

Chemistry 220b, Section 1  
Exam 2 (75 pts)  
Thursday, February 28, 2008

Name \_\_\_\_\_

**Write and sign the VU Honor Pledge:**

\_\_\_\_\_ signature

This Exam is closed book and closed notes

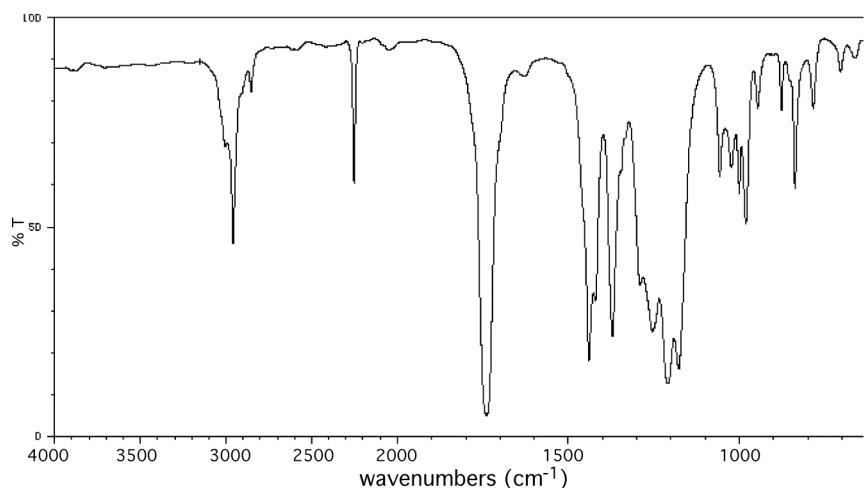
**NOTE:** It is difficult for me to give you partial credit if you do not show your work!

Neatness counts

Good Luck !!

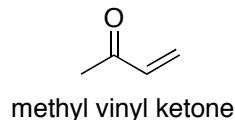
1-8. Multiple Choice. Give the best answer for the following. (24 pts)

1. Which structure is most consistent with the following IR spectrum?



a)  $\text{H}_3\text{CH}_2\text{CH}_2\text{C}-\text{C}\equiv\text{N}$       b)  $\text{N}\equiv\text{C}-\text{CH}_2\text{CH}_2\text{C}(=\text{O})-\text{OH}$       c)  $\text{N}\equiv\text{C}-\text{CH}_2\text{CH}_2\text{C}(=\text{O})-\text{OCH}_3$       d)  $\text{H}_3\text{CH}_2\text{CH}_2\text{C}(=\text{O})-\text{OH}$

2. Which of the following nucleophiles will undergo 1,2-addition with methyl vinyl ketone?

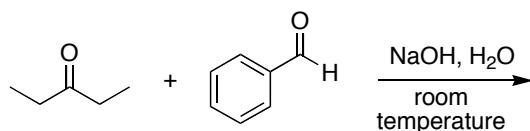


a)  $\text{H}_3\text{C}-\text{MgBr}$       b)  $(\text{H}_3\text{C})_2\text{CuLi}$       c)  $^-\text{CN}$       d) an enolate

3. Which of following can be used to synthesize pentanoic acid from 1-pentanol?

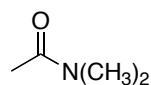
a)  $\text{H}_2\text{Cr}_2\text{O}_7, \text{H}_3\text{O}^+$   
 b) 1.  $\text{PBr}_3$  2.  $\text{Mg}(0)$ , 3.  $\text{CO}_2$ , then  $\text{H}_3\text{O}^+$   
 c) 1.  $\text{PBr}_3$  2.  $^-\text{CN}$  3.  $\text{H}_3\text{O}^+$   
 d) all of the above; a, b, and c can all be used to prepare pentanoic acid from 1-pentanol

4. Which is the major product from the base-catalyzed reaction of 3-pentanone and benzaldehyde?

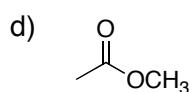
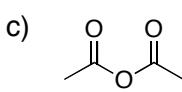
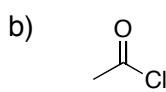
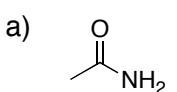


a)   
 b)   
 c)   
 d)

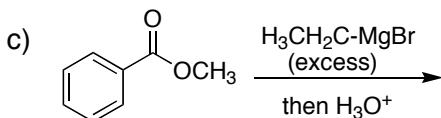
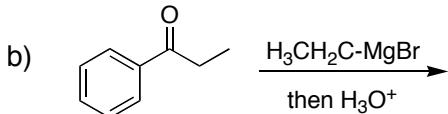
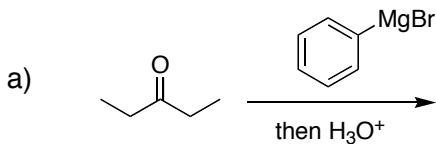
5. Which of the following is the *least* reactive toward dimethylamine to afford dimethylacetamide?



dimethylacetamide



6. Which of the following is *not* a feasible way to make 3-phenyl-3-pentanol.



d) none all of the above; a, b, and c are all feasible methods to make 3-phenyl-3-pentanol

7. Which of the following best describes a Robinson annulation?

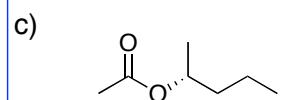
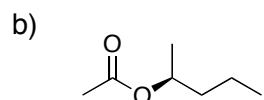
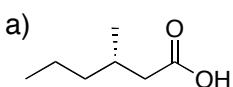
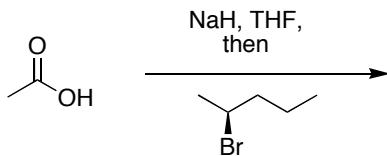
a) An aldol condensation, followed by dehydration

b) A Michael addition, followed by an intramolecular aldol condensation, followed by dehydration.

c) A Michael addition, followed by an intermolecular aldol condensation

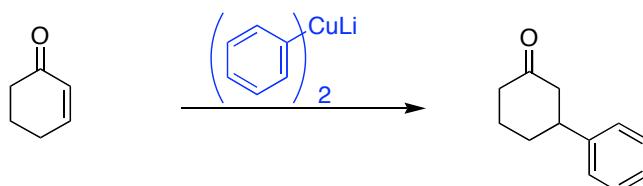
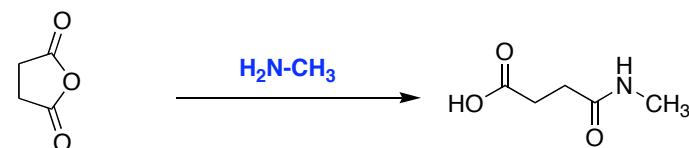
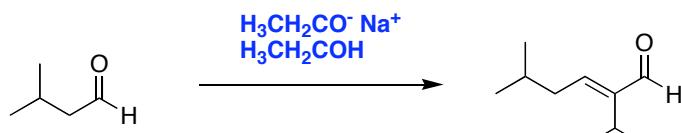
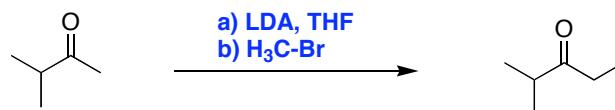
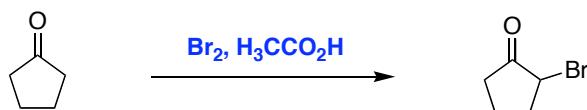
d) A double alkylation reaction of a ketone enolate with 1,6-dibromohexane.

8. What is the product of the following reaction? The stereochemistry of the reactants and products are as indicated.

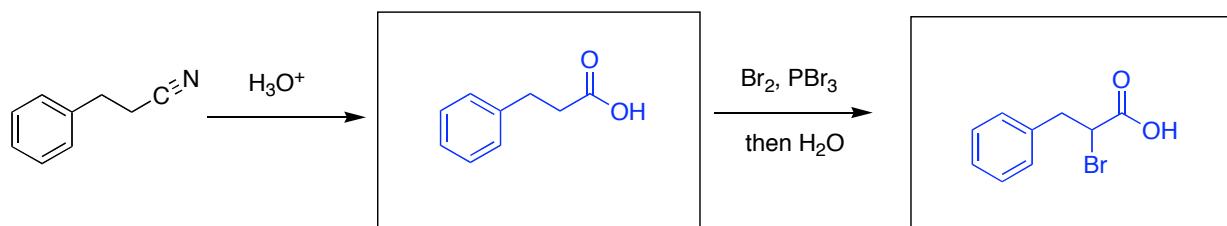
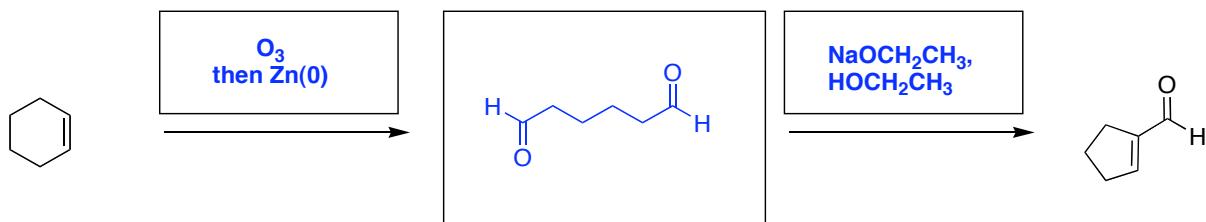
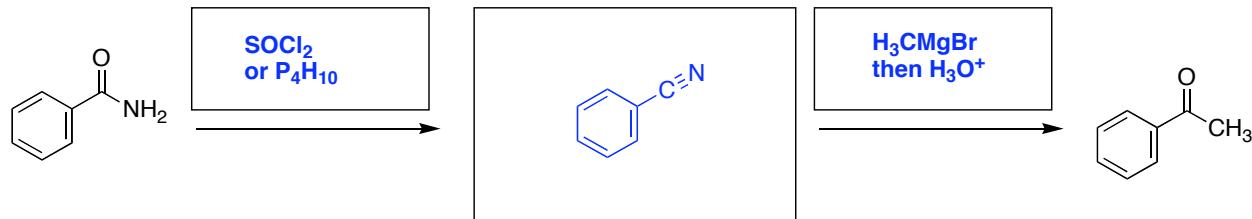


d) b and c will be formed in equal amounts

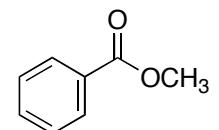
9. Provide the reagent(s) and any other necessary reactants for the following reactions (15 pts)



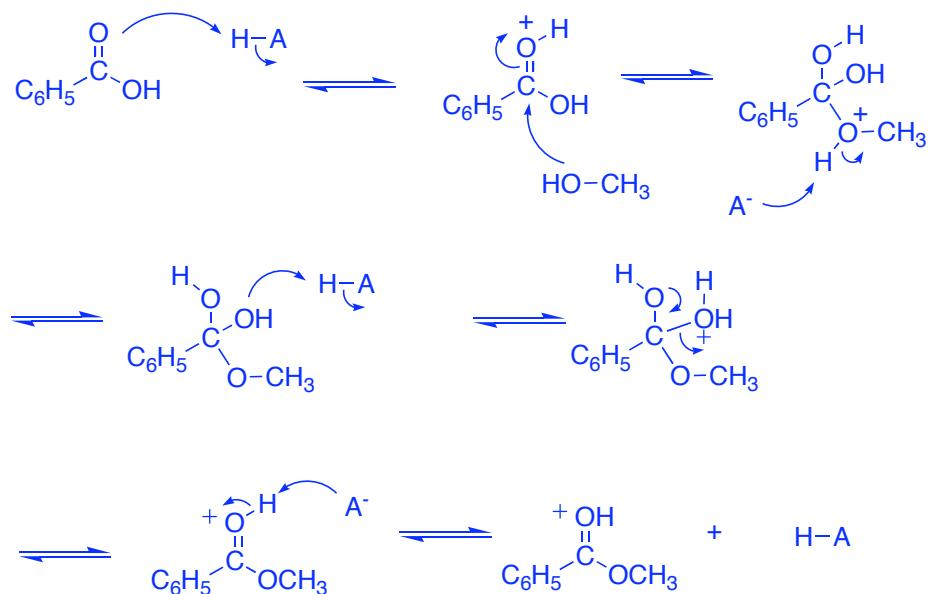
10. Complete the following syntheses by providing the necessary reagents and intermediates. (16 pts)



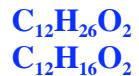
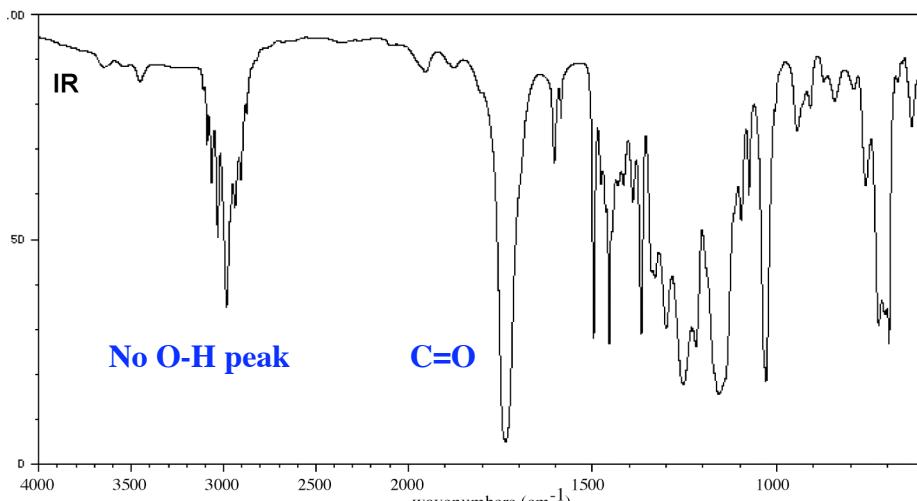
11. Show the reactants for the preparation of methyl benzoate by a Fischer esterification and give a detailed, step-wise mechanism for its formation. (10 pts)



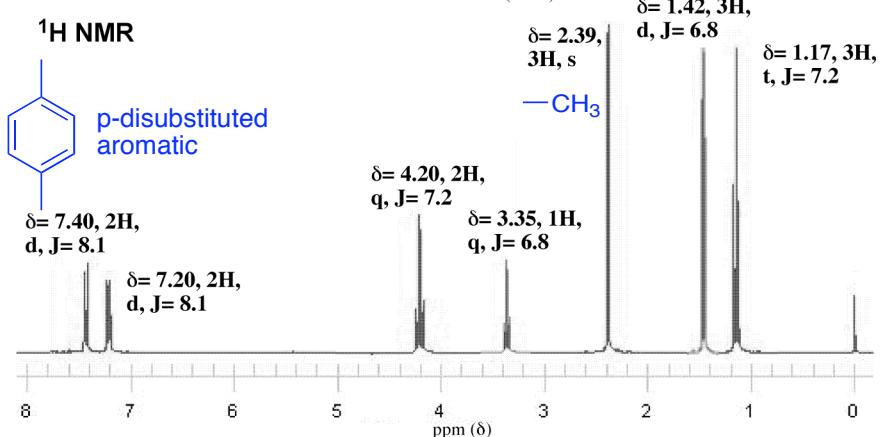
methyl benzoate



12. A molecule of formula  $C_{12}H_{16}O_2$  has the following IR,  $^1H$  and  $^{13}C$  NMR spectra. Provide a structure that is consistent with the data. Please read the NMR data carefully as the resolution of the actual spectrum is low. (10 pts)

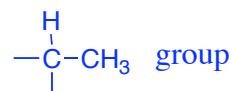


$H_{10}/2 = 5$  units of unsaturation



$\delta = 4.20$  (q, 2H) and  $1.17$  (t, 3H) have the same  $J$ , therefore coupled to one another. Consistent with a  $-CH_2CH_3$  group

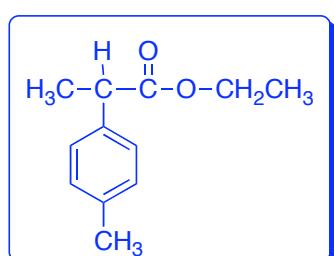
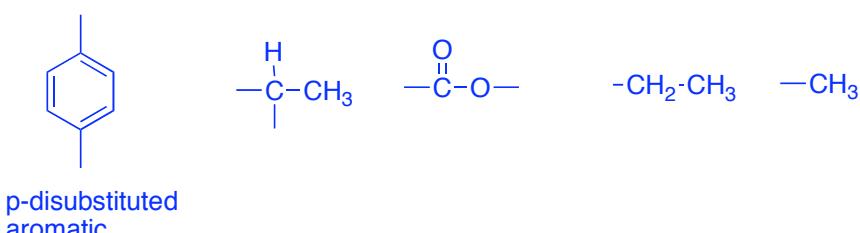
$\delta = 3.35$  (q, 1H) and  $1.42$  (d, 3H) have the same  $J$ , therefore coupled to one another. Consistent with a



$^{13}C$  NMR:  $\delta = 173.0, 137.2, 132.0, 129.7, 129.1, 61.7, 40.5, 25.5, 17.0, 14.1$

$\delta = 173$  is consistent w/ an acid, ester or amide

no acid peak in IR, no nitrogen in molecular formula, therefore it is an ester



$-CH_2$  of ethyl group ( $\delta = 4.20$ ) is further downfield than the  $-CH_3$  ( $\delta = 2.39$ ) - more consistent with an ethyl ester than a methyl ester. The  $-CH_3$  ( $\delta = 2.39$ ) is consistent with it being benzylic

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Problem 1-8: \_\_\_\_\_ (24 pts)

9: \_\_\_\_\_ (15 pts)

10: \_\_\_\_\_ (16 pts)

11: \_\_\_\_\_ (10 pts)

12: \_\_\_\_\_ (10 pts)

Total out of 75: \_\_\_\_\_