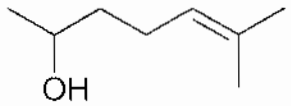
CHEM 2061 - Fall 2007 – **Exam #4** Name KEY

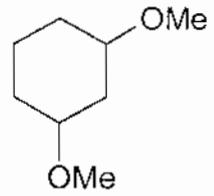
1. (6 pts, 3 each) Give the IUPAC name of the following compounds.

a)



6-methyl-5-hepten-2-ol

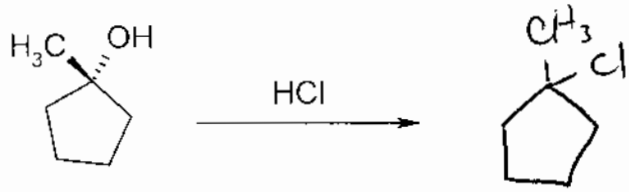
b)



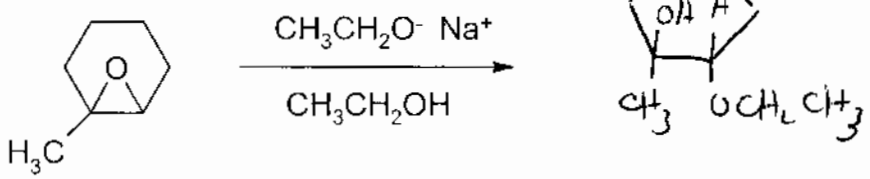
1,3-dimethoxycyclohexane

2. (32 pts, 4 each) Give the structure of the **major product, starting material** or **the reagents needed** for the following transformations. *Be sure to show stereochemistry where appropriate.* Write "No RXN" if there is no reaction.

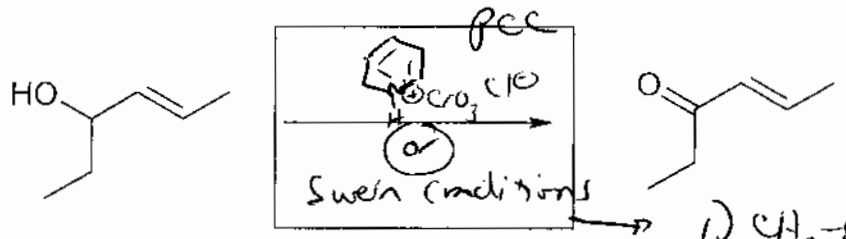
a)



b)

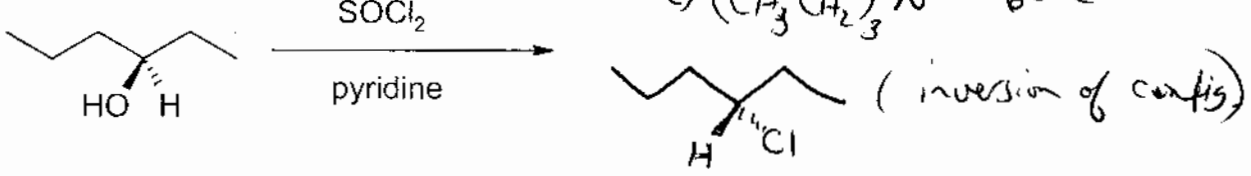


c)



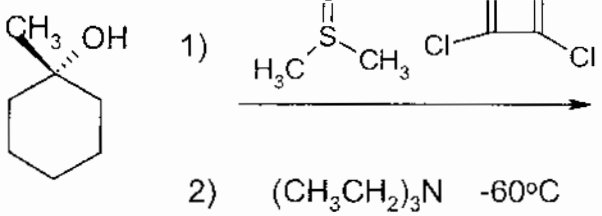
Not Jones, too acidic for alkene

d)

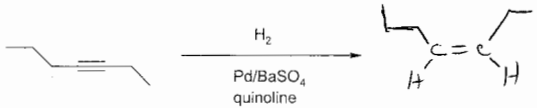


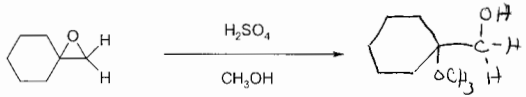
(inversion of config)

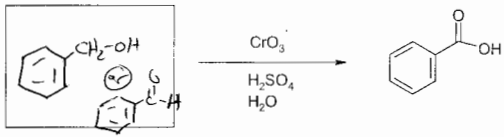
e)



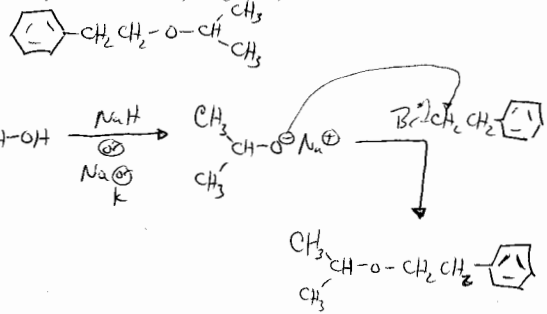
No Rxn

f) 

g) 

h) 

3. (7 pts) Show how you would synthesize the following ether by the Williamson method, being sure to show an outline of a procedure that will give the **best yield**. (Note: Don't forget to show how you would produce the alkoxide anion you use from the corresponding alcohol).



4. (2 pts) The following compounds all have approximately the same molecular weight. Which has the highest boiling point?

a) $CH_3CH_2CH_2CH_3$ b) $CH_3CH_2CH_2OH$ c) $HOCH_2CH_2OH$ d) $CH_3CH_2OCH_3$

5. (1 pt) **True** or **False** In proton-coupled ^{13}C-NMR, a carbon-13 signal is split into N+1 peaks, where N = number of equivalent adjacent carbon atoms.

6. (2 pt) 3-membered ring cyclic ether is also called an epoxide ← common or oxirane ← IUPAC name. *(You may write the common or IUPAC name in the blank).*

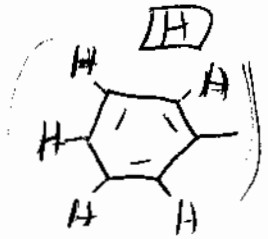
7. (14 pts) The following is a listing of the ^{1}H-NMR spectral data of a compound with a molecular formula of $C_{10}H_{14}O$.

δ 1.2, 3H, triplet; δ 1.5, 3H, doublet; δ 3.5, 2H, quartet; δ 4.0, 1 H, quartet; δ 7.2 , 5H, broad multiplet

a) How many units of unsaturation are in this compound?

$$\frac{2C+2+N-H-X}{2} = \text{units of unsat.} \qquad \frac{2(10)+2-14}{2} = \boxed{4}$$

b) **Propose a structure** for this compound and **place your final answer in the box.** Be sure to **show any partial structures** you determine below and correlate these structures to their chemical shifts in order to receive partial credit.

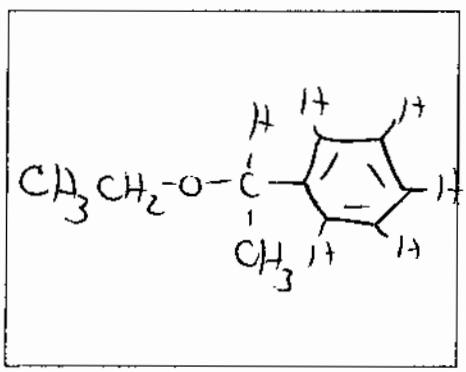
ppm	Integ	Splitting	
1.2	3H	triplet	CH_3CH_2-
1.5	3H	doublet	$CH_3-\underset{H}{\overset{|}{C}}-X$
3.5	2H	quartet	CH_3-CH_2-X – probably oxygen
4.0	1H	quartet	$CH_3-\underset{H}{\overset{|}{C}}-Y$ ← probably oxygen
7.2	5H	broad multiplet	

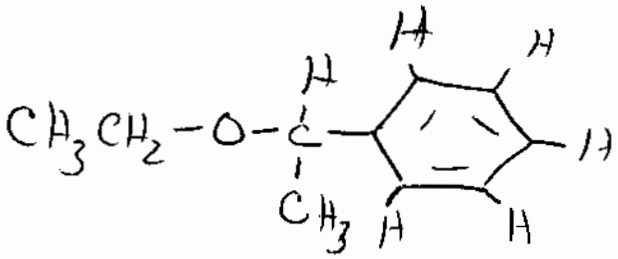
$C_{10}H_{14}O$

$C_{10}H_{14}O$

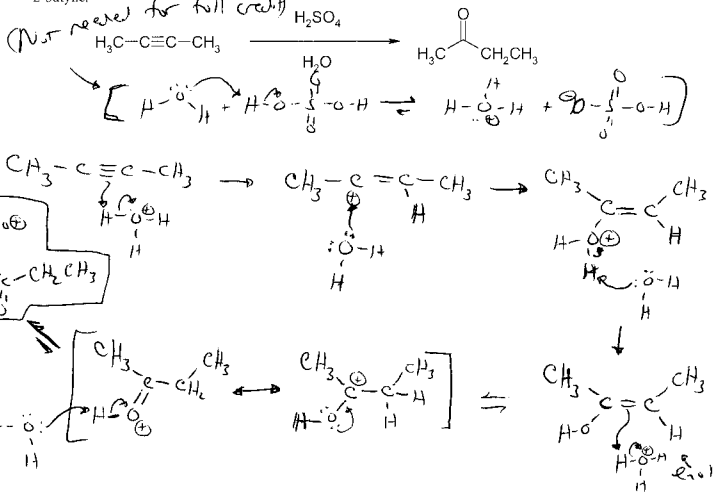
0 ↑ only element left

(CH_3CH_2-Y) $\left(CH_3-\underset{H}{\overset{|}{C}}-Y\right)$

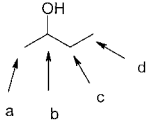


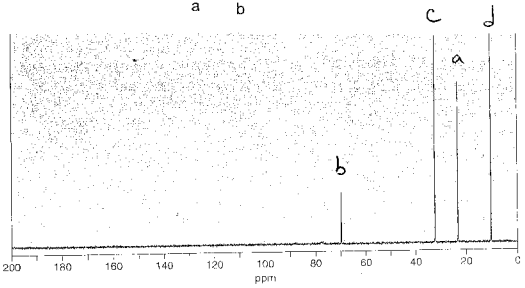


8. (12 pts) Write a **COMPLETE MECHANISM** that explains the formation of 2-butanone from 2-butyne.

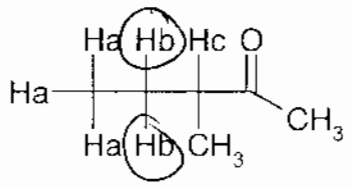


9. (6 pts) Identify the carbon atoms that give rise to each signal in the proton-decoupled ^{13}C-NMR spectrum shown below. (Label a – d on the spectrum below).

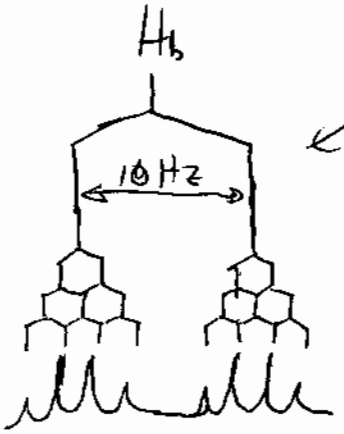




10. (6 pts) Draw a branching diagram to show the expected splitting pattern that would be observed for the H_b hydrogens in the following compound. Note the coupling constants given below for J_{ab} and J_{ac}.



J_{ab} = 1.5 Hz; J_{bc} = 10 Hz



only need this for full credit

(doublet of quartets)

don't need this

11. (12 pts) Show how the following multistep transformation can be accomplished. You may use any reagents you deem necessary for your synthesis. Be sure to show the structures of intermediate compounds along the pathway to the final product.