Exam III Organ	ic Chem II (CHEM 4	42) Spring 16 4/20V	V Dr. Hahn	MWF 1pm	Form A	Exam#_	
Sign Name	Ken		nt Name				
(3 pts name abo	ve print & sign, 3 pt s	cantron name) (10	pts, 11 page	s + periodic	table + so	cantron s	heet)

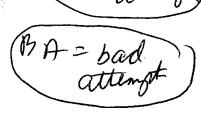
Please show work on all questions for partial credit even on questions which do not specify. Please write legibly. If I cannot read your answer, I cannot grade your answer. (use back of exam for scratch paper — If you want me to grade something not in the space for the answer, clearly specify in writing. Telling me during the exam where to find the answer does not qualify because I will just vaguely remember someone telling me something during the exam not which one of 200 students told me what to grade on what page.) <u>Circle answer on this form for backup to the scantron. There is no partial credit for showing work in the multiple choice</u>. In all questions on all parts of this exam, R is not equal to hydrogen but is an alkyl. Assume standard workup in all reactions even if workup is not explicitly shown.

Please READ and FOLLOW directions. This is a <u>TIMED EXAM</u>. (ex: don't give me 5 structures if I only ask for one or you will lose points on this exam by <u>RUNNING OUT OF TIME</u>)

- I. Multiple Choice (3 pts each, 27 pts) Choose the one best statement in each question.
- 1. In IUPAC nomenclature the higher priority functional group name shows up most of the time as a suffix. If something higher priority is in the name, then the functional group name would be written as a prefix.

Choose the best statement.

- (a) Aldehyde as a suffix is -al, as a prefix is formyl.
- (b) Alcohol as a suffix is -ol, as a prefix is hydroxy
- (c) Ketone as a suffix is -one, as a prefix is oxo.
- (d) All of the above are correct.
- (e) All of the above are incorrect.



2. Choose the following reactions which will give aldehyde or ketone products.

(b)
$$R \subset R$$
 $hot KMnO_4$

- (c) R—CH₂—O—H <u>K₂Cr₂O₇</u>
- (d) All of the above give aldehyde, or ketone products.

1

3. If you start with a ketone or aldehyde, and you reduce it using a reducing agent like LiAlH4 and then work up the product,

- (d) (a) and (b) are correct
- (e) (a), (b) and (c) are correct.
- 4. To an α, β unsaturated aldehyde or ketone CH₃-

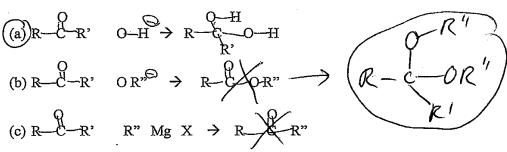
- (c) All statements above are true.
- (d) All statements above are false.
- 5. By "Nucleophilic Addition" choose the best reaction.

(a)
$$CH_3$$
— C — H + O — H \rightarrow CH_3 — C — O - CH_3
 CH_3

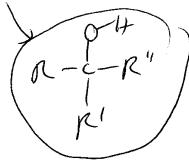
(c) CH₃—C—H + Na C=N
$$\rightarrow$$
 CH₃—C=N H

- (d) (b) and (c) are correct.
- (e) All except (d) are correct.

- 6. Choose the following reactions which will give carboxylic acid products.
- (a) R-Ç-O-H PCC
- (b) R R H hot KMnO₄
- (c) R-CH₂-O-H <u>K₂Cr₂O₇</u>
- (d) All of the above give carboxylic acid products.
- (e) Only (b) and (c) give carboxylic acid products
- 7. The reaction of R—C—R' with the following results in which of the products shown. Circle the letter of the correct reactions.



(d) All reactions above are correct.



3

8. Choose the best statement.

(a) The following is a hemiacetal:

(b)') The following is a hemiketal.

(c) The following is a aetal

(d) All statements above are true.

Choose the best statement.

- H_C_O_H is formic acid
- (b) CH₃—C O C CH₃ is acetic anhydride
- O—H is benzoic acid
- O-CH2CH3 is ethyl acetate
- (e) All of the above are correct.

II.	Short Answers (43	pts)

A.

Given the structural formula shown below, give the IUPAC name of the molecule. 1.

name 2-Chloro -4-methyl heptanoic acid

Nomenclature: (2 pts each, 6 pts)

heptenoic acid

2-chloro

3-methyl

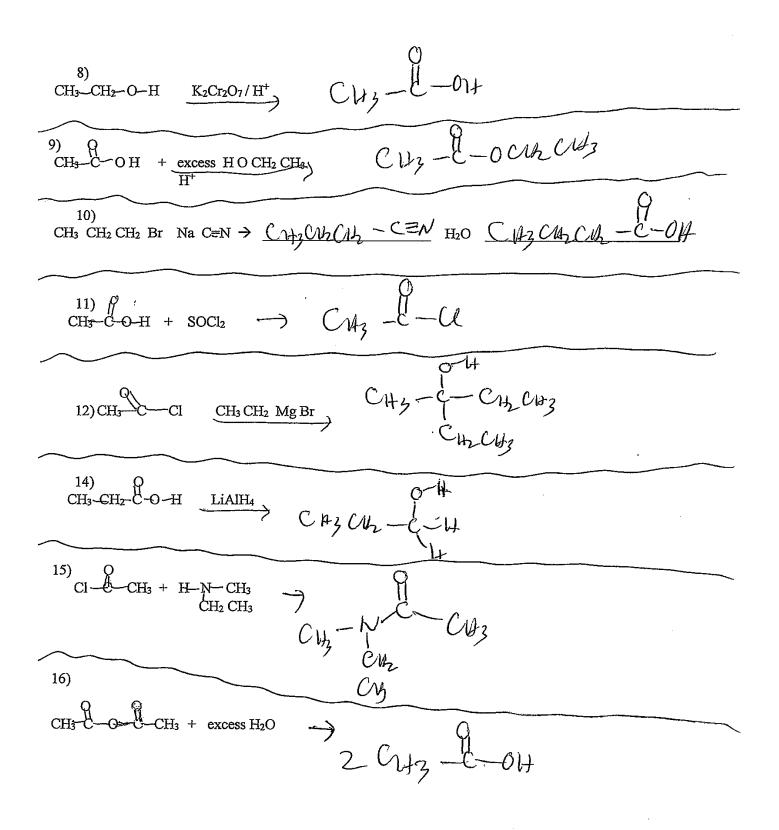
b.

2. Given the following IUPAC name, draw a structural formula of the molecule (skeletal formula acceptable, condensed structure, Lewis Dot structure acceptable, molecular formula not acceptable don't forget to show the hydrogens in your formula unless you are using the skeletal structure.)

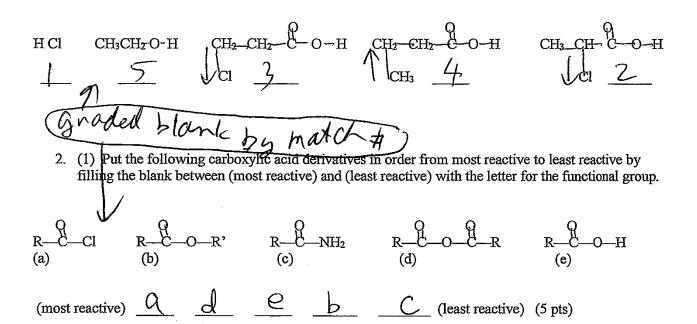
4-hydroxy-heptanal

B. Reactions Part of Short Answers: (2 pts per reaction, 16 pts total)

Given the following, what is the the expected organic product? Chouse to do 8 of the following reactions you want graded by circling the letter of the reaction. If you do not choose, I will just grade the first SEVEN (3 pts each, 21 pts) 1) CH₃ CH₂ Mg 🕅 2) CH₃-C-CH₃ + excess H O CH₂ CH₃ -4) CH₃ K2Cr2O7/H+ 5) CH₂ CH₃ H2NNH2, KOH ÇH2 ČH₃ 7) (Ph)₃ P CH₃ Organic Chemistry II (CHEM 442) Spring 16 MWF 1 pm Dr. Hahn Exam III Form A



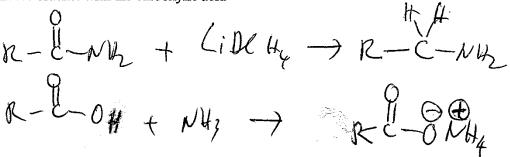
- C. Short Answers part of Short Answers: (21 pts)
- 1. Given the following acids, put in order from (most acidic # 1) to (least acidic- # 5) (5 pts)



(2) Put the above carboxylic acid derivative in order from worst leaving group to best leaving group

be d (best leaving group) (5 pts) (worst leaving group)

3. Give ONE example of a carboxylic acid derivative which does NOT do the normal carboxylic acid derivative reactions by showing the starting carboxylic acid derivaties using R groups, the reactant and the product that you normally do not get for the other carboxylic acid derivatives. (6 pts) (fill in the bracket with the carboxylic acid

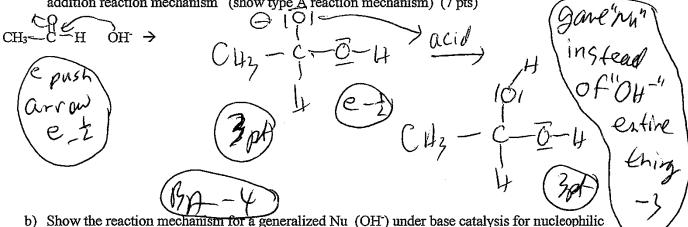


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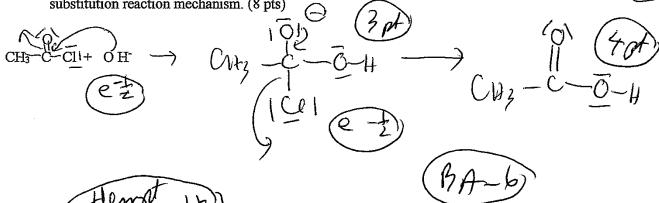
Part III. Show work where applicable for full and partial credit. Long Answers (30 pts)

1. Show the following reaction mechanism. This is a nucleophilic addition and substitution reaction mechanism under base catalysis. (I may not have gone over this specific mechanism but if you think "generalized nucleophilic addition" or "generalized nucleophilic substitution" then you will get it) (18 pts)

a) Show the reaction mechanism for a generalized Nu (OH) under base catalysis for nucleophilic addition reaction mechanism (show type A reaction mechanism) (7 pts)



b) Show the reaction mechanism for a generalized Nu (OH) under base catalysis for nucleophilic substitution reaction mechanism. (8 pts)



c) Explain why almost all reactions of aldehydes and ketones do nucleophilic addition and almost all reactions of carboxylic acids and carboxylic acid derivatives do nucleophilic substitution. You should mention something about "good leaving group". (3 pts)

le have bad learning groups Corposylic acid + derivatives have good leaving groups so Ketore + abbetide do hun addition while composylir acid + derivatives do 'Nn' substitution.

Organic Chemistry II (CHEM 442) Spring 16 MWF 1 pm Dr. Hahn Exam III Form A

Complete the following synthesis by filling in the blank. I have provided some hints to help you come up with the answers. NOTE: The way I grade this is for you to fill in reasonable molecules based on the immediate prior molecule. i.e. If you fill in part A with the wrong molecule and then do the next reaction to molecule B correctly you will get half credit for answering B correctly. If you fill in B with what you would have gotten if you got A correctly but which cannot possibly be generated from your wrong A, you will lose all credit even if it matches what you should have gotten for B. (2 pts each, 12 pts total)
(wrong prior step - Correct Current RXN-does not) match blank -
$CH_3-CH_2-CH_2-CH_2-CI + Na C=N \rightarrow CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2$
match blank but incorrect
RXN because of wrong prior Can Clu Cure OH Can Swer -2
CH3 CH2 CH2 CH2-CH-OH
B C ₅ H ₁₀ O ₂
Ego few Hor C=POK
CH3CH2CH2CH2CH Ph3P base CH3CH2CH2CH2CH2 CI + Ph3P base X C4H8PPh3 HCH
Hegio H (regio) H (Free) CH3 CU2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
Cly
Chy Chy Chy Chy Chy Chy Chy Chy axgms did not have
Organic Chemistry In (CHEM 442) Spring 16 MWF I pm Dr. Hahn Exam III Form A page 10
Organic Chemistry II (CHEM 442) Spring 16 MWF I pm Dr. Hahn Exam III Form A page 10

Exam III Organic Chem II (CHEM 442) Spring 16 4	/20W Dr. Hahn MWF 1pm Form B Exam#
Sign Name Kory	Print Name
(3 pts name above print & sign, 3 pt scantron name)	(100 pts, 10 pages + periodic table + scantron sheet)

Please show work on all questions for partial credit even on questions which do not specify. Please write legibly. If I cannot read your answer, I cannot grade your answer. (use back of exam for scratch paper — If you want me to grade something not in the space for the answer, clearly specify in writing. Telling me during the exam where to find the answer does not qualify because I will just vaguely remember someone telling me something during the exam not which one of 200 students told me what to grade on what page.) Circle answer on this form for backup to the scantron. There is no partial credit for showing work in the multiple choice. In all questions on all parts of this exam, R is not equal to hydrogen but is an alkyl. Assume standard workup in all reactions even if workup is not explicitly shown.

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- I. Multiple Choice (3 pts each, 27 pts) Choose the <u>one</u> best statement in each question.
 - 1. Choose the following reactions which will give carboxylic acid products.

- b) R R H hot KMnO₄
- (c) R-CH₂-O-H K₂Cr₂O₇
- (d) All of the above give carboxylic acid products.
- (e) Only (b) and (c) give carboxylic acid products

NA = not attended

(BA = bad attenst)

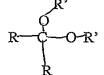
2. Choose the best statement.

(a) The following is a hemiacetal:

acetal

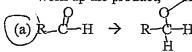
(b) The following is a hemiketal.

(c) The following is a aetal



ketal

- (d) All statements above are true.
- 3. If you start with a ketone or aldehyde, and you reduce it using a reducing agent like LiAlH4 and then work up the product, H



(b)
$$R$$
— C — H \rightarrow R — C — H

- (c) R—C—H \rightarrow R—C—O-H
- (d) (a) and (b) are correct
- (e) (a), (b) and (c) are correct.

4. Choose the following reactions which will give aldehyde or ketone products.

- (b) $R \leftarrow R$ $hot KMnO_4$
- (c) R—CH₂—O—H <u>K₂Cr₂O₇</u>
- (d) All of the above give aldehyde, or ketone products.
- O

 5. To an α, β unsaturated aldehyde or ketone CH₃-C-CH=CH-CH₃

- (b) LiCu R₂ adds 1,4 to give CH₃—CH₂-CH—CH₃
- (c) All statements above are true.
- (d) All statements above are false.
- 6. By "Nucleophilic Addition" choose the best reaction.

(a)
$$CH_3$$
— C — H + O — H \rightarrow CH_3 — C — O - CH_5

(b) CH₃—C—H + LiAlH₄
$$\rightarrow$$
 CH₃—C—H H

(c) CH₃—C—H + Na C=N
$$\rightarrow$$
 CH₃—C—C=N H

- (d) b) and (c) are correct.
- (e) All except (d) are correct.

page

7. In IUPAC nomenclature the higher priority functional group name shows up most of the time as a suffix. If something higher priority is in the name, then the functional group name would be written as a prefix.

Choose the best statement.

- (a) Aldehyde as a suffix is -al, as a prefix is formyl.
- (b) Alcohol as a suffix is -ol, as a prefix is hydroxy
- (c) Ketone as a suffix is -one, as a prefix is oxo.
- (d)\All of the above are correct.
- (e) All of the above are incorrect.
- R' with the following results in which of the products shown. Circle the letter of the correct reactions.

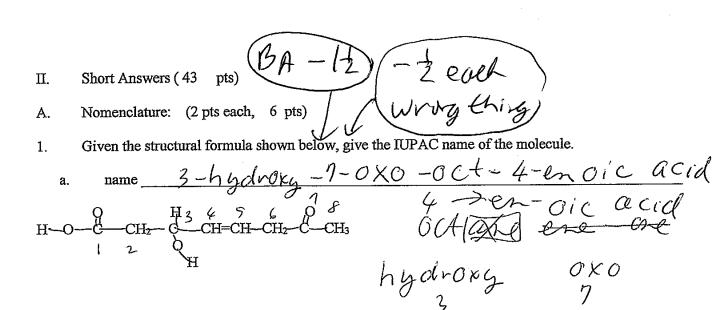
(a)
$$R$$
— C — R , O — H \rightarrow R — C — O — H R ,

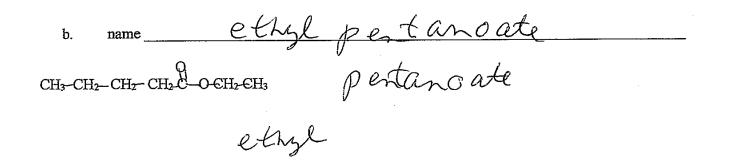
(b) R—C—R'
$$O$$
 R" \rightarrow R—C— O R"

(c)
$$R$$
— C — R ' R " $Mg X \rightarrow R$ — C — R "

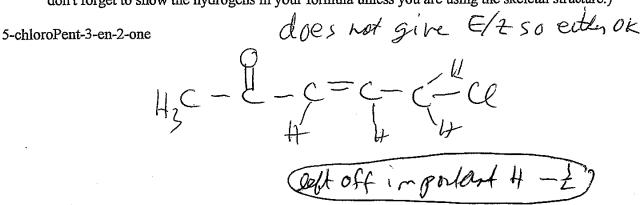
- (d) All reactions above are correct.
- Choose the best statement.
- H_C-O_H is formic acid
- (b) CH₃—C—O—C—CH₃ is acetic anhydride

- (d) CH₃-C-O-CH₂CH₃ is ethyl acetate
- (e) All of the above are correct.





2. Given the following IUPAC name, draw a structural formula of the molecule (skeletal formula acceptable, condensed structure, Lewis Dot structure acceptable, molecular formula not acceptable - don't forget to show the hydrogens in your formula unless you are using the skeletal structure.)



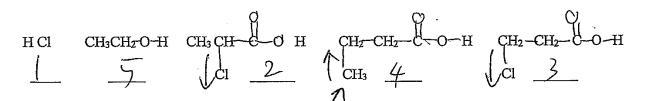
B. Reactions Part of Short Answers: (2 pts per reaction, 16 pts total)

Given the following, what is the the expected organic product? Choose to do 8 of the following reactions you want graded by circling the letter of the reaction. If you do not choose, I will just grade the first SEVEN (3 pts each, 21 pts) 1) C-CH₃ + CH₃ Mg Br 2) -CH₂CH₃ + excess H_O-CH₃ 3) K₂Cr₂O₇/ H⁺ 4) O-H 5) -CH₂ CH₃ H2NNH2, KOH ĊH₂ ĊH₃ (Ph)₃ P 7) CH₃ base eg10 tereo CH3-CH2-CH2-O-H +

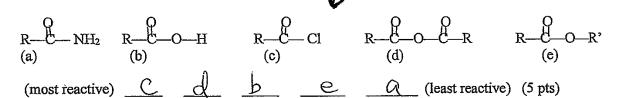
6

OH + excess HOCH3 > Clts CM - C. 11) O CH₃_CH₂-C-O-H + SOCl₂ — 12) CH₃ Mg Br LiAlH₄ CH3-CH2-CH2-C 15) -O CH₃ + H--N--H 16) CH₃ + excess CH₃—O-H 2 CA3-12-0 CH2

- C. Short Answers part of Short Answers: (21 pts)
- 1. Given the following acids, put in order from (most acidic # 1) to (least acidic- # 5) (5 pts)



2. (1) Put the following carboxylic acid derivatives in order from most reactive to least reactive by filling the blank between (most reactive) and (least reactive) with the letter for the functional group.



(2) Put the above carboxylic acid derivative in order from worst leaving group to best leaving group

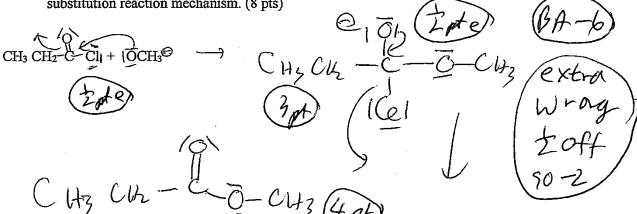
(worst leaving group) α γ γ γ γ (best leaving group) (5 pts)

3. Give ONE example of a carboxylic acid derivative which does NOT do the normal carboxylic acid derivative reactions by showing the starting carboxylic acid derivaties using R groups, the reactant and the product that you normally do not get for the other carboxylic acid derivatives. (6 pts) (fill in the bracket with the carboxylic acid

Part III. Long Answers (30 pts) Show work where applicable for full and partial credit.

1. Show the following reaction mechanism. This is a nucleophilic addition and substitution reaction mechanism under base catalysis. (I may not have gone over this specific mechanism but if you think "generalized nucleophilic addition" or "generalized nucleophilic substitution" then you will get it) (18 pts)

b) Show the reaction mechanism for a generalized Nu (OCH₃-) under base catalysis for nucleophilic substitution reaction mechanism. (8 pts)



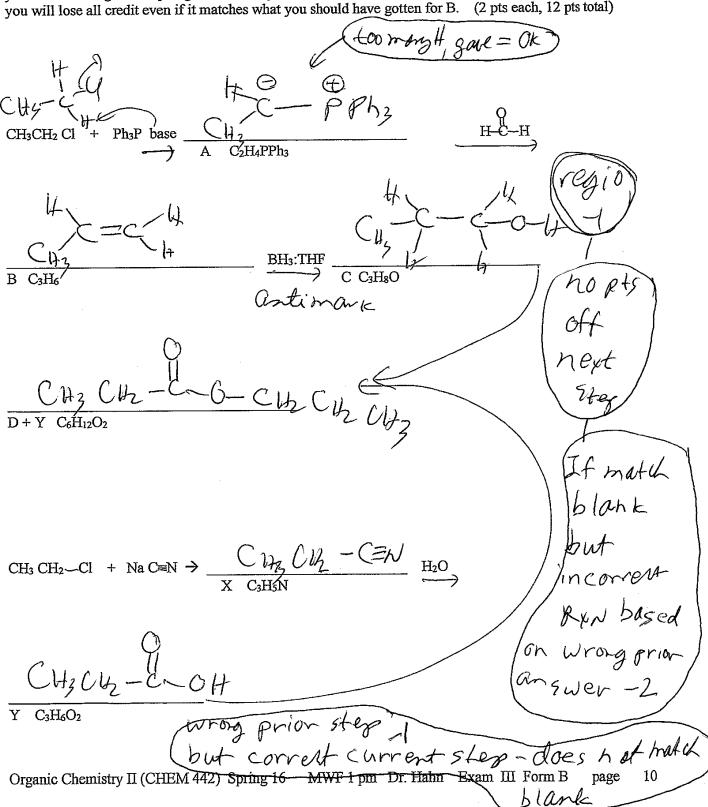
c) Explain why almost all reactions of aldehydes and ketones do nucleophilic addition and almost all reactions of carboxylic acids and carboxylic acid derivatives do nucleophilic substitution. You should mention something about "good leaving group". (3 pts)

ketore/aldersle have really bad (It)
leaving group albyl on H. All Corboxylic
a cid derivatives have good / earing
groups. So ketore aldersle do his addr.

Organic Chemistry II (CHEM 442) Spring 16 MWF 1 pm Dr. Hahn Exam III Form B page 9

Carbo kg/ic a Cid & derivatives do" My 5wb 5h fulin

Complete the following synthesis by filling in the blank. I have provided some hints to help you come up with the answers. NOTE: The way I grade this is for you to fill in reasonable molecules based on the immediate prior molecule. i.e. If you fill in part A with the wrong molecule and then do the next reaction to molecule B correctly you will get half credit for answering B correctly. If you fill in B with what you would have gotten if you got A correctly but which cannot possibly be generated from your wrong A, you will lose all credit even if it matches what you should have gotten for B. (2 pts each, 12 pts total)



Exam III Organic Chem II (CHEM 442) Spring 16 4	/20W Dr. Hahn	MWF 1pm Form A	Exam#
Sign Name	Print Name		
(3 pts name above print & sign, 3 pt scantron name)	(100 pts, 11 page	es + periodic table + s	cantron sheet)

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Choose the best statement.

- (a) Aldehyde as a suffix is -al, as a prefix is formyl.
- (b) Alcohol as a suffix is -ol, as a prefix is hydroxy
- (c) Ketone as a suffix is -one, as a prefix is oxo.
- (d) All of the above are correct.
- (e) All of the above are incorrect.
- Choose the following reactions which will give aldehyde or ketone products.

(c)
$$R$$
— CH_2 — O — H $K_2Cr_2O_7$

(d) All of the above give aldehyde, or ketone products.

3. If you start with a ketone or aldehyde, and you reduce it using a reducing agent like LiAlH4 and then work up the product, H

(a)
$$R-C-H \rightarrow R-C-H$$

(b)
$$R - C + H \rightarrow R - C + H$$

(c)
$$R$$
— C — H \rightarrow R — C — O — H

- (d) (a) and (b) are correct
- (e) (a), (b) and (c) are correct.
- 4. To an α , β unsaturated aldehyde or ketone

- (c) All statements above are true.
- (d) All statements above are false.
- 5. By "Nucleophilic Addition" choose the best reaction.

(a)
$$CH_3$$
— C — H + O — H \rightarrow CH_3 — C — O - CH_3

(b)
$$CH_3$$
— C — H + $LiAlH_4$ \rightarrow CH_3 — C — H

(c) CH₃—C—H + Na C=N
$$\rightarrow$$
 CH₃—C=N H

- (d) (b) and (c) are correct.
- (e) All except (d) are correct.

6. Choose the following reactions which will give carboxylic acid products.

(a)
$$R \xrightarrow{H} O \xrightarrow{PCC} H$$

- R-CH₂O-H K₂Cr₂O₇ (c)
- (d) All of the above give carboxylic acid products.
- (e) Only (b) and (c) give carboxylic acid products
- 7. The reaction of R—C—R' with the following results in which of the products shown. Circle the letter of the correct reactions.

(a)
$$R - C - R'$$
 $O - H \rightarrow R - C - O - H$

(b)
$$R = C - R'$$
 $O R'' \rightarrow R - C - O R''$

(c) R
$$\stackrel{Q}{\leftarrow}$$
 R' Mg X \rightarrow R $\stackrel{Q}{\leftarrow}$ R"

(d) All reactions above are correct.

8. Choose the best statement.

(a) The following is a hemiacetal:

(b) The following is a hemiketal.

(c) The following is a aetal

(d) All statements above are true.

Choose the best statement.

- H_C_O_H is formic acid
- (b) CH₃—C O C CH₃ is acetic anhydride

- O-CH₂CH₃ is ethyl acetate
- (e) All of the above are correct.

- II. Short Answers (43 pts)
- A. Nomenclature: (2 pts each, 6 pts)
- 1. Given the structural formula shown below, give the IUPAC name of the molecule.
 - a.

b.

- 2. Given the following IUPAC name, draw a structural formula of the molecule (skeletal formula acceptable, condensed structure, Lewis Dot structure acceptable, molecular formula not acceptable don't forget to show the hydrogens in your formula unless you are using the skeletal structure.)
- 4-hydroxy-heptanal

B. Reactions Part of Short Answers: (2 pts per reaction, 16 pts total)

Given the following, what is the expected organic product? Choose to do 8 of the following reactions you want graded by circling the letter of the reaction. If you do not choose, I will just grade the first SEVEN (3 pts each, 21 pts)

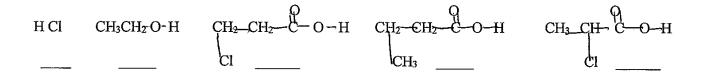
- 1) O CH₃—C-H + CH₃ CH₂ Mg X —)
- 2) CH₃-C-CH₃ + excess H O CH₂ CH₃ -->
- - 4) CH₃ C O H K₂Cr₂O₇/ H⁺ CH₃
 - 5) O CH₂ CH₂ CH₃ H₂NNH₂, KOH

 - 7) (Ph)₃ P + H CH₃ base ______

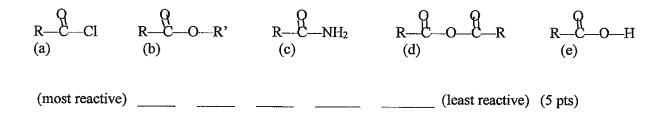
CH₃-C CH₃

6

- C. Short Answers part of Short Answers: (21 pts)
- 1. Given the following acids, put in order from (most acidic # 1) to (least acidic- # 5) (5 pts)



2. (1) Put the following carboxylic acid derivatives in order from most reactive to least reactive by filling the blank between (most reactive) and (least reactive) with the letter for the functional group.



- (2) Put the above carboxylic acid derivative in order from worst leaving group to best leaving group (worst leaving group) _____ (best leaving group) (5 pts)
 - 3. Give ONE example of a carboxylic acid derivative which does NOT do the normal carboxylic acid derivative reactions by showing the starting carboxylic acid derivaties using R groups, the reactant and the product that you normally do not get for the other carboxylic acid derivatives. (6 pts) (fill in the bracket with the carboxylic acid

Part III. Long Answers (30 pts) Show work where applicable for full and partial credit.

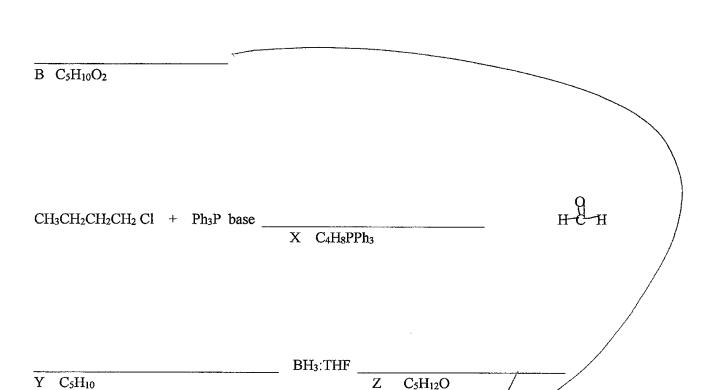
- 1. Show the following reaction mechanism. This is a nucleophilic addition and substitution reaction mechanism under base catalysis. (I may not have gone over this specific mechanism but if you think "generalized nucleophilic addition" or "generalized nucleophilic substitution" then you will get it) (18 pts)
 - a) Show the reaction mechanism for a generalized Nu (OH-) under base catalysis for nucleophilic addition reaction mechanism (show type A reaction mechanism) (7 pts)

b) Show the reaction mechanism for a generalized Nu (OH) under base catalysis for nucleophilic substitution reaction mechanism. (8 pts)

c) Explain why almost all reactions of aldehydes and ketones do nucleophilic addition and almost all reactions of carboxylic acids and carboxylic acid derivatives do nucleophilic substitution. You should mention something about "good leaving group". (3 pts)

page

Complete the following synthesis by filling in the blank. I have provided some hints to help you come up with the answers. NOTE: The way I grade this is for you to fill in reasonable molecules based on the immediate prior molecule. i.e. If you fill in part A with the wrong molecule and then do the next reaction to molecule B correctly you will get half credit for answering B correctly. If you fill in B with what you would have gotten if you got A correctly but which cannot possibly be generated from your wrong A, you will lose all credit even if it matches what you should have gotten for B. (2 pts each, 12 pts total)



B+Z C10 H20 O2

Please show work on all questions for partial credit even on questions which do not specify. Please write legibly. If I cannot read your answer, I cannot grade your answer. (use back of exam for scratch paper – If you want me to grade something not in the space for the answer, clearly specify in writing. Telling me during the exam where to find the answer does not qualify because I will just vaguely remember someone telling me something during the exam not which one of 200 students told me what to grade on what page.) <u>Circle answer on this form for backup to the scantron.</u> There is no partial credit for showing work in the <u>multiple choice</u>. In all questions on all parts of this exam, R is not equal to hydrogen but is an alkyl. Assume standard workup in all reactions even if workup is not explicitly shown.

Please READ and FOLLOW directions. This is a <u>TIMED EXAM</u>. (ex: don't give me 5 structures if I only ask for one or you will lose points on this exam by **RUNNING OUT OF TIME**)

- I. Multiple Choice (3 pts each, 27 pts) Choose the one best statement in each question.
 - 1. Choose the following reactions which will give carboxylic acid products.

(a)
$$R - C - O - H \xrightarrow{PCC}$$

- (d) All of the above give carboxylic acid products.
- (e) Only (b) and (c) give carboxylic acid products

2. Choose the best statement.

(a) The following is a hemiacetal:

(b) The following is a hemiketal.

(c) The following is a aetal

(d) All statements above are true.

3. If you start with a ketone or aldehyde, and you reduce it using a reducing agent like LiAlH4 and then work up the product, H

(a)
$$R$$
— C — H \rightarrow R — C — H

$$\begin{array}{ccc} & & & H \\ \text{(b) } R - \overset{\text{H}}{C} - H & \rightarrow & R - \overset{\text{H}}{C} - H \\ & & H \end{array}$$

(c)
$$R$$
— C — H \rightarrow R — C — O — H

- (d) (a) and (b) are correct
- (e) (a), (b) and (c) are correct.

4. Choose the following reactions which will give aldehyde or ketone products.

(b)
$$R = R$$
 hot $KMnO_4$

- (c) R—CH₂—O—H <u>K₂Cr₂O₇</u>
- (d) All of the above give aldehyde, or ketone products.
- 5. To an α , β unsaturated aldehyde or ketone CH₃-C-CH=CH-CH₃

(a) RMgX and RLi adds 1,2 to give
$$CH_3-C-CH=CH-CH_3$$

- (c) All statements above are true.
- (d) All statements above are false.
- 6. By "Nucleophilic Addition" choose the best reaction.

(b) CH₃—C-H + LiAlH₄
$$\rightarrow$$
 CH₃—C-H H

(c)
$$CH_3$$
— C — H + Na C = N \rightarrow CH_3 — C — C = N

- (d) (b) and (c) are correct.
- (e) All except (d) are correct.

7. In IUPAC nomenclature the higher priority functional group name shows up most of the time as a suffix. If something higher priority is in the name, then the functional group name would be written as a prefix.

Choose the best statement.

- (a) Aldehyde as a suffix is -al, as a prefix is formyl.
- (b) Alcohol as a suffix is -ol, as a prefix is hydroxy
- (c) Ketone as a suffix is -one, as a prefix is oxo.
- (d) All of the above are correct.
- (e) All of the above are incorrect.
- -R' with the following results in which of the products shown. Circle the 8. The reaction of letter of the correct reactions.

(a)
$$R-C-R'$$
 $O-H \rightarrow R-C-O-H$

(b)
$$R$$
— C — R ' O R " \rightarrow R — C — O R "

(c) R—C—R' R" Mg X
$$\rightarrow$$
 R—C—R"

- (d) All reactions above are correct.
- Choose the best statement.

(c)
$$\bigcirc$$
 O—H is benzoic acid

(e) All of the above are correct.

- П. Short Answers (43
- A. Nomenclature: (2 pts each, 6 pts)
- 1. Given the structural formula shown below, give the IUPAC name of the molecule.
 - a.

b.

2. Given the following IUPAC name, draw a structural formula of the molecule (skeletal formula acceptable, condensed structure, Lewis Dot structure acceptable, molecular formula not acceptable don't forget to show the hydrogens in your formula unless you are using the skeletal structure.)

5-chloroPent-3-en-2-one

B. Reactions Part of Short Answers: (2 pts per reaction, 16 pts total)

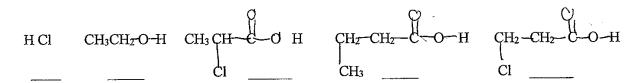
Given the following, what is the the expected organic product? Choose to do 8 of the following reactions you want graded by circling the letter of the reaction. If you do not choose, I will just grade the first **SEVEN** (3 pts each, 21 pts)

- 1) CH₃-C-CH₃ + CH₃ Mg Br
- 2) CH₂CH₃ + excess H₂O-CH₃
- 3)
- - CH₃–C−CH₂ CH₃

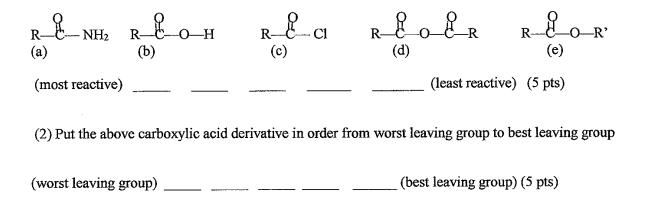
CH₃-CH₂-CH₂-O-H + K₂Cr₂O₇/H⁺

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- C. Short Answers part of Short Answers: (21 pts)
- 1. Given the following acids, put in order from (most acidic # 1) to (least acidic- # 5) (5 pts)



2. (1) Put the following carboxylic acid derivatives in order from most reactive to least reactive by filling the blank between (most reactive) and (least reactive) with the letter for the functional group.



3. Give ONE example of a carboxylic acid derivative which does NOT do the normal carboxylic acid derivative reactions by showing the starting carboxylic acid derivaties using R groups, the reactant and the product that you normally do not get for the other carboxylic acid derivatives. (6 pts) (fill in the bracket with the carboxylic acid

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Long Answers (30 pts) Show work where applicable for full and partial credit. Part III.

- 1. Show the following reaction mechanism. This is a nucleophilic addition and substitution reaction mechanism under base catalysis. (I may not have gone over this specific mechanism but if you think "generalized nucleophilic addition" or "generalized nucleophilic substitution" then you will get it) (18 pts)
 - a) Show the reaction mechanism for a generalized Nu (OCH₃⁻) under base catalysis for nucleophilic addition reaction mechanism (show type A reaction mechanism) (7 pts)

b) Show the reaction mechanism for a generalized Nu (OCH₃-) under base catalysis for nucleophilic substitution reaction mechanism. (8 pts)

c) Explain why almost all reactions of aldehydes and ketones do nucleophilic addition and almost all reactions of carboxylic acids and carboxylic acid derivatives do nucleophilic substitution. You should mention something about "good leaving group". (3 pts)

Complete the following synthesis by filling in the blank. I have provided some hints to help you 2 come up with the answers. NOTE: The way I grade this is for you to fill in reasonable molecules based on the immediate prior molecule. i.e. If you fill in part A with the wrong molecule and then do the next reaction to molecule B correctly you will get half credit for answering B correctly. If you fill in B with what you would have gotten if you got A correctly but which cannot possibly be generated from your wrong A, you will lose all credit even if it matches what you should have gotten for B. (2 pts each, 12 pts total)

