

Chemistry 220b, Section 1  
Exam 1 (75 pts)  
Tuesday, February 5, 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

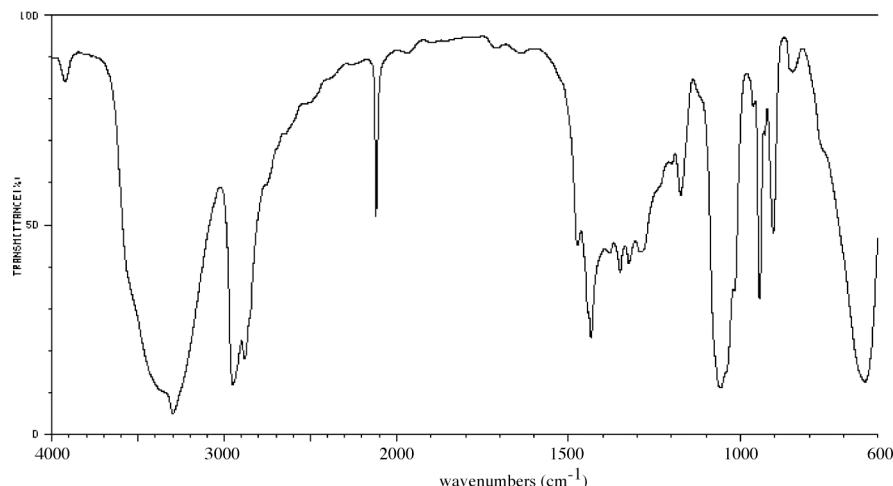
Good Luck !!

1-8. Multiple choice: Select the best answer for the follow questions. (8 questions, 24 points)

1. Absorption of UV-visible light by a molecule results in . . .

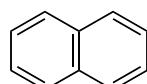
- a) transitions in vibrational energy levels
- b) transitions in electronic energy levels
- c) transitions in nuclear spin energy levels when in an external magnetic field
- d) loss in an electron and the formation of an  $M^+$  ion.

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



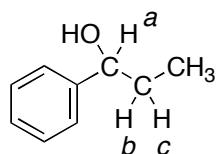
- a)  $\text{HC}\equiv\text{C}-\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$       b)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$       c)  $\text{H}_3\text{CH}_2\text{CH}_2\text{C}-\text{C}\equiv\text{N}$       d)  $\text{HC}\equiv\text{C}\cdot\text{CH}_2\cdot\text{CH}_2\overset{\text{O}}{\text{C}}-\text{OH}$

3. How many  $^{13}\text{C}$  resonances are expected for naphthalene?



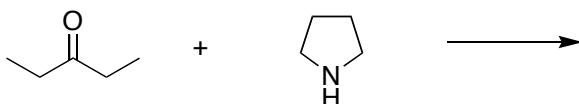
- a) 10      b) 6      c) 4       d) 3

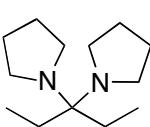
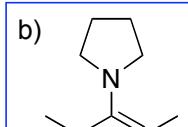
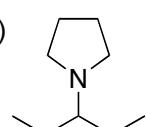
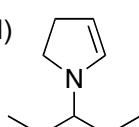
4. The coupling constants for the protons labeled *a-c* of 1-phenyl-1-propanol are:  $J_{ab} = 7.4$ ,  $J_{ac} = 4.2$ , and  $J_{bc} = 12.6$ . The multiplicity of the proton labeled *a* is predicted to be a . . .



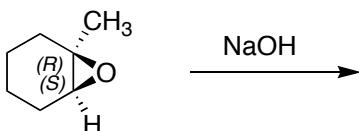
- a) singlet      b) triplet       c) doublet of doublets      d) doublet of triplets

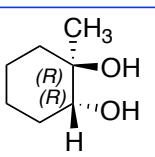
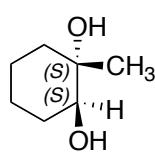
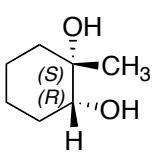
5. Which is the predicted product from the following reaction?



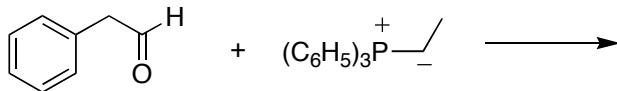
- a) 
- b) 
- c) 
- d) 

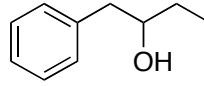
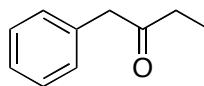
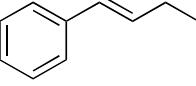
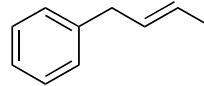
6. Which is the predicted product from the following reaction? The stereochemistry of the reactant and products are as shown.



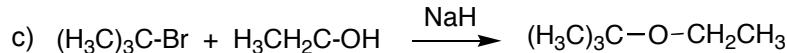
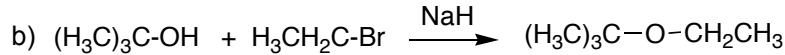
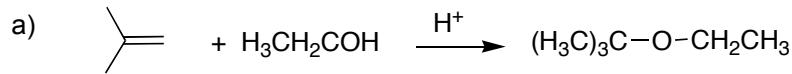
- a) 
- b) 
- c) 
- d) An equal mixture of products a and b

7. Which is the predicted product from the following reaction?



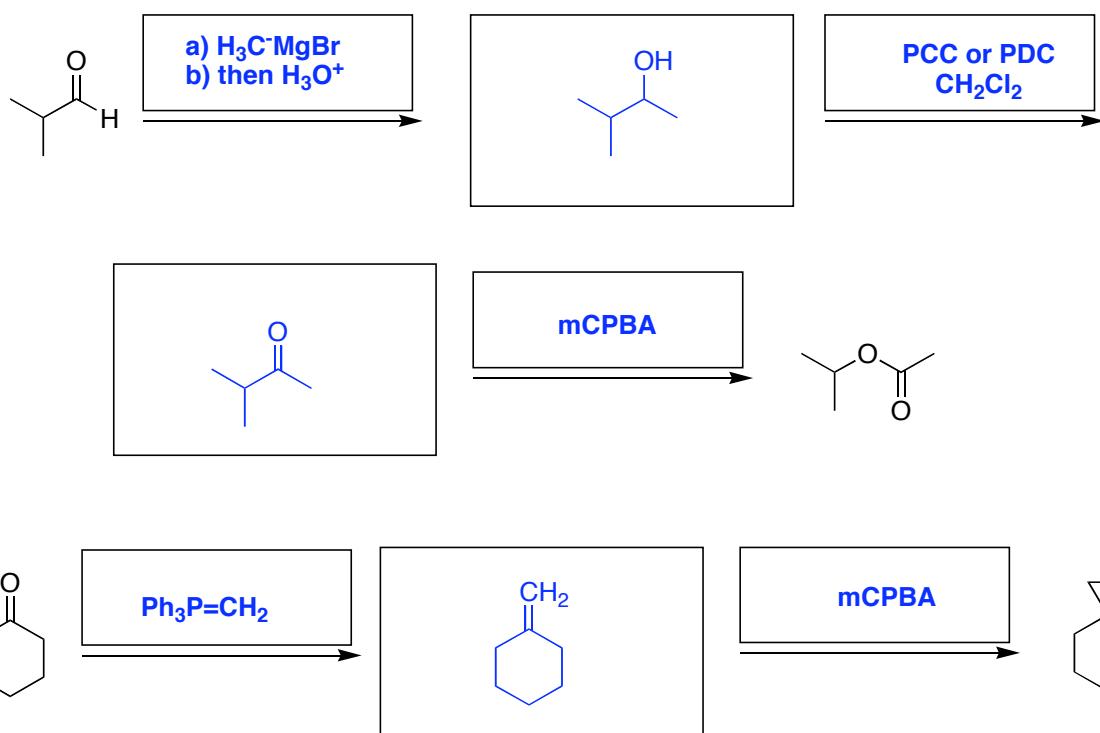
- a) 
- b) 
- c) 
- d) 

8. Which of the following is not a feasible method for the preparation of tert-butyl ethyl ether?

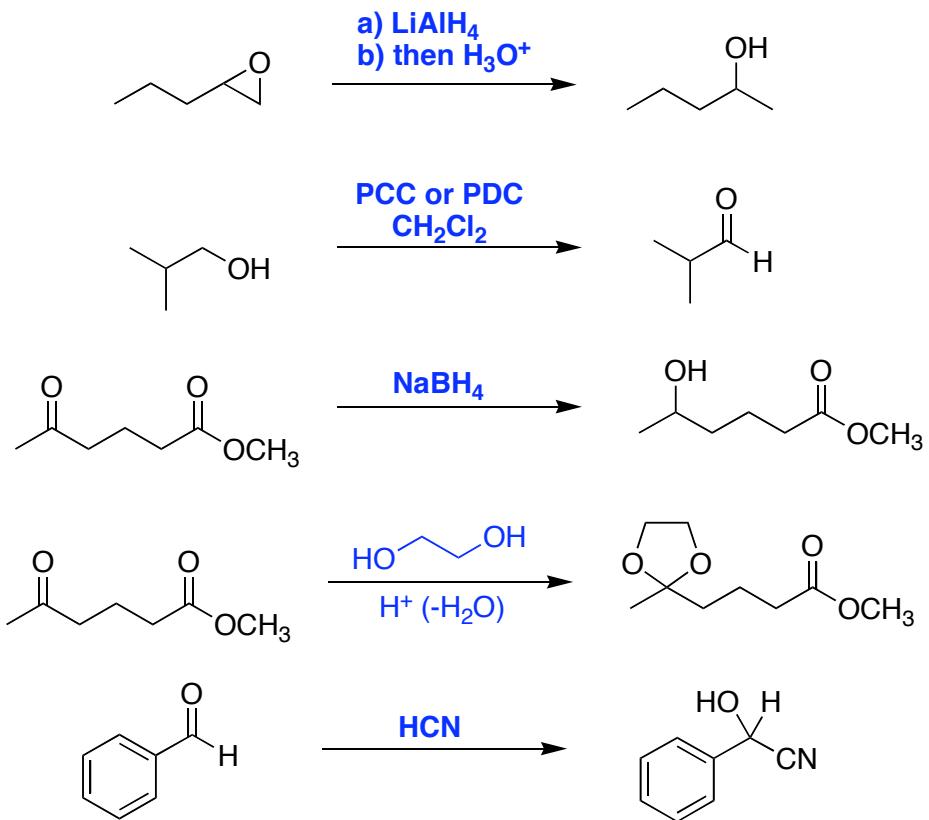


- d) none of the above; a, b, and c are all feasible methods for the preparation of tert-butyl ethyl ether

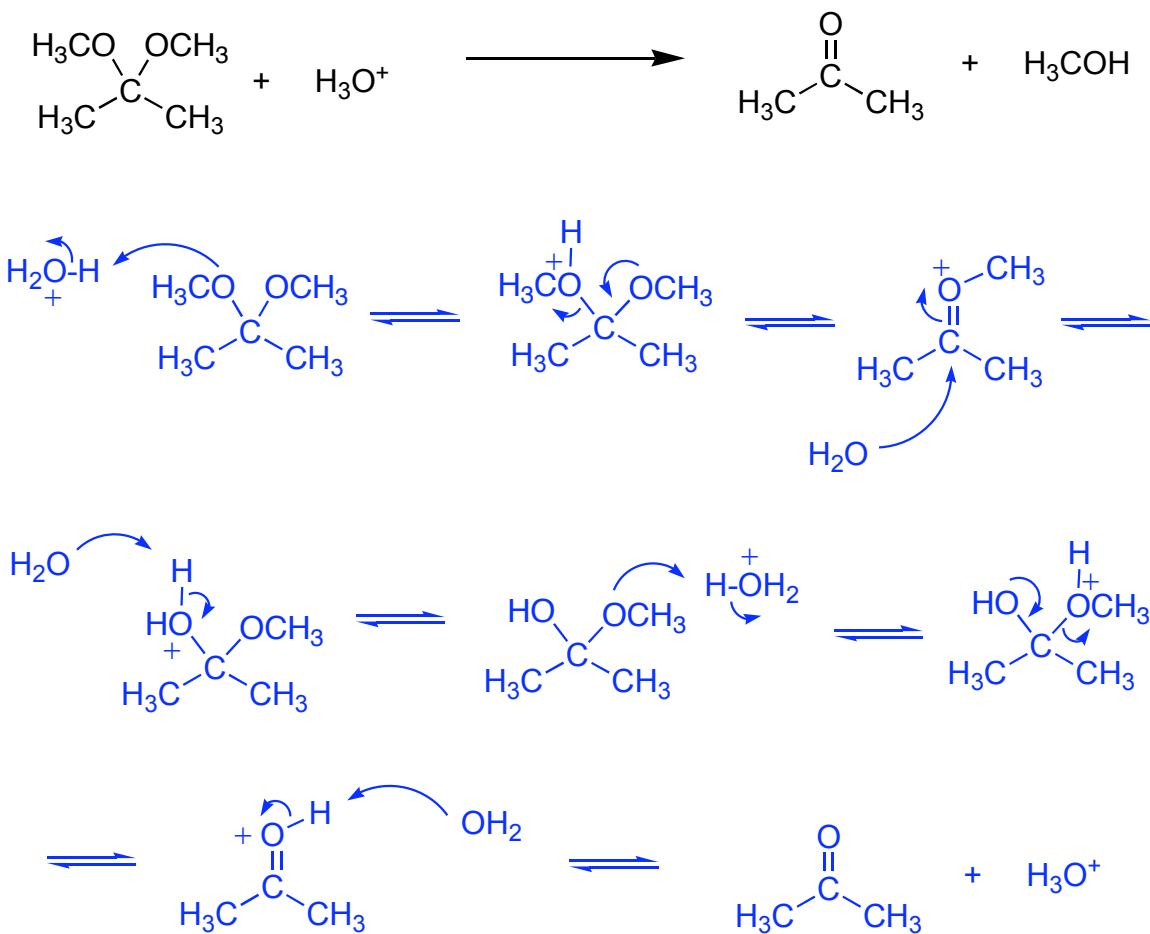
9. Complete the following syntheses by providing the necessary reagents and intermediates. (16 pts)



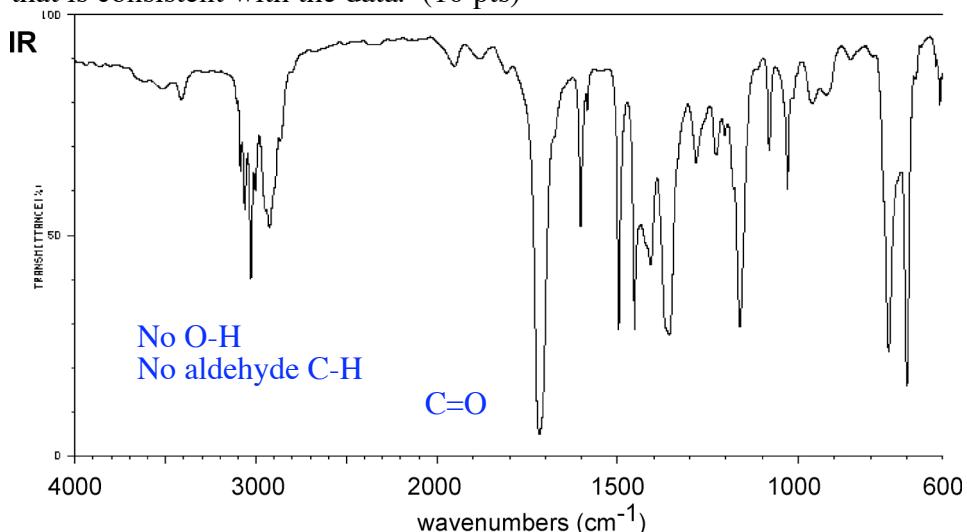
10. Provide the reagent(s) and any other necessary reactants for the following reactions (15 pts)



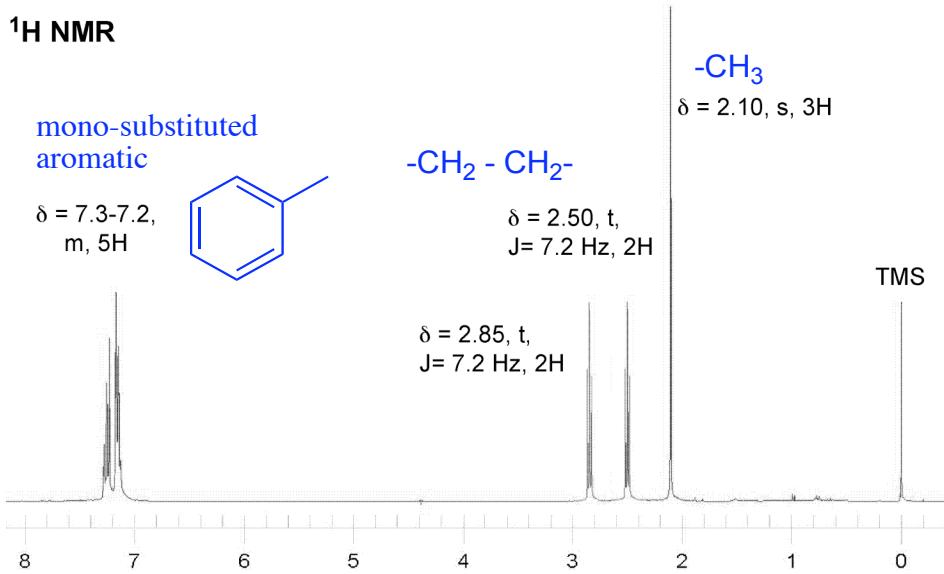
11. Provide a complete mechanism for the *acid-catalyzed* hydrolysis of 2,2-dimethoxypropane to acetone and methanol. (10 pts)



12. A molecule of formula  $C_{10}H_{12}O$  has the following IR,  $^1H$  and  $^{13}C$  NMR spectra. Provide a structure that is consistent with the data. (10 pts)



$C_{10}H_{22}O$   
 $- C_{10}H_{12}O$   
 $\text{H}_{10} / 2$   
 $= 5 \text{ units of}$   
 $\text{unsaturation}$



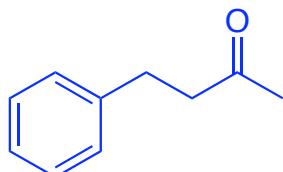
$^{13}C$  NMR: 207, 141, 128, 126, 124, 45, 29, 27

$^{13}C$  NMR: 207 ppm = ketone or aldehyde (no aldehyde resonance in  $^1H$  NMR spectrum)

$^1H$  NMR:  $\delta = 2.85$  is a triplet that integrates for 2Hs, a  $\text{CH}_2$  with an adjacent  $\text{CH}_2$ ; chemical shift is consistent with the  $\text{CH}_2$  being adjacent to a  $\text{C}=\text{C}$  or  $\text{C}=\text{O}$ .

$\delta = 2.50$  is a triplet that integrates for 2Hs, a  $\text{CH}_2$  with an adjacent  $\text{CH}_2$ ; chemical shift is consistent with the  $\text{CH}_2$  being adjacent to a  $\text{C}=\text{C}$  or  $\text{C}=\text{O}$ . Since the coupling constants for  $\delta = 2.85$  and  $\delta = 2.50$  are the same (7.2 Hz), they are adjacent  $\text{CH}_2$ .

$\delta = 2.10$  is a singlet that integrates to 3Hs and is a methyl group that is adjacent to a carbon with no Hs; chemical shift is consistent with the  $\text{CH}_3$  being adjacent to a  $\text{C}=\text{C}$  or  $\text{C}=\text{O}$ .



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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: \_\_\_\_\_