CHEM 3331 **Exam #3** **Name**_____
Dr. Minger **July 26, 2010**

Please read and sign the Honor Code statement below:

I pledge that on my honor, as a University of Colorado at Boulder student, I have neither given nor received unauthorized assistance on this exam.

_____
Signature

General Instructions: There are 9 pages and 15 questions, including this cover sheet. Be sure you have them all. Read each question carefully so that you know exactly what is being asked and what you need to write or draw. Your work on scratch pages will not be graded, so be sure everything you want graded is written on the exam itself and that your answers to the multiple choice questions are correctly bubbled in on the Scantron.

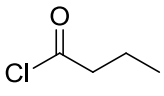
Each multiple choice question (1-12) is worth **4 points and has only one correct answer.** Good luck!

PERIODIC CHART OF THE ELEMENTS

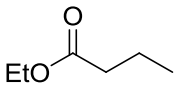
IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII			IB	IIB	IIIA	IVA	VA	VIA	VIIA	INERT GASES
1 H 1.00797																1 H 1.00797	2 He 4.0026
3 Li 6.939	4 Be 9.0122											5 B 10.811	6 C 12.0112	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.183
11 Na 22.9898	12 Mg 24.312											13 Al 26.9815	14 Si 28.086	15 P 30.9738	16 S 32.064	17 Cl 35.453	18 Ar 39.948
19 K 39.102	20 Ca 40.08	21 Sc 44.956	22 Ti 47.90	23 V 50.942	24 Cr 51.996	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28 Ni 58.71	29 Cu 63.54	30 Zn 65.37	31 Ga 69.72	32 Ge 72.59	33 As 74.9216	34 Se 78.96	35 Br 79.909	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.905	40 Zr 91.22	41 Nb 92.906	42 Mo 95.94	43 Tc (99)	44 Ru 101.07	45 Rh 102.905	46 Pd 106.4	47 Ag 107.870	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.904	54 Xe 131.30
55 Cs 132.905	56 Ba 137.34	*57 La 138.91	72 Hf 178.49	73 Ta 180.948	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 196.967	80 Hg 200.59	81 Tl 204.37	82 Pb 207.19	83 Bi 208.980	84 Po (210)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	†89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 ? (271)	111 ? (272)	112 ? (277)						

Select the single best answer to each multiple choice question (1-12). (4 pts each)

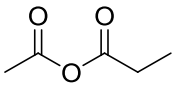
1. Which of the following is the least reactive compound towards nucleophilic acyl substitution?



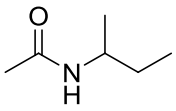
A



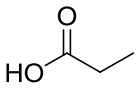
B



C

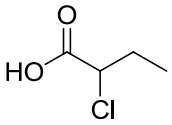


D

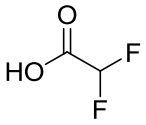


E

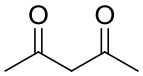
2. Which of the following is the most acidic species?



A



B



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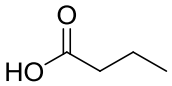

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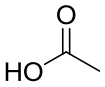
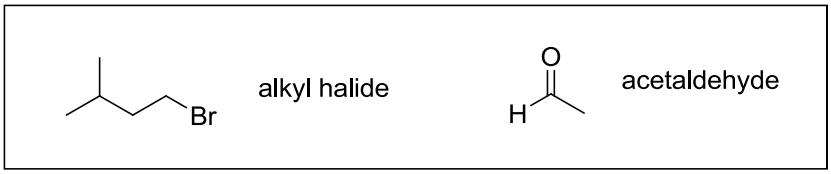
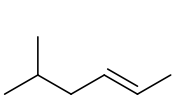


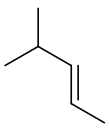
E

3. An ylide was generated from the alkyl halide shown and then reacted with acetaldehyde (structures are given below). What is the major organic product of the reaction of the ylide with acetaldehyde?





A



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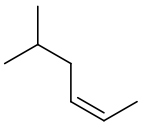

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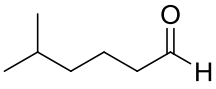
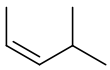
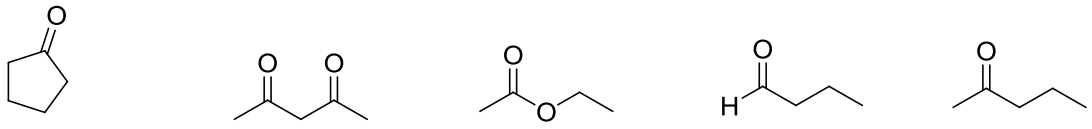


D



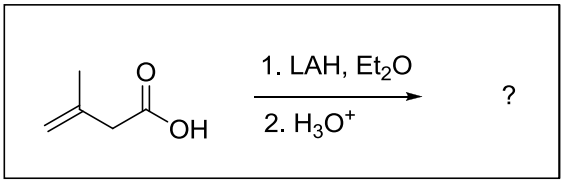
E

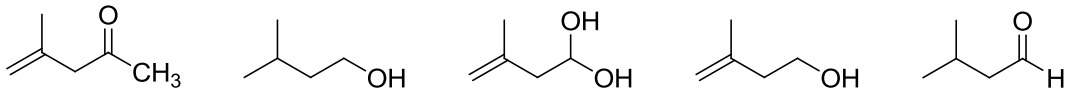
4. Which of the following compounds, when placed in water, do you expect to have the highest concentration of enol at equilibrium?



A **B** **C** **D** **E**

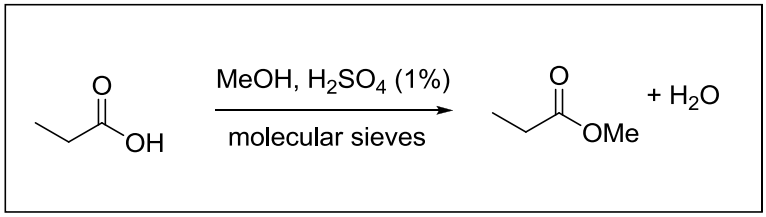
5. What is the major organic product of the following reaction?

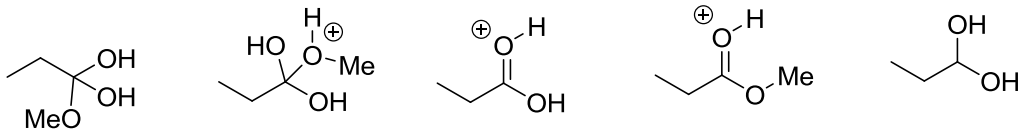




A **B** **C** **D** **E**

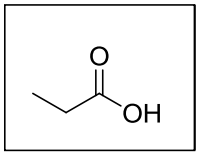
6. Which of these structures is not a mechanistic intermediate in an acid-catalyzed esterification of a carboxylic acid (Fischer esterification)?

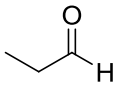




A **B** **C** **D** **E**

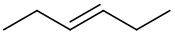
7. From which of the following compounds could the acid shown *not* be made in one synthetic step (plus appropriate workup)?



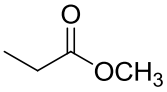


A

B



C

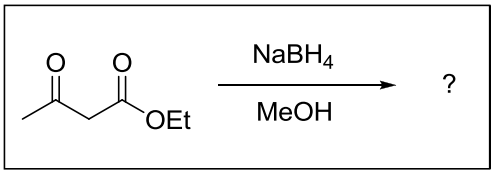


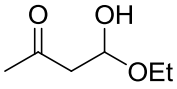
D

The acid could be made from all these compounds.

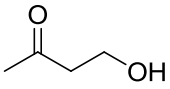
E

8. What is the major organic product of the reaction conditions shown?

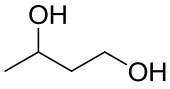




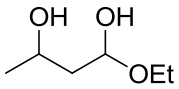
A



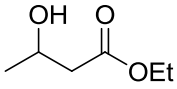
B



C

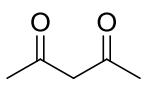


D

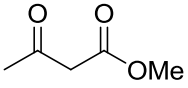


E

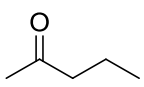
9. Which of the following is the least acidic species?



A



B



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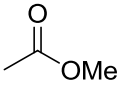
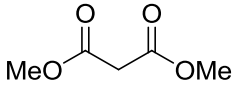
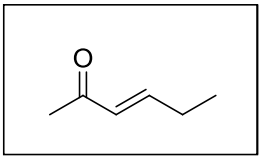


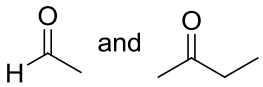
D



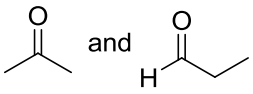
E

10. What are the starting materials needed to make this molecule using an aldol condensation?

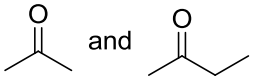




A



B



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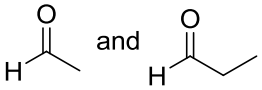
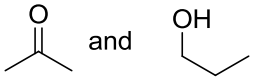


D



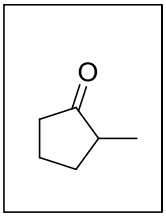
E

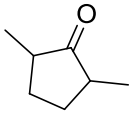
11. Which of the following conditions would successfully form a cyanohydrin? Potentially helpful information: pK_a of HCN: 9.2; pK_a of HCl: < 0; pK_a of ROH: 16

I. HCl (1.0 equiv) and NaCN (1.0 equiv)
II. HCl (1.0 equiv) and NaCN (1.2 equiv)
III. HCN (1.0 equiv) and NaCN (1.0 equiv)

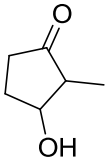
a. I
b. II
c. III
d. I and III
e. II and III

12. The ketone shown is treated with 0.95 equiv of NaH, then with 1.0 equiv methyl iodide, CH_3I. What is the major organic product that will result?





A



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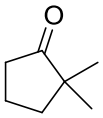
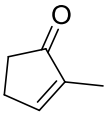
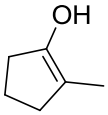


C

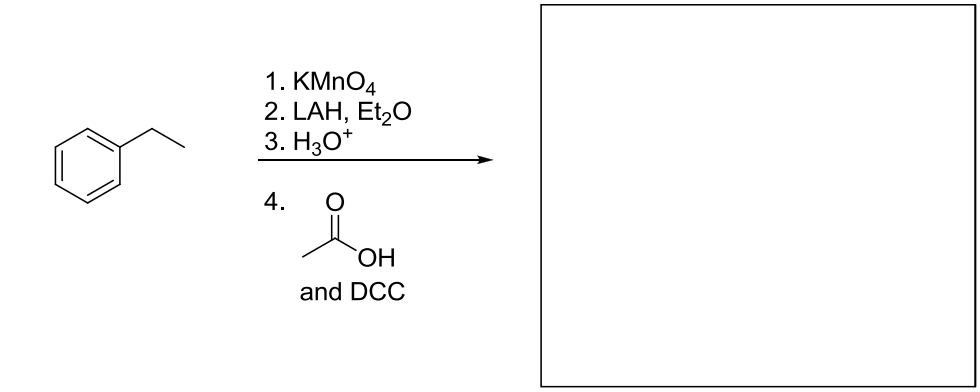


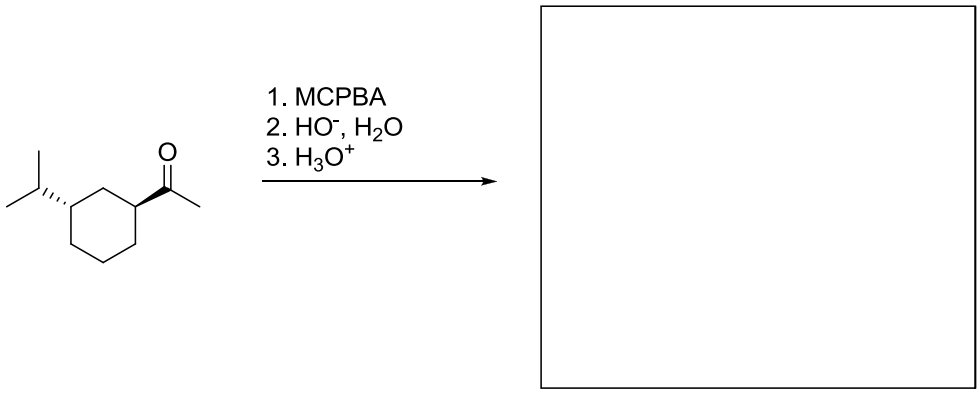
D

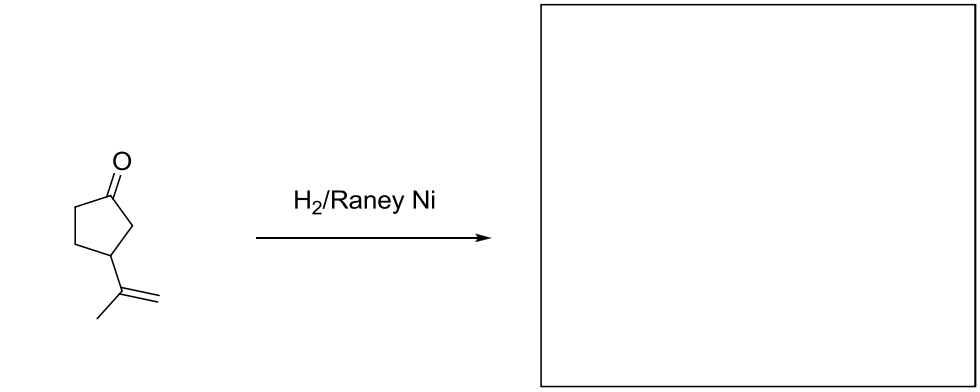


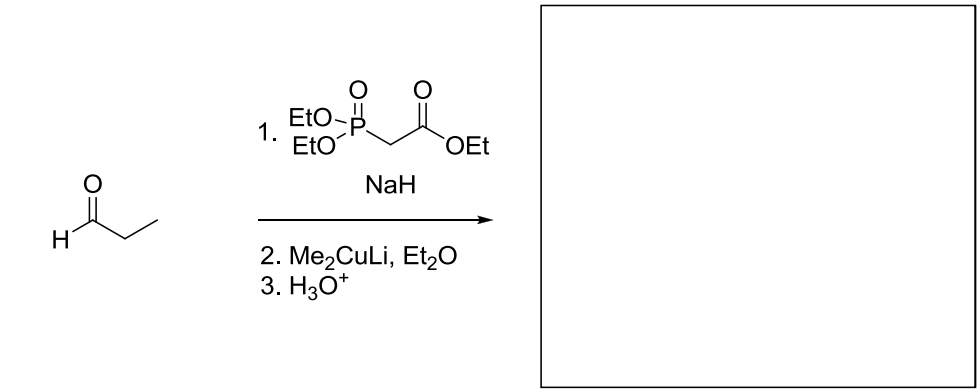
E

13. Predict the major organic product, *including stereochemistry where appropriate*, of each of the following reactions or reaction sequences. (16 pts)

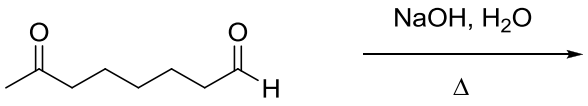




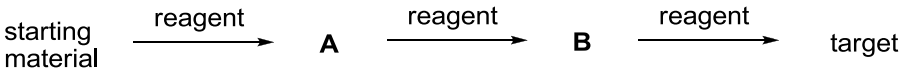




14. Predict the major organic product of the conditions shown and draw a mechanism to rationalize its formation. Include all curved arrows, intermediates, lone pairs of electrons, and non-zero formal charges for full credit. (16 pts)



15. Design a multi-step synthesis for each of the following transformations. Show the reagents needed for each step and the product of each step. Do not draw any mechanisms. Do not provide a list of reagents without showing the product of each step. Write your answer in exactly this format (note that your syntheses may or may not be three steps):



(20 pts)