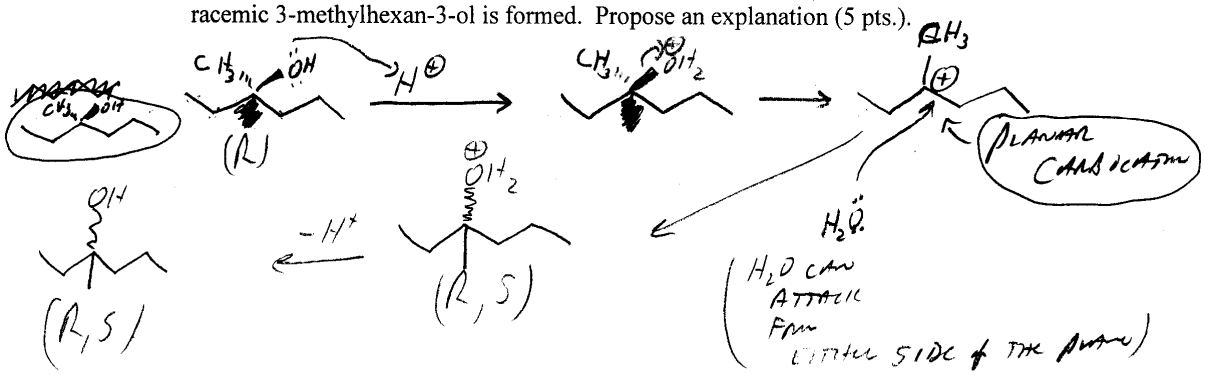
ii)



iii)



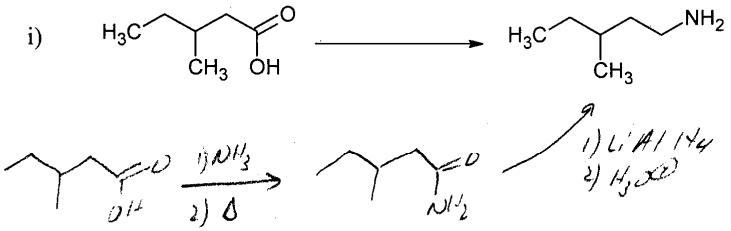
5B. When (R)-3-methylhexan-3-ol is heated in aqueous acid (H_3O^+), racemic 3-methylhexan-3-ol is formed. Propose an explanation (5 pts.).



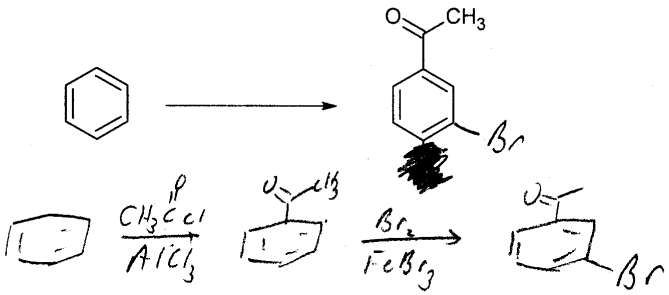
Part 6: Synthesis (20 pts):

Propose a synthesis of each of the following compounds starting from the indicated compound and any other reagents you need (5 pts. each):

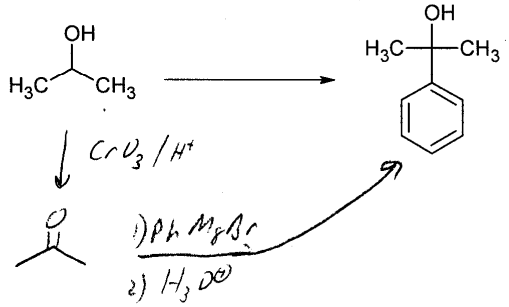
i)



ii)



iii)



iv)