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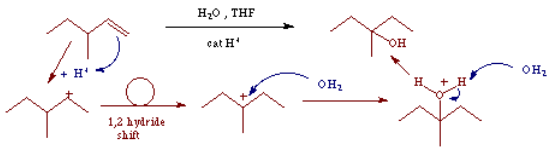
Organic Chemistry 2444-01

September 24, 2008

EXAM ONE - **ANSWER KEY**

Need a Periodic Table? Click here.

1. (8 pts) Give the complete mechanism for the following reaction.



2. (12 pts) In each case circle the correct answer(s).
-1/2 for each extra answer.

(a) Circle all structures that are consistent with a mass spectrum having a P-35 peak.

(b) Circle all molecules expected to show at least one a singlet proton NMR.

(c) Circle the molecule used as the zero point in the proton NMR.

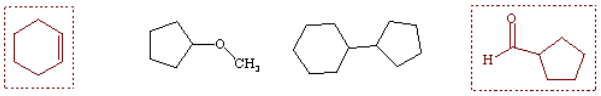
CH_3CH_2OH KBr $(CH_3)_4Si$ THF $CH_3CH_2OCH_2CH_3$

(d) Circle the most stable carbocation.

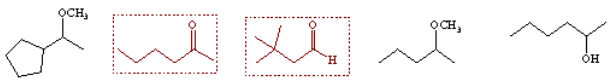
(e) Circle all reagents that convert 2-pentanol to 2-bromopentane..

$SOCl_2$ PBr_3 $POCl_3$ HBr KBr

(f) Circle all molecules that exhibit magnetic anisotropy in the proton NMR.

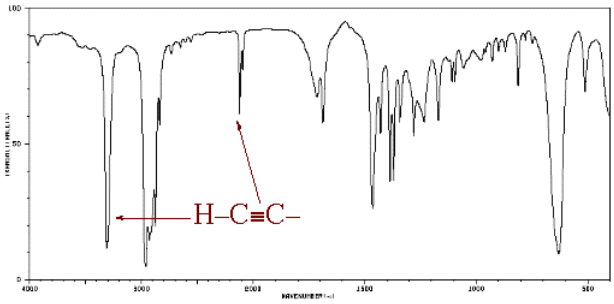


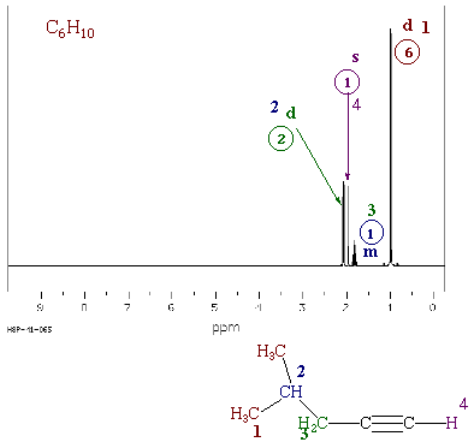
(g) A molecule with a formula $C_6H_{12}O$ shows a strong peak at 1725 cm^{-1} and no peak at 3300-3600 cm^{-1}.
Circle all possible structures that are consistent with this data.



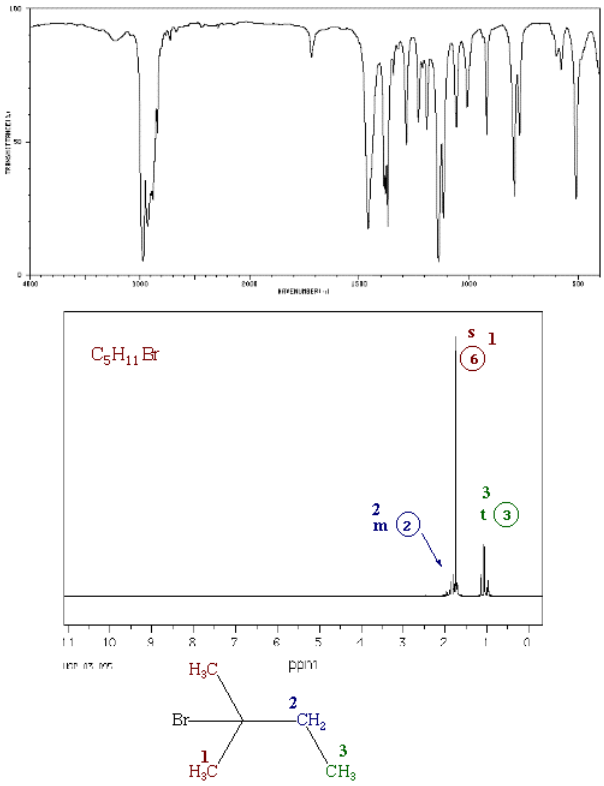
(h) Circle all molecules that react with 1. $NaBH_4$ ii. aq NH_4Cl to give 4-methyl-2-hexanol.

3. (15 pts) Given the following spectral data, what is the structure of this molecule? SHOW YOUR WORK.
P (82) (100) P+1 (83) (6.66) P+2 (84) (0.22)

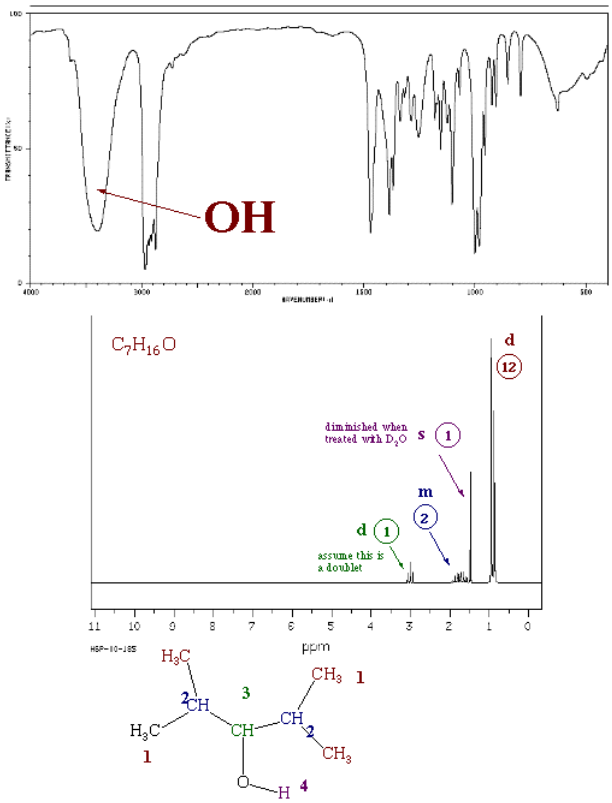




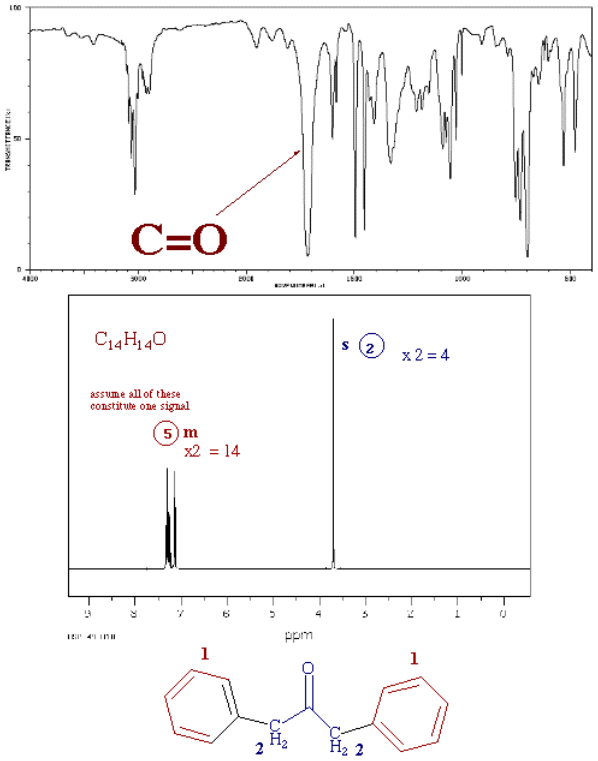
4. (15 pts) Given the following spectral data, what is the structure of this molecule? SHOW YOUR WORK.
P (150) (100) P+1 (151) (5.55) P+2 (152) (98)



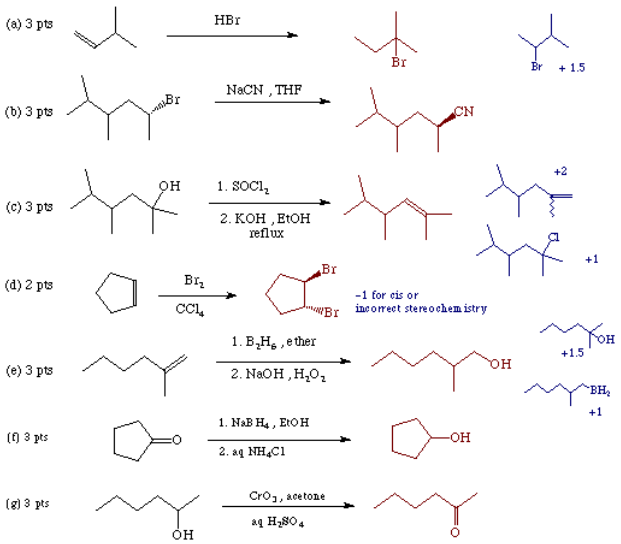
5. (15 pts) Given the following spectral data, what is the structure of this molecule? SHOW YOUR WORK.
P (116) (100) P+1 (117) (7.77) P+2 (118) (0.50)



6. (15 pts) Given the following spectral data, what is the structure of this molecule? SHOW YOUR WORK.
P (210) (100) P+1 (211) (16.65) P+2 (212) (1.59)



7. (20 pts). In each reaction give the major product. If there is no reaction, indicate that with N.R. Remember stereochemistry where it is appropriate.



P+1 = (1.11)(#C) + 0.38 (#N) P+2 = [1.11 x #C]/200 + 0.20 (#O) rings or pi-bonds(no N) = 2#C+2-#H-#X/2 rings or pi bonds (

InfraRed

Functional Group	ν (μ)	Functional Group	ν (μ)
C-H alkanes			
	2850-2960 (3.38-3.51)		
	1350-1470 (6.80-7.41)	C-H alkenes	
	3020-3080 (3.25-3.31)		
	675-1000 (10.00-14.81)		
C-H aromatic rings			
	3000-3100 (3.23-3.33)		
	675-870 (11.49-14.81)	CaC-H alkynes	
	3300 (3.03)		
C=C alkenes			
	1640-1680 (5.95-6.10)	CaC	alkynes

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       2100-2260   (4.42-4.76)
C-C    aromatic  rings 1600 & 1500 (6.25 & 6.75)       C-O     alcohols, ethers,
          acids, esters, etc.  1080-1300   (7.69-9.26)
C=O   aldehydes, ketones,
                  acids, esters
         acid chloride
         conjugated carbonyls  1690-1760 (5.68-5.92)

1802         (5.55)
1695         (5.90)     O-H     monomeric
           H-Bonded

      RCOOH     3610-3640   (2.75-2.77)
3200-3600   (2.78-3.13)

2500-3000   (3.33-4.00)
N-H     amines
   1¡ = doublet; 2¡ = singlet   3300-3500  (2.86-3.03)  C-N     amines  1180-1360    (7.35-8.48)
CaN     nitriles        2210-2260  (4.43-4.52)  O=C-H     aldehyde C-H  2817         (3.55)

NMR CHEMICAL SHIFTS in ppm from TMS
cyclopropane    ..... 0.2       primary  R-CH3  ..... 0.9
secondary   R2-CH2      ..... 1.2       tertiary     R3-CH      ..... 1.5
vinylic   C=C-H ..... 4.6-5.9   alkynyl   CaC-H ..... 2.0-3.0
aromatic     Ar-H       ..... 6.0-8.5   benzylic  Ar-C-H        ..... 2.2-3.0
allylic   C=C-C-H       ..... 1.7       fluorides     F-C-H      ..... 4.0-4.5
chlorides    Cl-C-H     ..... 3.0-4.0   bromides     Br-C-H      ..... 2.5-4.0
iodides     I-C-H       ..... 2.0-4.0   alcohols     HO-C-H      ..... 3.4-4.0
ethers     C-O-C-H      ..... 3.3-4.0   esters     RCOO-C-H      ..... 3.7-4.1
acids     HOOC-C-H      ..... 2.0-2.2   esters     ROOC-C-H      ..... 2.0-2.6
carbonyls  O=C-C-H      ..... 2.0-2.7   aldehydes  O=C-H         ..... 9.0-10.3
hydroxyl     C-O-H      ..... 1.0-5.5   phenols   Ar-O-H         ..... 4.0-12.0
enols     C=C-O-H       ..... 15.0-17.0 carboxyl   RCO-O-H       ..... 10.5-15.0
amino     R-N-H ..... 1.0-5.0   amines   N-C-H  ..... 2.5
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Thank you very much.