CHM 2220 EXAM 4 July 20, 2017

Last Name (printed): Bhagirath First Name (printed): Neha

Access ID (ex. xx1234) fv68870 Section: 002 004 005 006 007 008 010 (ENG)

You must have the correct section number to earn credit for your exam.

Signature: [signature]

Academic Integrity Pledge

During the exam I will

- turn off my cell phone and put it away (out of sight and not on my person)
- close all books, notebooks, etc. and put them under the seat in which I sit
- keep my eyes down and focused on my own paper
- keep my answers covered
- sit in the area assigned to my section

I will stop writing when time is called.

I will hand in my paper when told to do so.

During the exam I will not

- have any papers other than those provided
- have any writing on my clothing or person or desk
- talk to anyone other than the instructor

I understand that the ***minimum consequence*** of any behavior contrary to this pledge is that I will receive a zero ***on this exam*** that will not be replaced by the percent earned on my final exam.

Name (sign) [signature]

Scoring

Please write the answers to the multiple choice questions here.

1. C ✓	5. D ✗	9. B ✓	13. C ✓	17. B ✗
2. A ✓	6. A ✓	10. E ✗	14. B ✓	
3. A ✓	7. A ✓	11. B ✓	15. B ✓	
4. C ✓	8. D ✗	12. E ✓	16. B ✓	

MC Ques 39 / 51 points

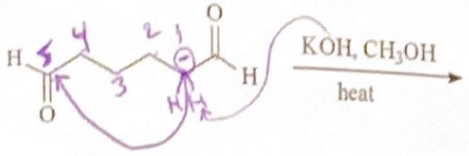
Page 8 8 / 20 points

Page 9 6 / 12 points

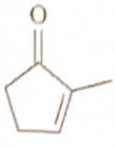
Page 10 20 / 18 points

Total 73 / (100 points)

1. What is the product of the following intramolecular aldol condensation reaction?



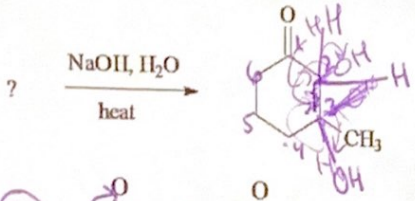
A) 

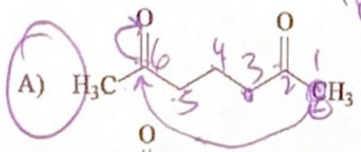
B) 

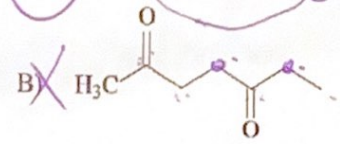
C) 

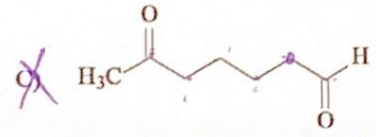
D) 

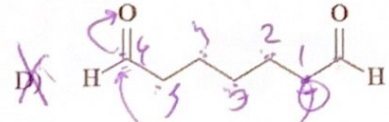
2. Identify the starting reagent needed to make the following cyclic ketone by an intramolecular aldol condensation reaction.



A) 

B) 

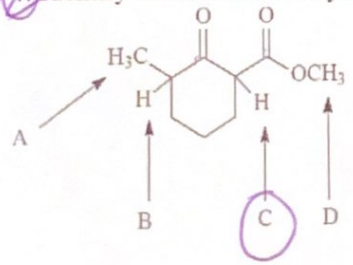
C) 

D) 

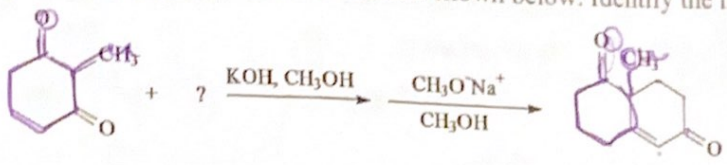
3. Which one of the following reagents adds a methyl group by conjugate (1,4-addition) addition to an α,β-unsaturated ketone or aldehyde?

A) $LiCu(CH_3)_2$ B) CH_3MgBr C) $Hg(O_2CCH_3)_2$ D) CH_3Li

4. Identify the most acidic hydrogen on the following molecule.



5. The Robinson annulation reaction is shown below. Identify the missing reagent in the first step.



A) $CH_3CH{=}CHCH$ (O)

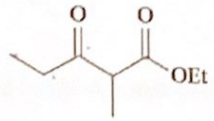
B) $H_2C{=}CHCCH_3$ (O)

C) $H_2C{=}CHCH_2CH$ (O)

D) $CH_3CCH_2CH_3$ (O)

6. Which of the following is the Claisen condensation product of ethyl propanoate, $CH_3CH_2CO_2Et$?

A)



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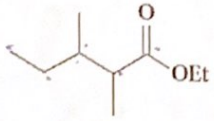

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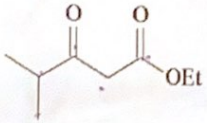

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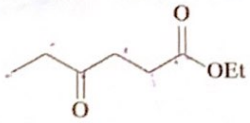
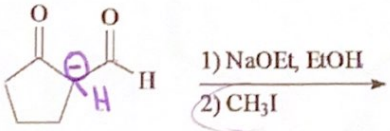
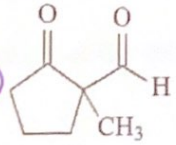


7. What is the product of the following reaction?



A)



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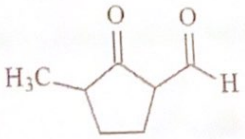

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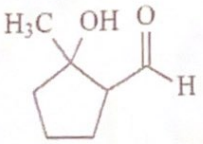

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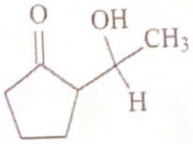
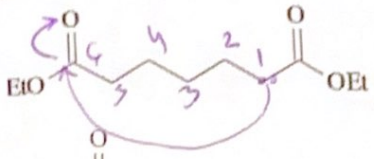
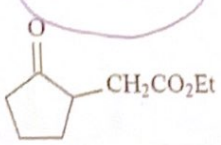
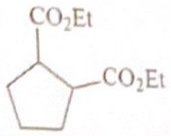
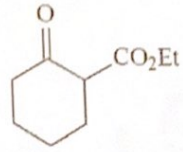


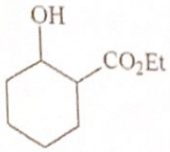
8. What is the product of the reaction shown below?



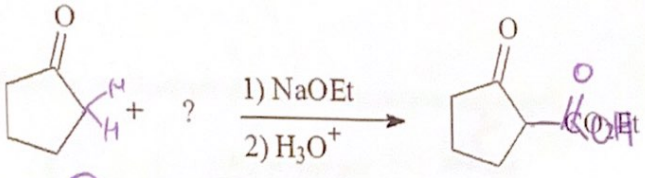
A) 

B) 

C) 

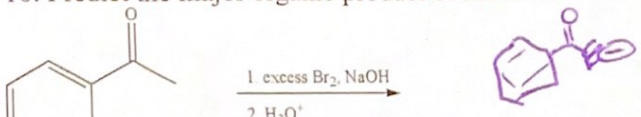
D) 

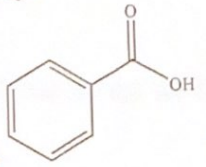
9. Identify the missing reagent in the reaction shown below.

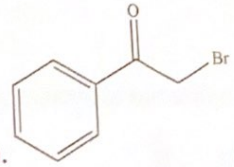


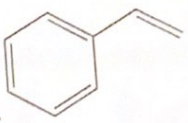
A) ethyl formate, HCO_2Et
B) diethyl carbonate, $(EtO)_2C{=}O$
C) diethyl oxalate, EtO_2CCO_2Et
D) ethyl acetate, CH_3CO_2Et

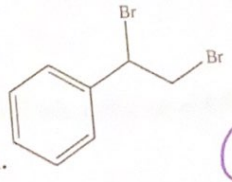
10. Predict the major organic product of the following reaction.

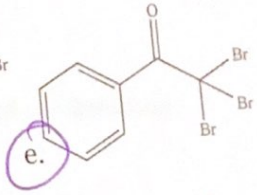


a. 

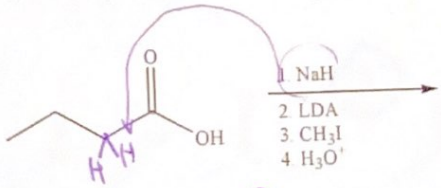
b. 

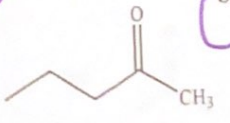
c. 

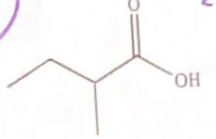
d. 

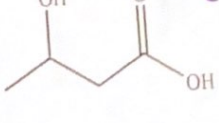
e. 

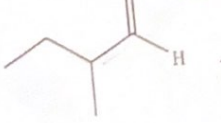
11. Which of the following is the correct product of the reaction conditions shown?

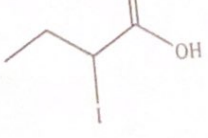


a. 

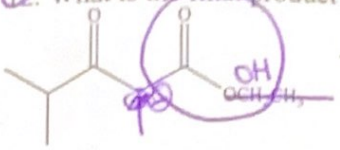
b. 

c. 

d. 

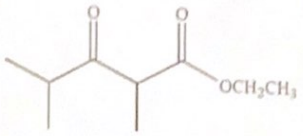
e. 

12. What is the final product of the following reaction sequence?



1. NaOEt, EtOH
2. CH_3I
3. NaOH, then H_3O^+ and heat

a.



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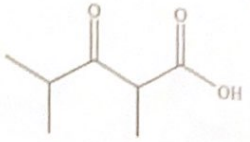

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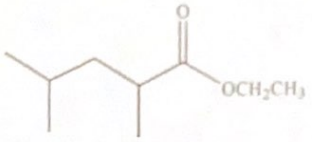

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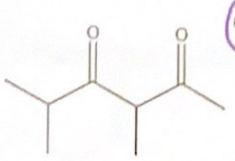
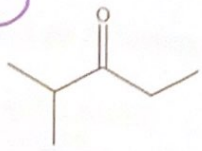
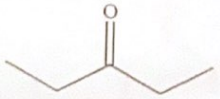


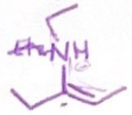
e.



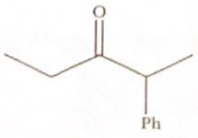
13. What is the final product of this reaction sequence?



1. Et_2NH, trace acid
2. $PhCH_2Br$
3. H_3O^+



a.



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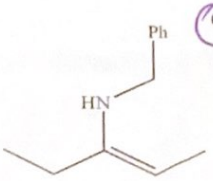

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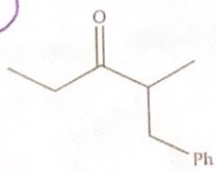

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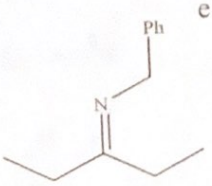

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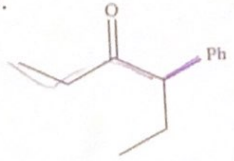
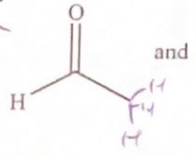
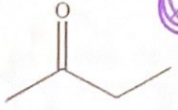


14. What are the starting materials needed to make the molecule shown using an aldol condensation?

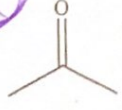
a.



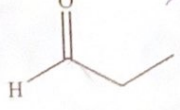
and



b.

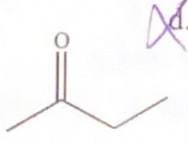


and

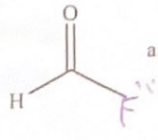


c.

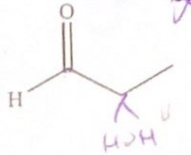
and



d.



and



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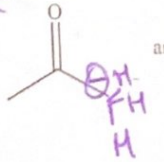

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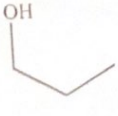
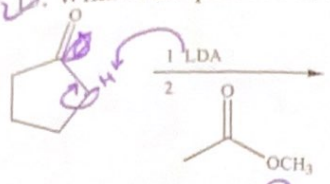
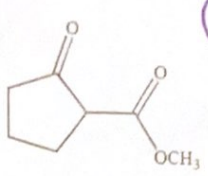
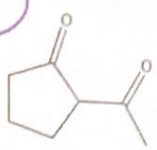
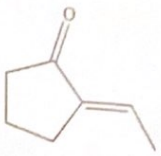


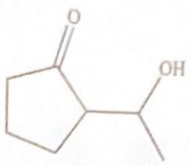
15. What is the product of this reaction?

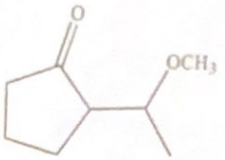


a. 

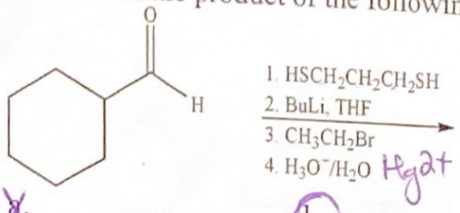
b. 

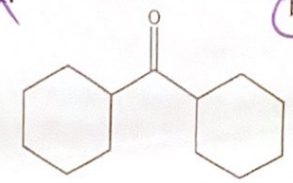
c. 

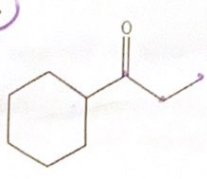
d. 

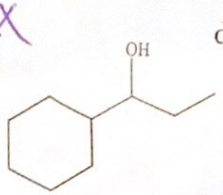
e. 

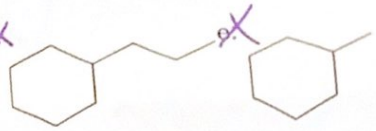
16. What is the product of the following reaction sequence?



a. 

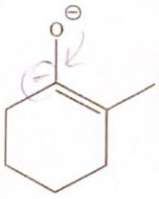
b. 

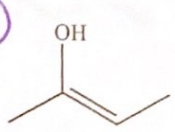
c. 

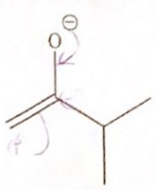
d. 

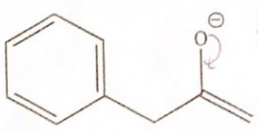
e.

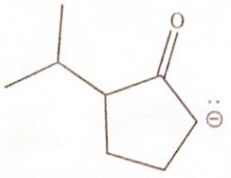
17. Which of the following is a thermodynamic enolate?

a. 

b. 

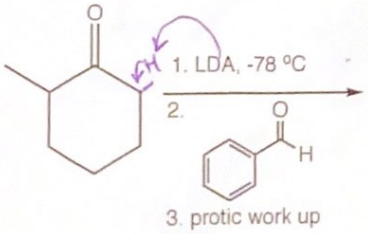
c. 

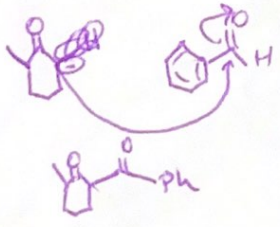
d. 

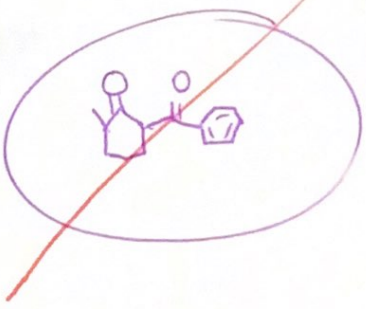
e. 

Write the major organic product formed in the following reactions. Write NR if you expect NO REACTION to occur. (4 points each)

20.







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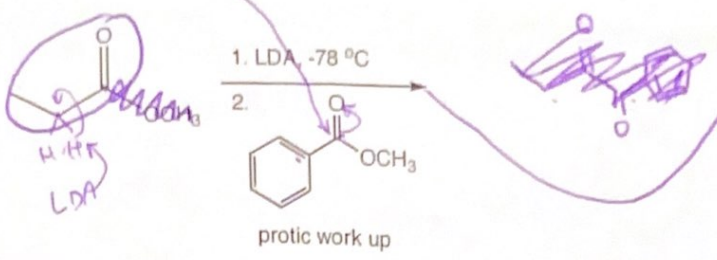

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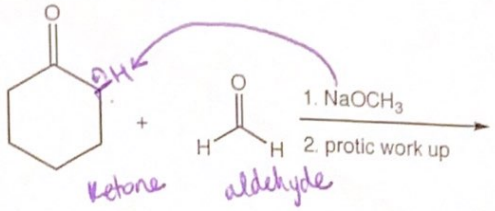

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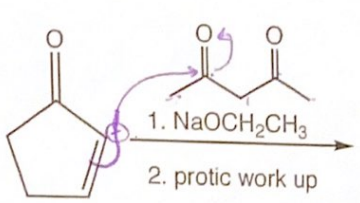
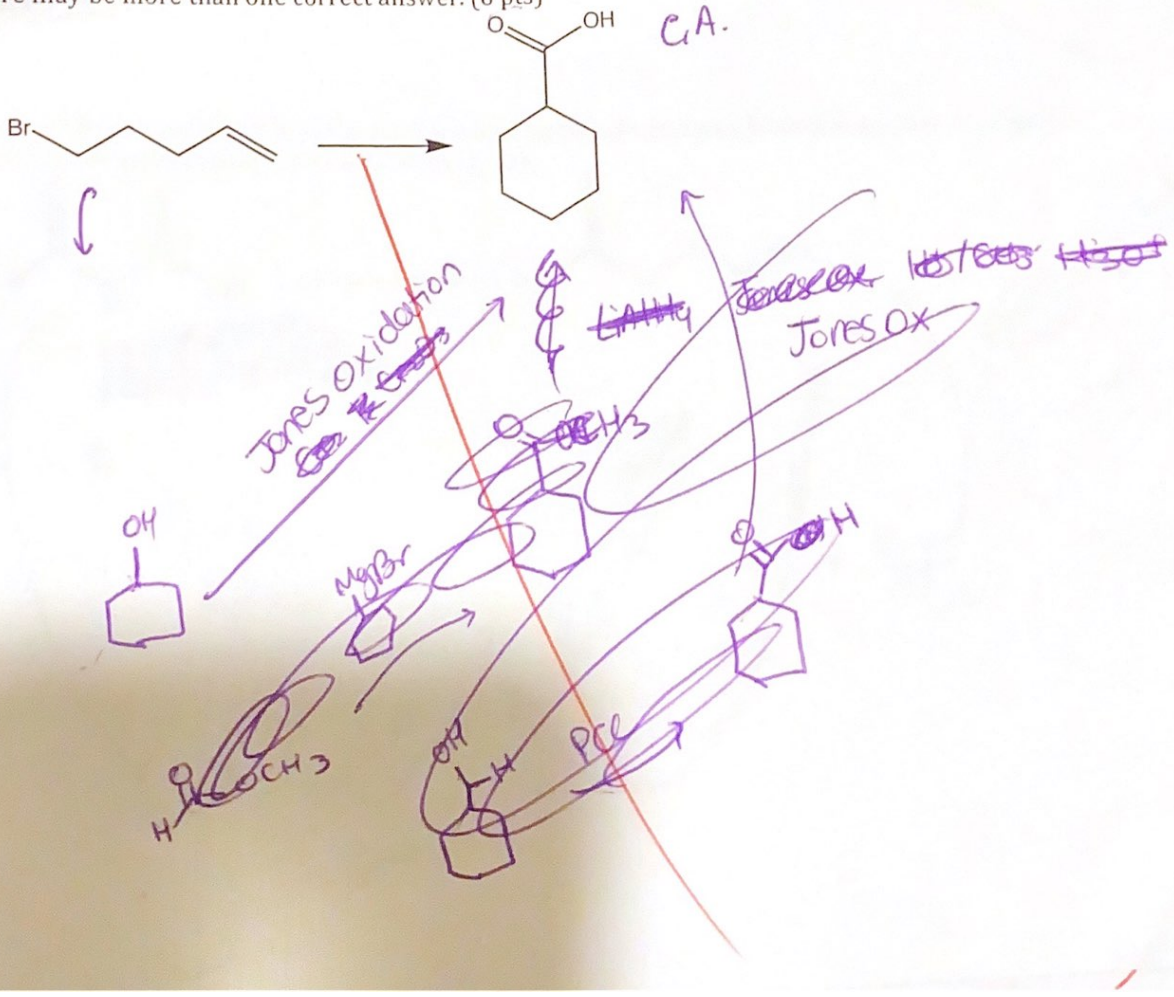
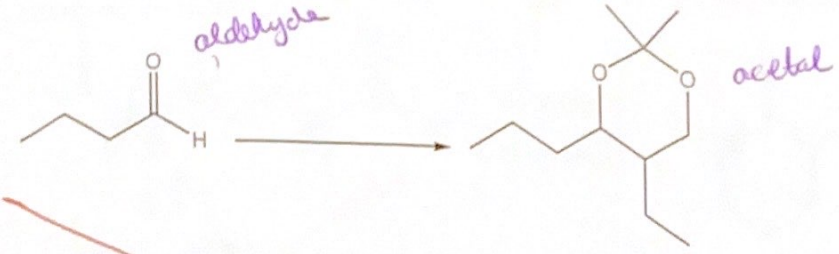


α,β unsat. C. (enone) + ketone

25. Provide reagents necessary to carry out the following transformations. Several steps may be required and there may be more than one correct answer. (6 pts)

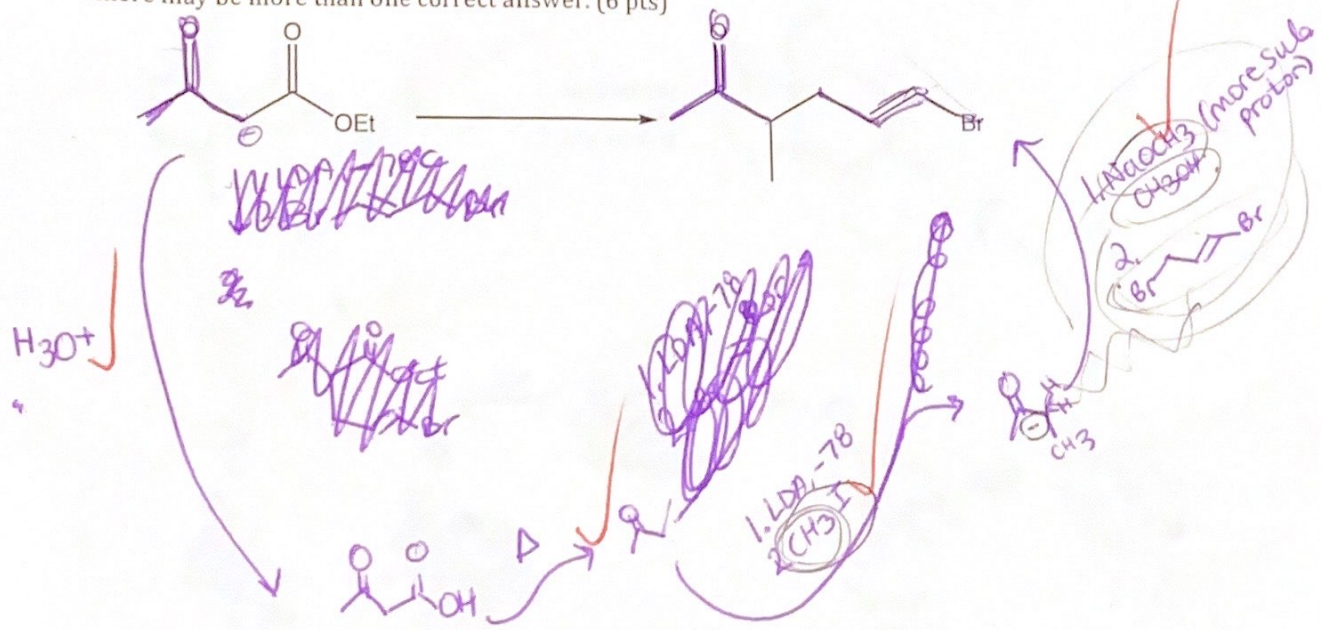


26. Provide reagents necessary to carry out the following transformations. Several steps may be required and there may be more than one correct answer. (6 pts)



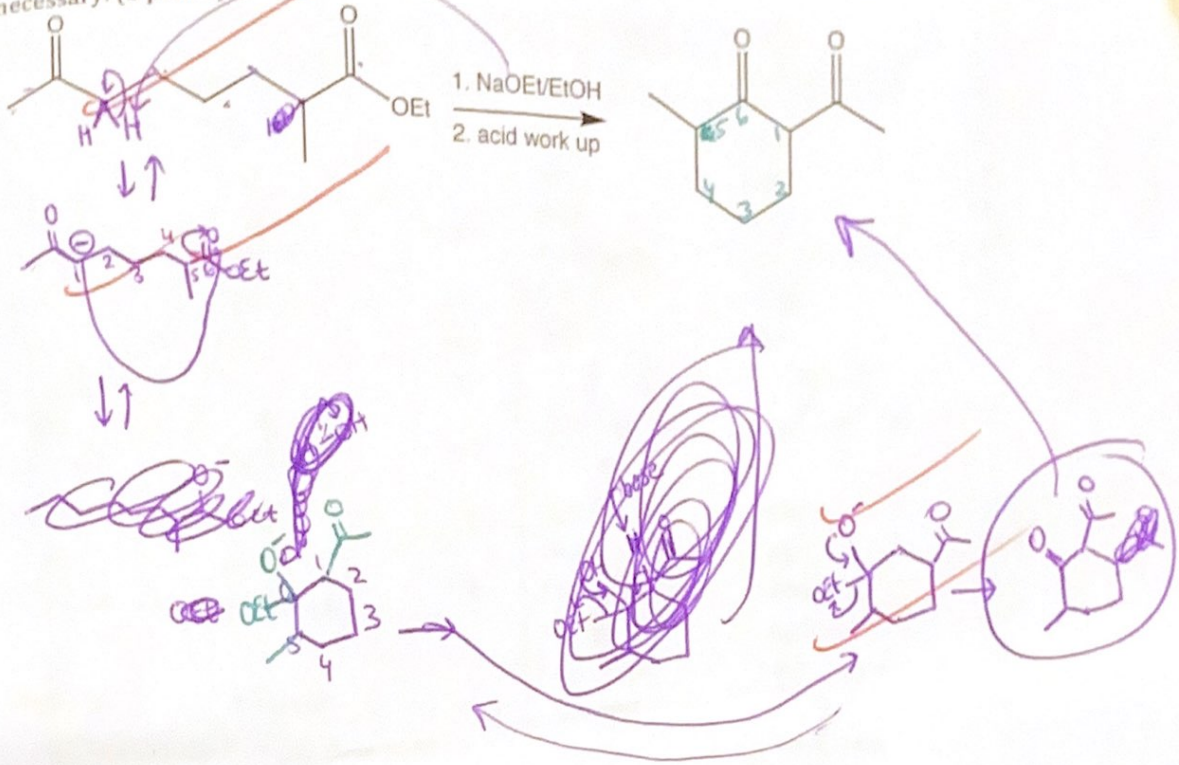
-6

27. Provide reagents necessary to carry out the following transformations. Several steps may be required and there may be more than one correct answer. (6 pts)



6

28. Indicate a plausible mechanism for the following reaction. Be sure to show bond making and bond breaking as well as all electron movement. Every arrow counts. Be precise! Don't forget to show charges where necessary. (8 points)



all in eq

29. Indicate a plausible mechanism for the following reaction. Be sure to show bond making and bond breaking as well as all electron movement. Every arrow counts. Be precise! Don't forget to show charges where necessary. (8 points)

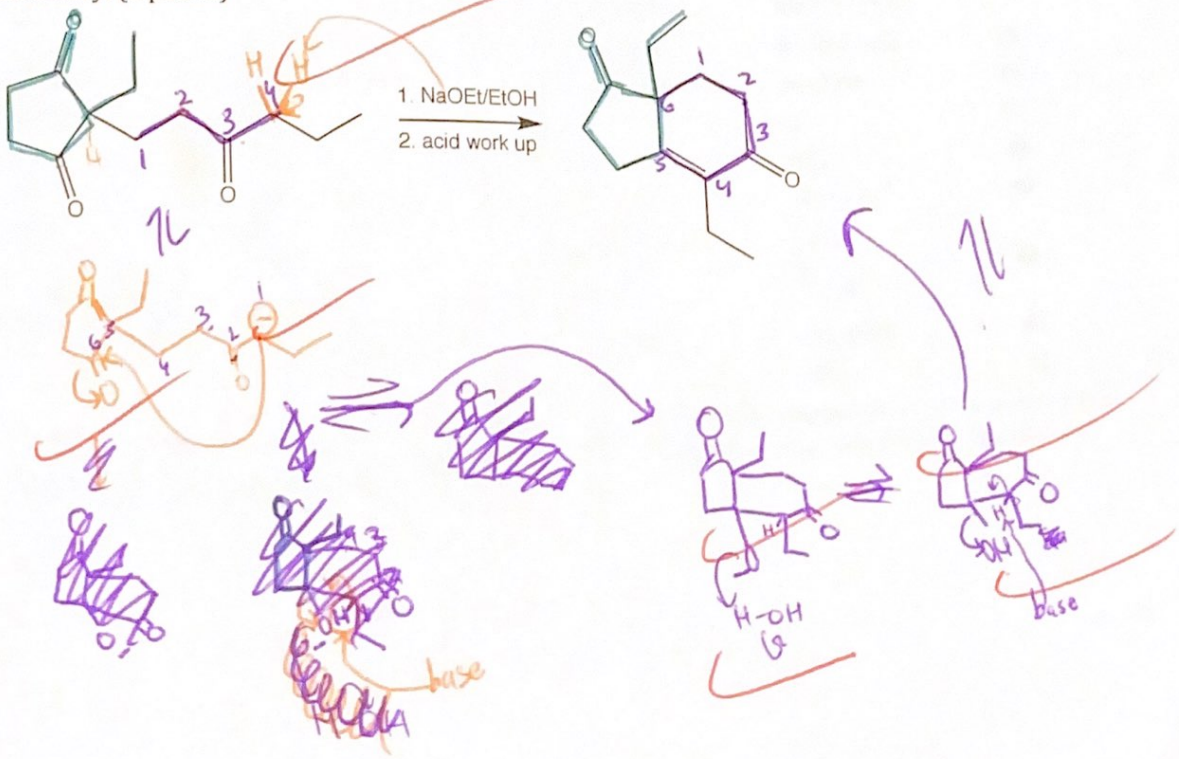
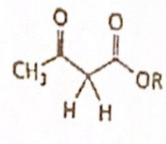
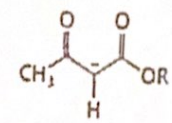
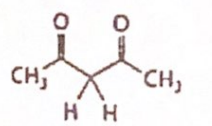
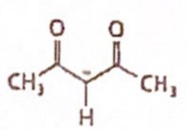
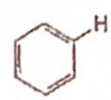


Table 6.3
Acidities of molecules and ions commonly encountered in organic chemistry.[a]

Acid	Conjugate base	pK_a	Acid	Conjugate base	pK_a
$HClO_4$	ClO_4^-	−10	HCN	CN^-	9.2
HI	I^-	−10	NH_4^+	NH_3	9.2
$R-C(=\overset{+}{O}H)-H$	$R-C(=O)-H$	−10	ArOH	ArO^-	10
H_2SO_4	HSO_4^-	−10	$R-CH_2NO_2$	$R-\bar{C}H-NO_2$	10
HBr	Br^-	−9	RNH_3^+	RNH_2	11
HCl	Cl^-	−7	RSH	RS^-	11
$R-C(=\overset{+}{O}H)-R$	$R-C(=O)-R$	−7			11
$ArSO_3H$	$ArSO_3^-$	−6.5	CH_3OH	CH_3O^-	15.2
$R-C(=\overset{+}{O}H)-OR'$	$R-C(=O)-OR'$	−6	H_2O	HO^-	15.7
$R-\overset{+}{O}(H)-R'$	$R-O-R'$	−3.5	RCH_2OH	RCH_2O^-	16
$R-\overset{+}{O}(H)-H$	$R-O-H$	−2	R_2CH-OH	R_2CH-O^-	17
H_3O^+	H_2O	−1.7	R_3C-OH	R_3C-O^-	17
HNO_3	NO_3^-	−1.4	$R-C(=O)-NH_2$	$R-C(=O)-NH^-$	17
HSO_4^-	SO_4^{2-}	2	$R-C(=O)-CH_3$	$R-C(=O)-CH_2^-$	20
HF	F^-	3.1	$RO-C(=O)-CH_3$	$RO-C(=O)-CH_2^-$	24
$ArNH_3^+$	$ArNH_2$	4	$R-CH_2CN$	$R-\bar{C}H-CN$	25
RCOOH	$RCOO^-$	5	$H-C\equiv C-H$	$H-C\equiv C^-$	25
H_2CO_3	HCO_3^-	6.4	H_2	H^-	35
H_2S	HS^-	7	NH_3	NH_2^-	38
ArSH	ArS^-	7	$Ph-CH_3$	$Ph-CH_2^-$	40
		9			43
			$CH_2=CH_2$	$CH_2=CH^-$	44
			CH_4	CH_3^-	48

[a] pK_a values from J. March, *Advanced Organic Chemistry*, 4th ed., John Wiley & Sons, New York, 1992, pp. 250–252. Abbreviations: Ar = aryl; Ph = phenyl; R = alkyl.