

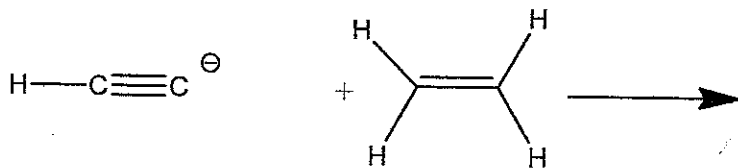
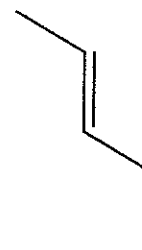


Directions: Work every question. NO CALCULATORS ALLOWED.

Δ ² chiral centers or  or 

$$\text{H}-\text{C}\equiv\text{C}-\text{H} + \text{NH}_2^- \longrightarrow$$


Acetylene $\xrightarrow[2) \text{ Reagent B}]{1) \text{ Reagent A}}$ Product C $\xrightarrow[2) \text{ Reagent E}]{1) \text{ Reagent D}}$ Product F $\xrightarrow{\text{Reagent G}}$



A NH_4^+

B ~~Ba^{2+}~~

C ~~NH_4^+~~

D NH_4^+

E B.

F — — — — —

G N₂/NH₃

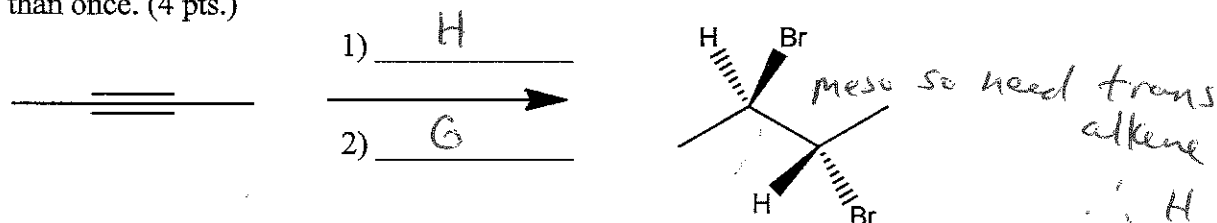
Steps ~~2~~ B + E can be switched,

4) Put the correct letter for the reagent next to the number. A reagent may be used more than once. Carry out the steps so that the ketone shown is the ONLY product. (5 pts.)



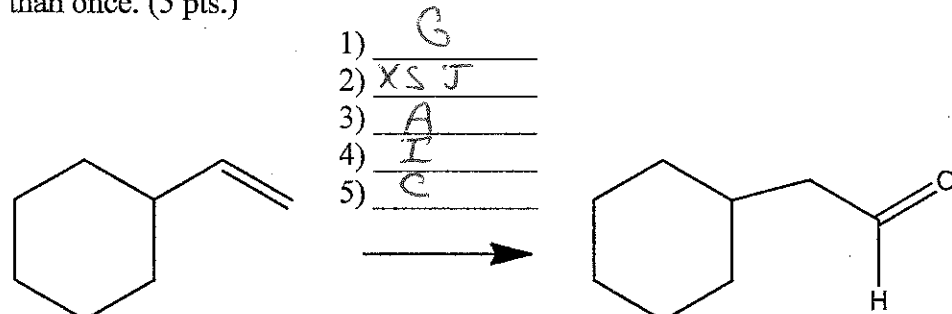
- | | | |
|--|--|--|
| A <u>CH₃I</u> | E <u>HBr (2 eq.)</u> | I <u>BH₃/THF</u> |
| B <u>CH₃CH₂I</u> | F <u>Br₂ (2eq.)</u> | J <u>NaNH₂</u> |
| C <u>NaOH</u> | G <u>Br₂ (1 eq.)</u> | K <u>HgSO₄/H₂O/H₂SO₄</u> |
| D <u>HBr (1 eq.)</u> | H <u>CH₃CH₂CH₂I</u> | L <u>H₂/Lindlar's catalyst</u> |

5) Put the correct letter for the reagent next to the number. A reagent may be used more than once. (4 pts.)



- | | | |
|--|---------------------------------|--|
| A <u>CH₃I</u> | E <u>HBr (2 eq.)</u> | I <u>BH₃/THF</u> |
| B <u>CH₃CH₂I</u> | F <u>Br₂ (2eq.)</u> | J <u>NaNH₂</u> |
| C <u>NaOH</u> | G <u>Br₂ (1 eq.)</u> | K <u>HgSO₄/H₂O/H₂SO₄</u> |
| D <u>HBr (1 eq.)</u> | H <u>Na/NH₃</u> | L <u>H₂/Lindlar's catalyst</u> |

6) Put the correct letter for the reagent next to the number. A reagent may be used more than once. (5 pts.)



- | | | |
|--|---------------------------------|--|
| A <u>H⁺</u> | E <u>HBr (2 eq.)</u> | I <u>(sia)₂BH</u> |
| B <u>O₃/Zn</u> | F <u>Br₂ (2eq.)</u> | J <u>NaNH₂</u> |
| C <u>H₂O₂/OH⁻</u> | G <u>Br₂ (1 eq.)</u> | K <u>HgSO₄/H₂O/H₂SO₄</u> |
| D <u>HBr (1 eq.)</u> | H <u>Na/NH₃</u> | L <u>H₂/Lindlar's catalyst</u> |

7) Give a molecular formula that fits the molecular weight of 275. NO CALCULATORS ALLOWED. SHOW YOUR WORK! (5 pts.)

$$13 \overline{) 275} \\ \underline{26} \\ 15$$

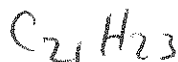
21 carbons

5

$$\begin{array}{r} 21 \\ 12 \\ \hline 42 \\ 210 \\ \hline 252 \end{array}$$

for carbon

$$\begin{array}{r} 275 \\ -252 \\ \hline 23 \text{ H's} \end{array}$$



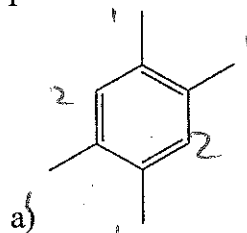
but odd M⁺
means odd
nitrogen



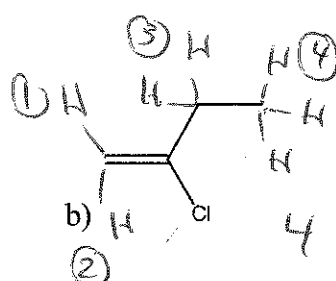
many other possibilities

N₃
42

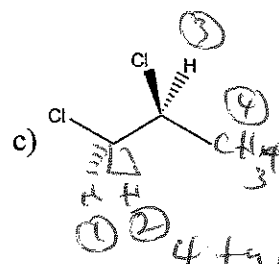
8) How many different types of hydrogens do the following compounds show in the proton NMR? Assume all of spectra will be taken in an achiral solvent. (2 pts. each)



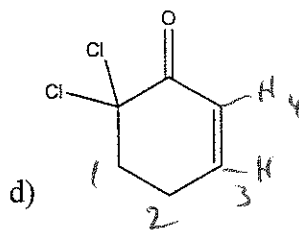
2 types



4 types



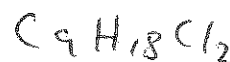
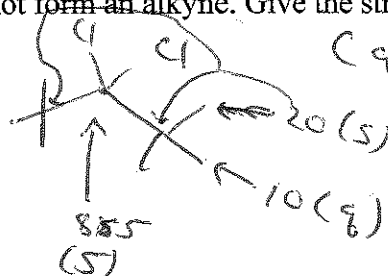
4 types



4 types

9) Compound A ($C_9H_{18}Cl_2$) has only one type of hydrogen. Compound A has three types of carbon. The locations in the carbon NMR are: δ 85 (singlet in proton-coupled), δ 20 (singlet in proton coupled) and δ 10 (quartet in proton coupled). Treatment of compound A with excess $-NH_2$ does not form an alkyne. Give the structure of A. (4 pts.)

one example

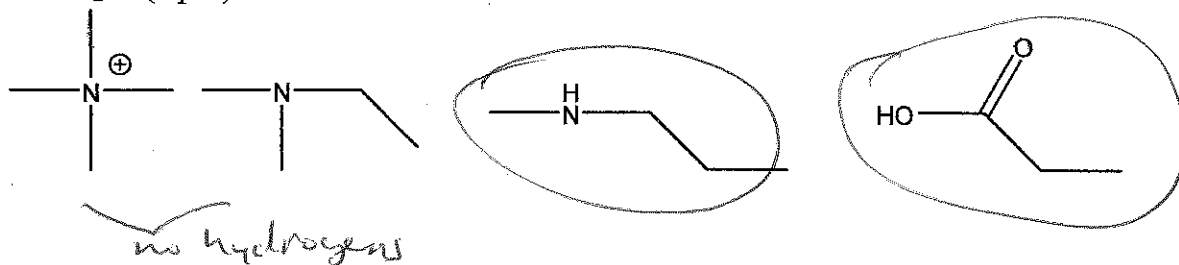


$\frac{20}{12} = 1 \frac{8}{3}$ 0° of unsat.

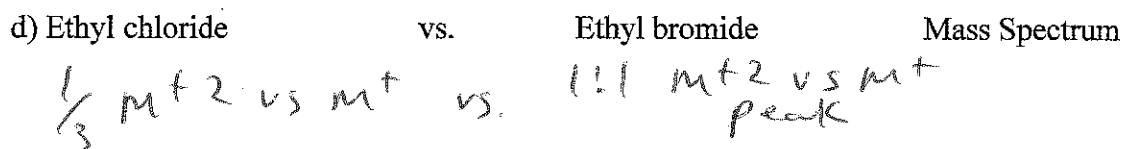
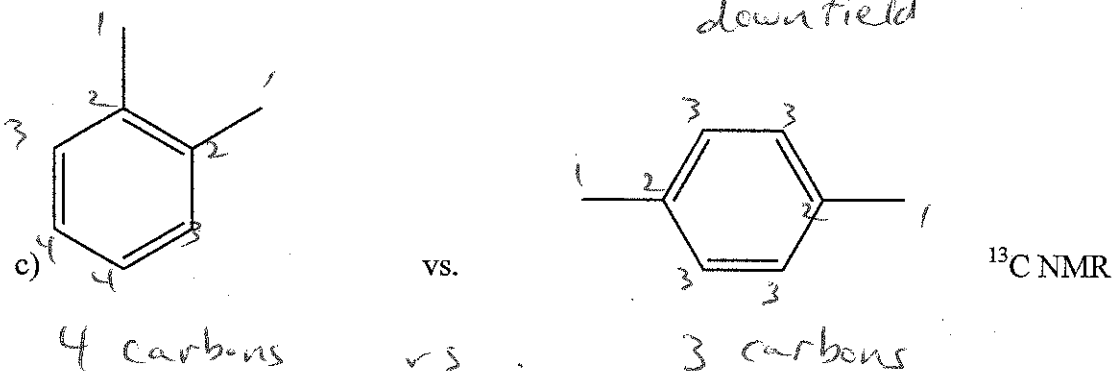
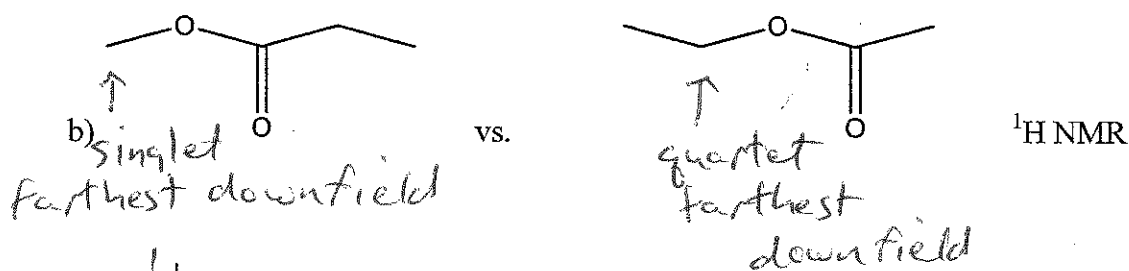
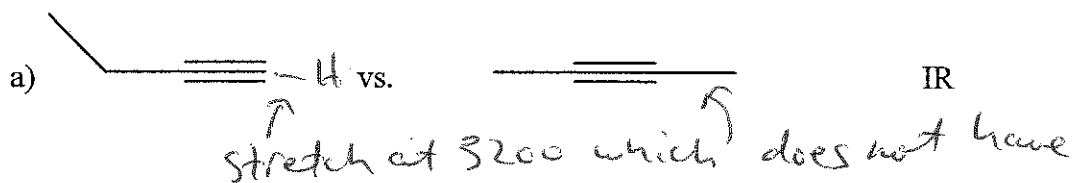
10) Compound B has the molecular formula C_5H_{12} and has only one peak in the proton NMR which is a singlet. Give a structure for compound B. (4 pts.)



11) Circle the molecule(s) (if any) below that will have a peak disappear upon stirring with D_2O . (4 pts.)



12) Using the method indicated, describe how you would tell the molecules apart. (3 pts. each)



13) What does an IR spectrum tell you? (4 pts.)

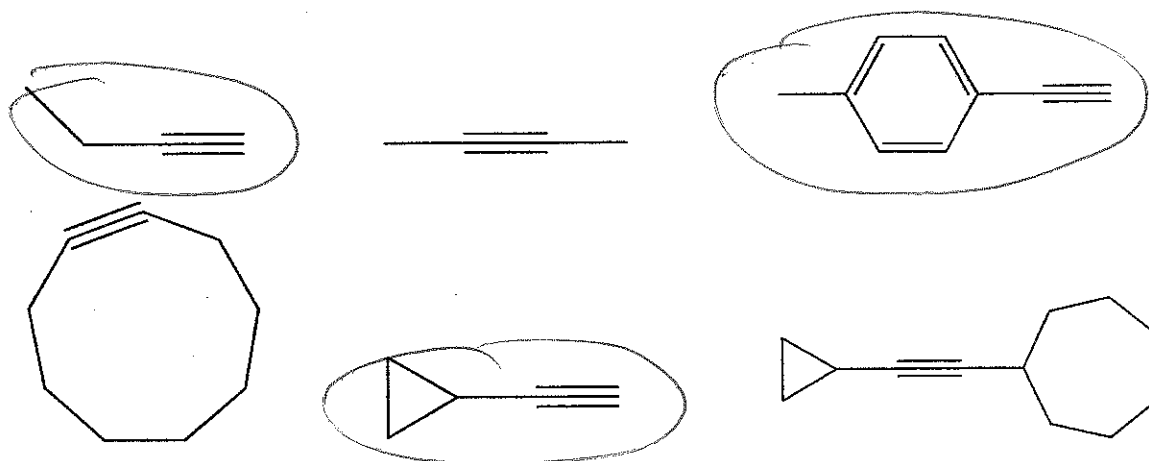
functional groups

14) What is the transformation seen in a UV spectrum? (4 pts.)

promoting electron from HOMO to LUMO.

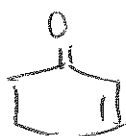
24/24

15) Circle the terminal alkyne(s) [if any] below. (4 pts.)

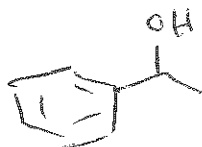


For the following three combined spectra problems, give a structure that will give all of the spectra. Partial credit will be given so indicate as much information as possible.

16) (6 pts.)



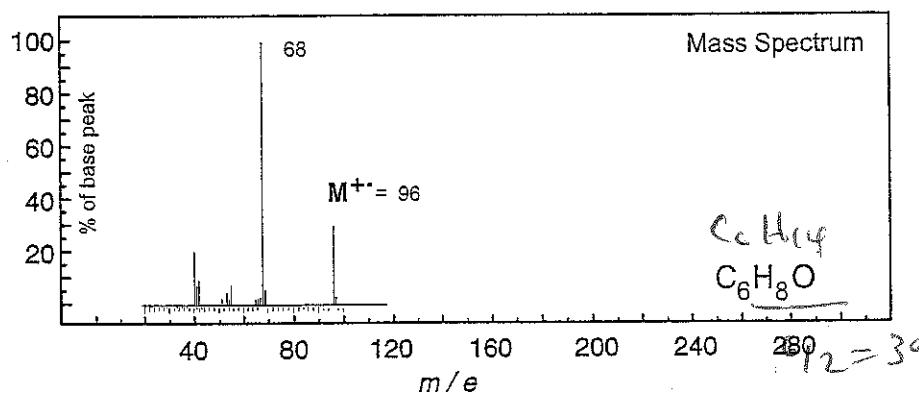
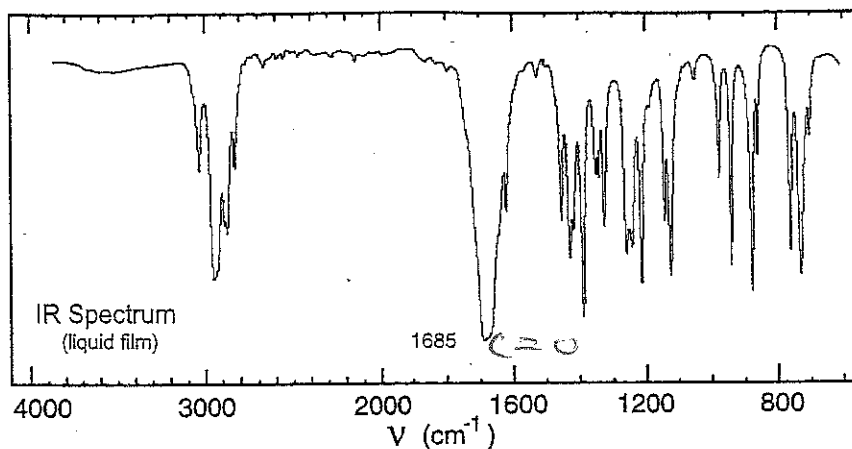
17) (6 pts.)



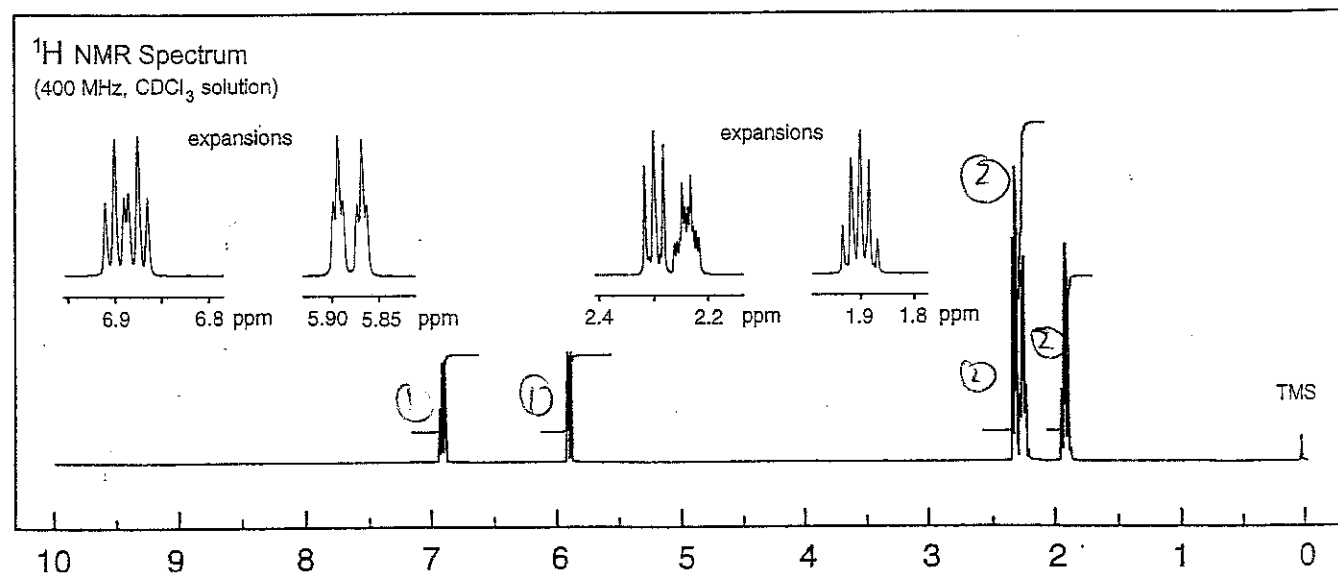
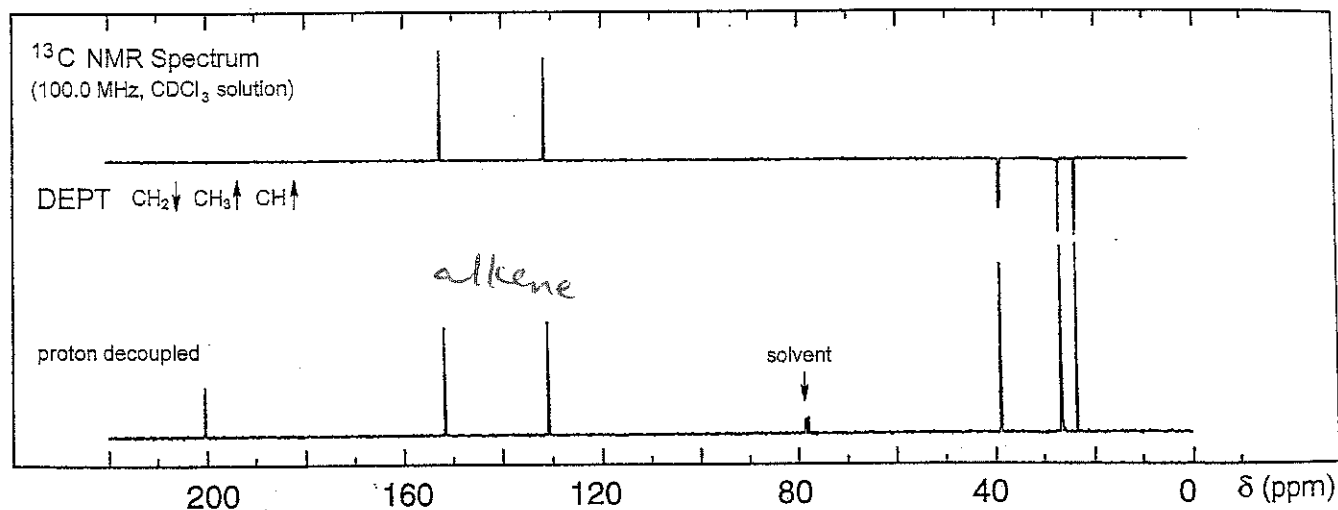
18) (6 pts.)

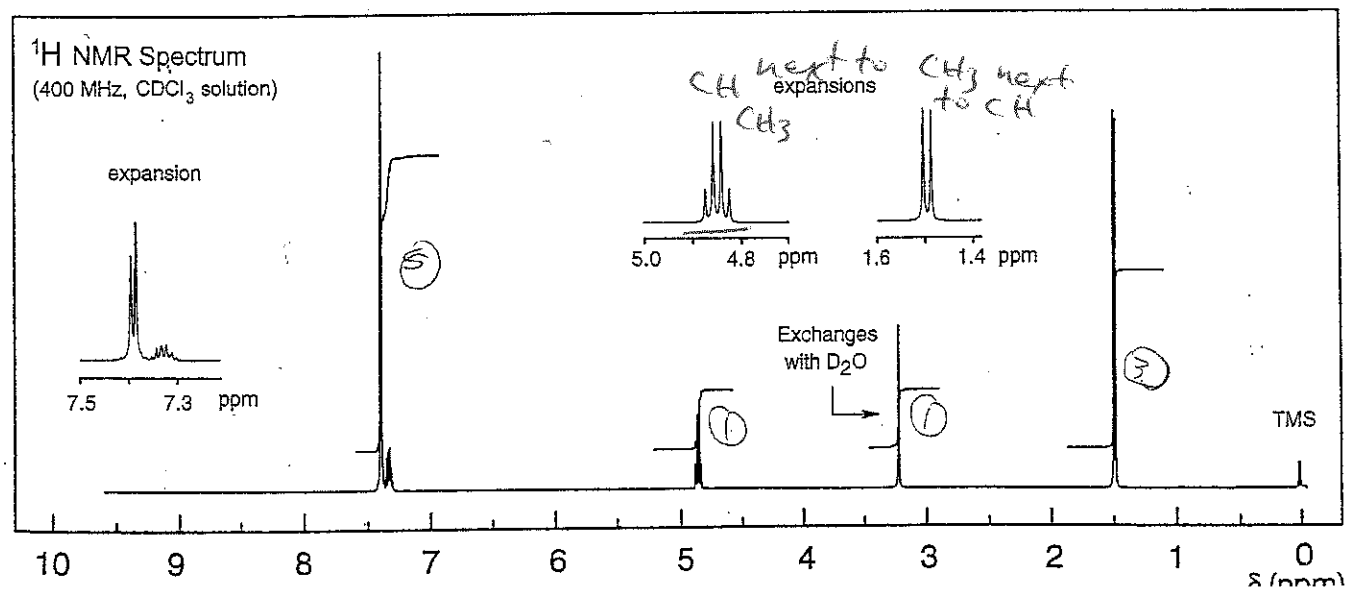
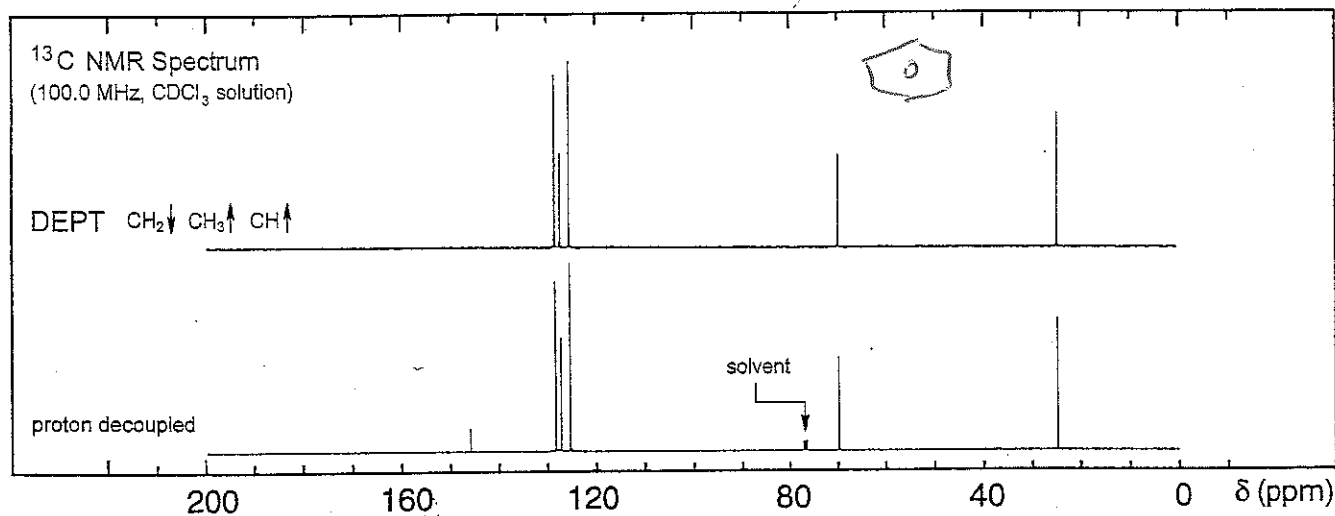
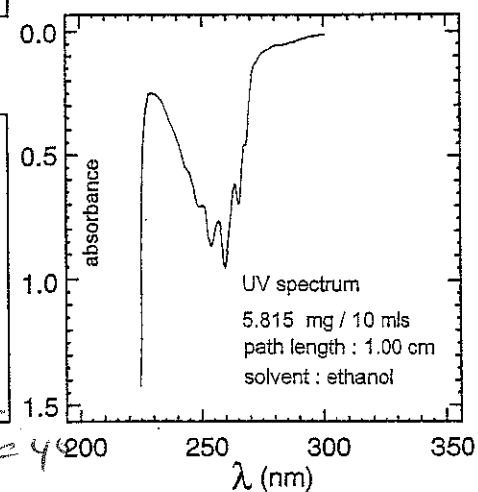
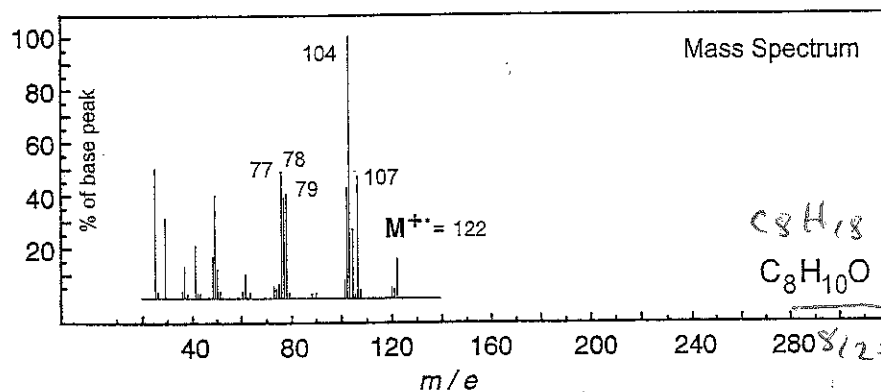
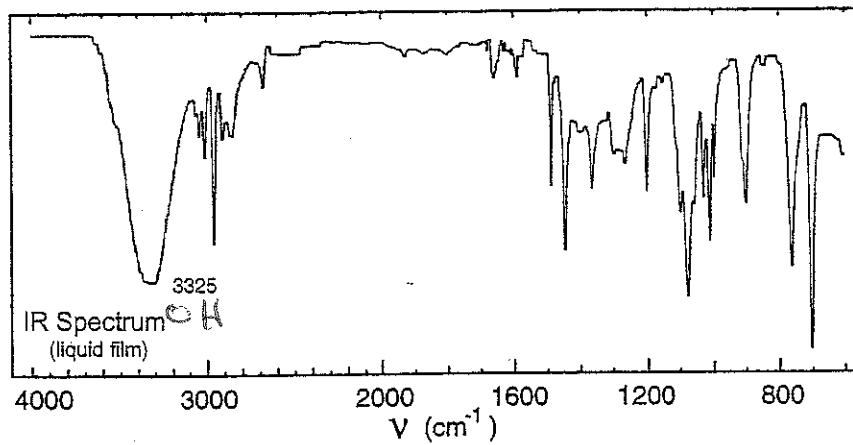


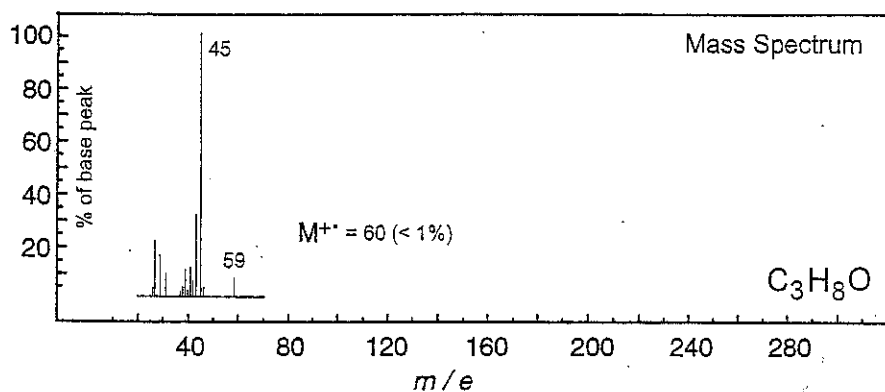
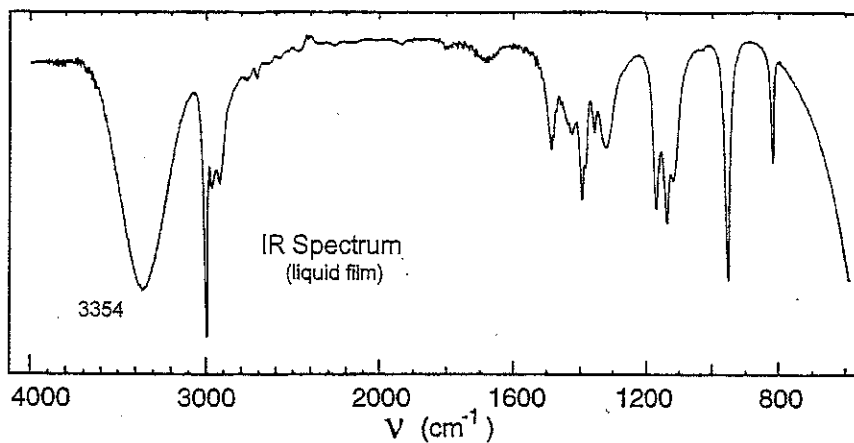
19) Free question: Give me something that you will remember about Organic I. (5 pts.)



UV Spectrum
 λ_{max} 225 nm ($\log_{10} \epsilon$ 3.9)
solvent: methanol







No significant UV
absorption above 220 nm

