CHEM 310 Final Exam

Dr. Hanna

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In Part V of the Winthrop University Student Conduct Code, it is stated that "A fundamenta
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"

evaluation including p	apers, projects, and exam	illiations	
By my signature below examination.	v, I pledge that I did not	commit academic misconduc	et (cheat) on this
Printed Name		Signature	
	Part 1	/35	
	Part 2	/35	
	Part 3	/30	
	Part 4		
	Part 5		
	Part 6		
	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):

$$\begin{array}{c} & \text{CO}_2\text{H} \\ \text{H}_3\text{C} \cdots \text{C} \cdots \text{IF} \\ \text{i)} & \text{CH}_2\text{CH}_2\text{CH}_3 \end{array}$$

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

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

$$i)$$
 H_3C C^+ CH_3 CH_3

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

$$H_3C \xrightarrow[HO]{O} O \\ O \\ OH \\ And \\ HO \\ HO \\ HO \\ HO \\ HO \\ HO$$

iii)
$$H$$
 CH_3 and H $S-CH_3$

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

Benzyl Cation

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

$$H$$
 CH_3 H_3C CH_3 H_3C H_3C H_3C H_3C H_3C H

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)
$$CH_3$$
 OH or Br OH OH

ii)
$$H_3C$$
 OH or H_3C OH

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

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

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

OH Br C D

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

iii)
$$\begin{array}{c} CH_{\bar{2}}CH_3 \\ \hline CH_{\bar{2}}CH_3 \end{array}$$

$$\begin{array}{c} KMnO_4 \\ \hline H^{\dagger}/H_2O \end{array}$$

iv)
$$H_3C$$
 CH_3
 H_3C
 CH_3

$$V) \qquad \begin{array}{c} 1. \\ \\ \hline \\ 2. \ H_3O^+ \end{array}$$

$$vi) \qquad \begin{matrix} H_3C-O & H \\ C & C & CH_3 \end{matrix} \qquad \begin{matrix} H_2 \\ Pd \end{matrix}$$

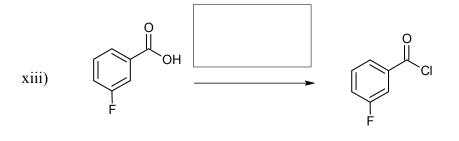
vii)
$$H_2O$$
 H^+

viii)
$$H_3C-S$$
 CH_2OH $S-CH_3$

$$ix) \qquad \begin{array}{c} CH_3 \\ H_3C \longrightarrow CH_3 \\ \hline \\ AlCl_3 \end{array}$$

$$H_3C$$
 H_3C SH

$$xi)$$
 H_3C CI CH_3 CI CI CH_3 CI CH_3 CI CH_3 CI CH_3 CI CH_3 CI CI CH_3 CI CH_3 CI



xiv)
$$C \equiv C - CH_3$$
 CH_3 CH_3 CH_3

Part 5: Reaction Mechanisms (20 pts):

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

i)
$$CH_3$$
 + NaOH CH_3 + NaI + H_2C

ii)
$$CH_3$$
 HCI CH_3

iii)
$$H_3C$$
 CH_3
 H_3C
 $H_$

5B. When (R)-3-methylhexan-3-ol is heated in aqueous acid (H₃O⁺), 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):

$$i) \qquad \begin{array}{c} \text{H}_3\text{C} \\ \hline \text{CH}_3 & \text{OH} \end{array} \qquad \begin{array}{c} \text{NH}_2 \\ \hline \text{CH}_3 \end{array}$$

iii)
$$H_3C$$
 CH_3 H_3C CH_3