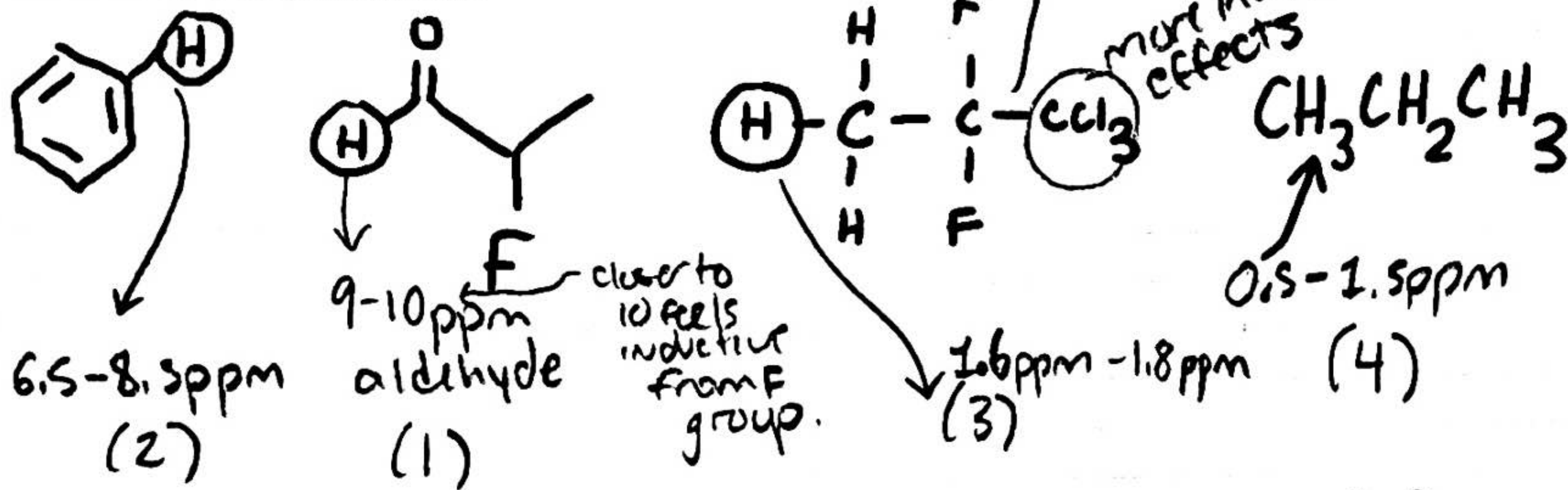


SL midterm review

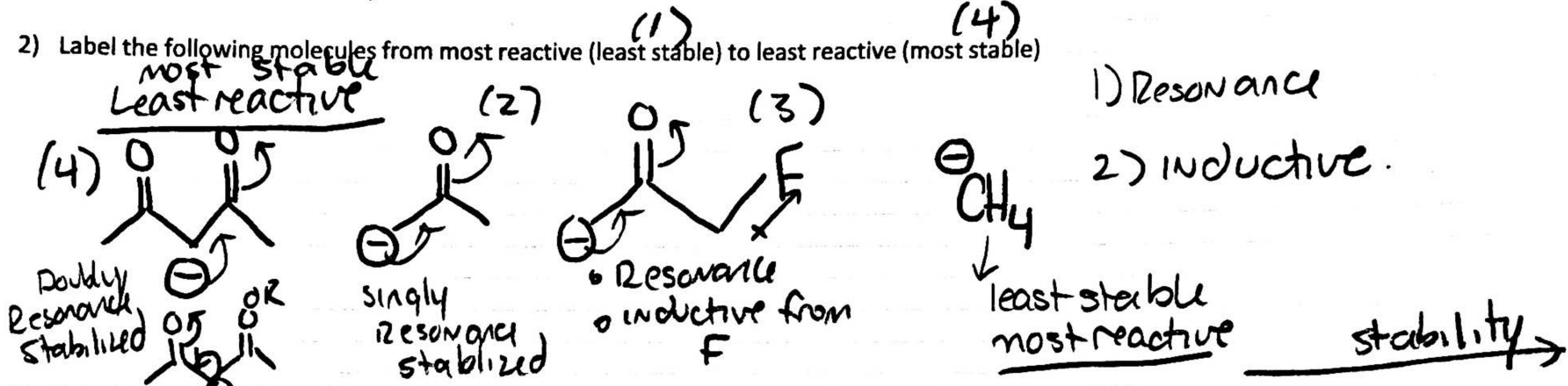
November 19, 2021 10:36 AM

1) Order the following hydrogens in the molecules shown from electron poorest (1) → electron richest (4) in accordance to where they would occur on a proton NMR



e^- rich = NO one group is taking e^- from you

2) Label the following molecules from most reactive (least stable) to least reactive (most stable)

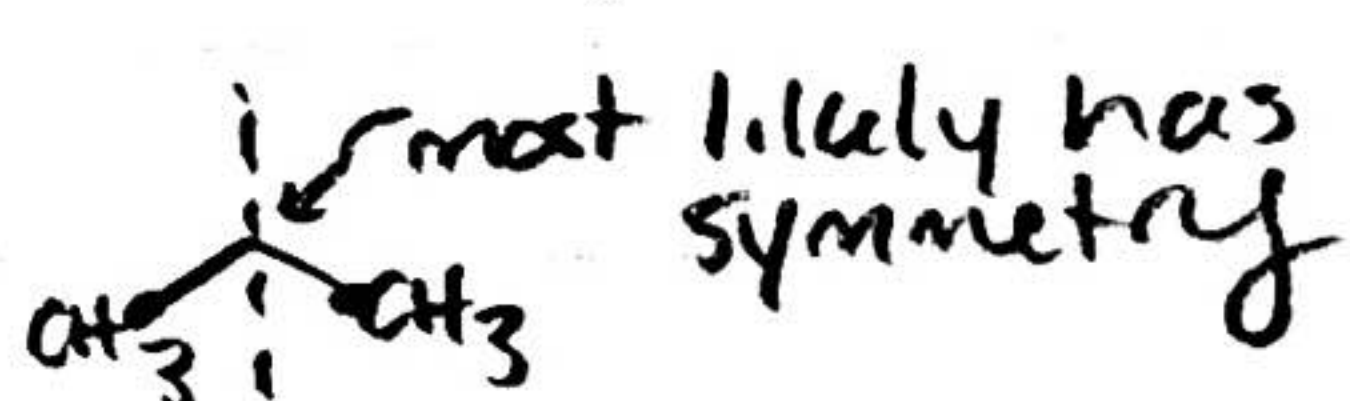


3) If the integration of a peak that occurs at 1.2 ppm is 6 what might this peak consist of?

2 CH_3 groups most likely

* integration is relative, counts all hydrogens

(1) (1) < (2) < (3) < (4)

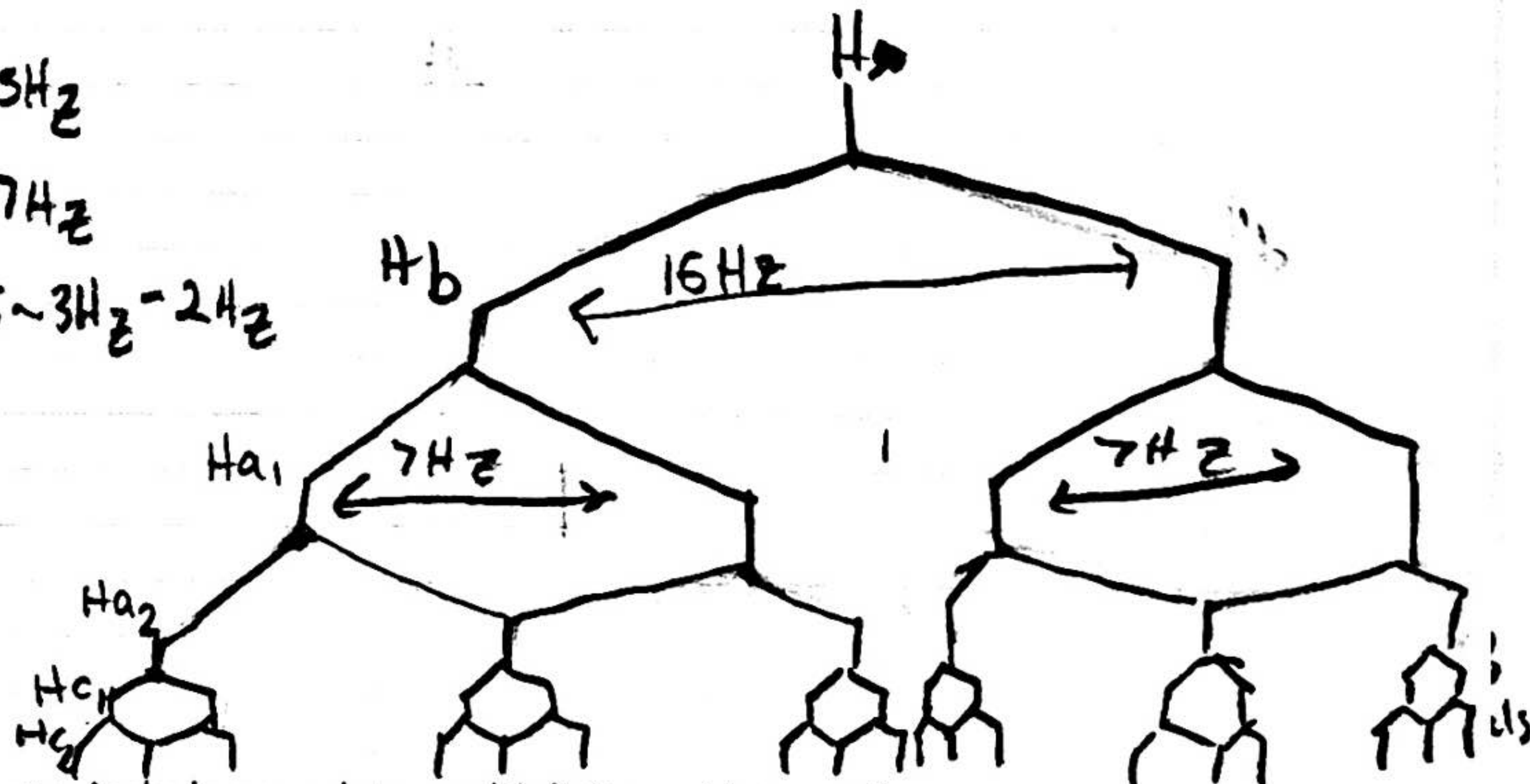
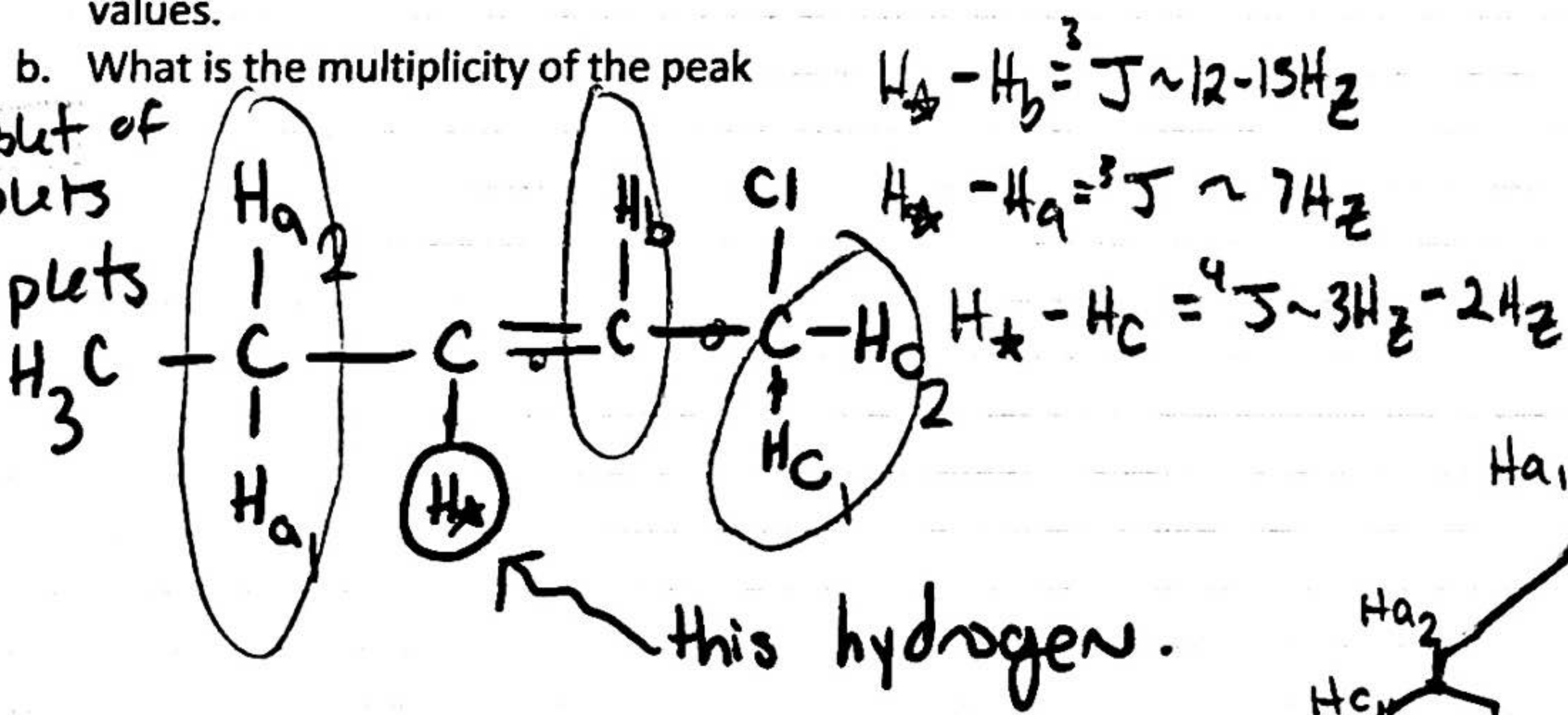


4) Consider the following molecule

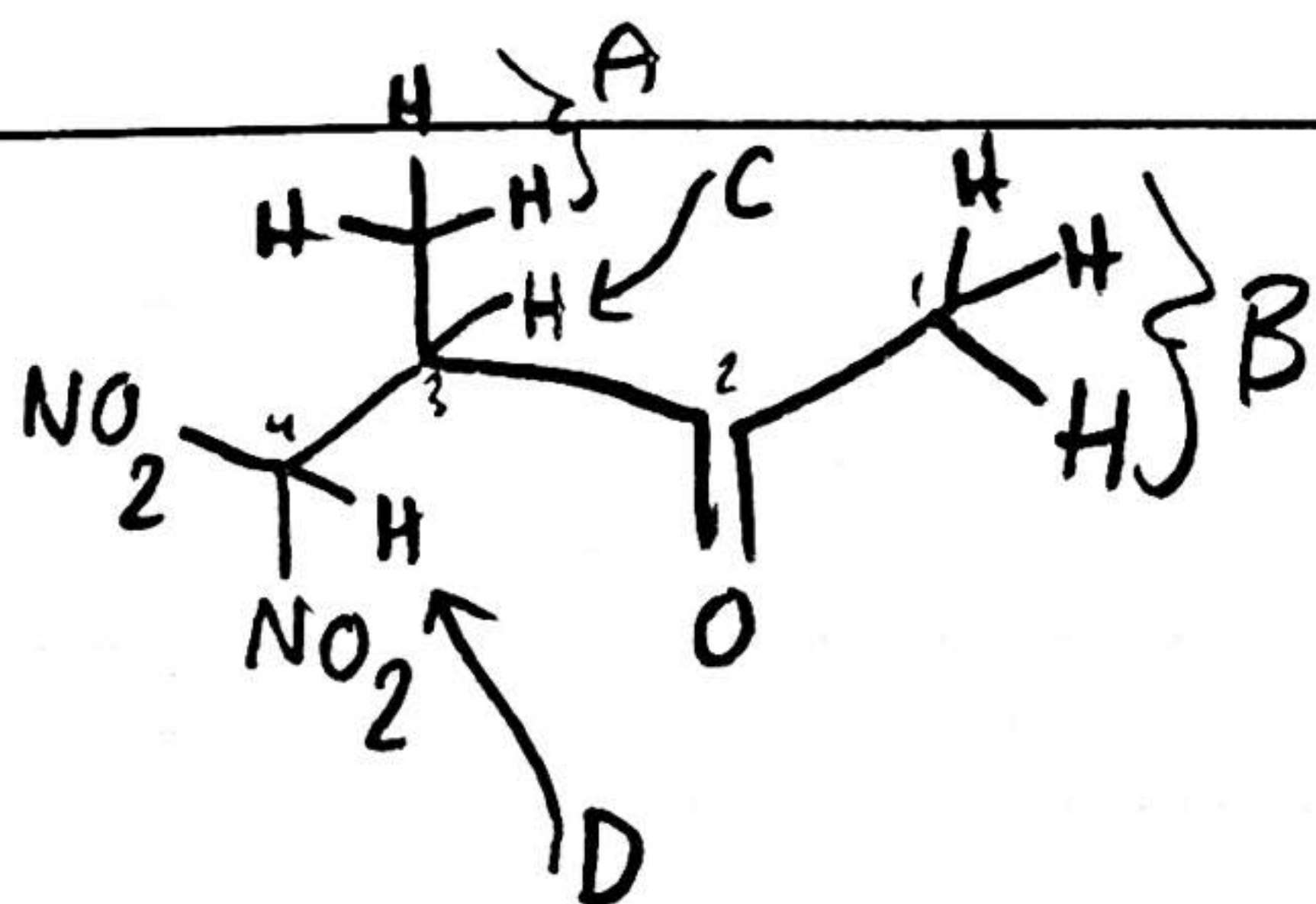
a. Draw the pascals triangle for the following molecule (indicated hydrogen) estimate relative J values based on your knowledge of Hz values.

b. What is the multiplicity of the peak

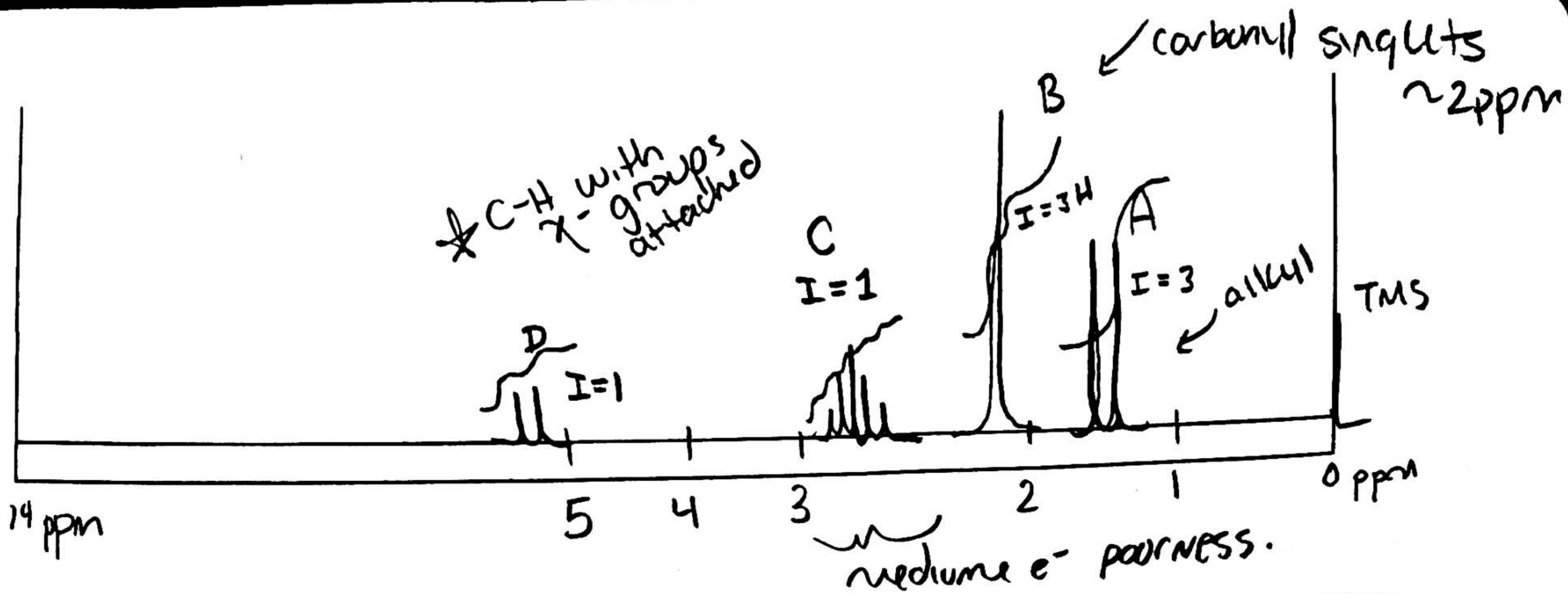
{
 Doublet of
 Triplets
 of
 Triplets



5) Draw the full ^1H NMR spectrum of 4,4'-dinitro-3-methyl-butan-2-one, include ppm data, multiplicity and integration on your spectrum. Label each hydrogen as a different letter and write that letter over the appropriate peaks



A = e^- rich = doublet I=3
 B = ~ 2 ppm more e^- poor = singlet I=3
 C = somewhat e^- poor = pentet I=1
 D = e^- POOR = doublet, I=1



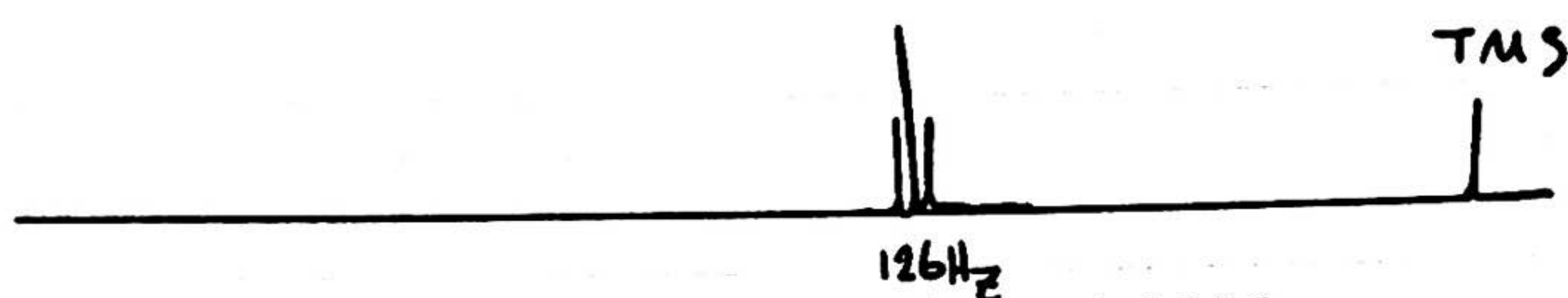
5) What ppm value does the following peak occur if the peak is 126Hz away from TMS and the instrument is operating at 60MHz.

$$60\text{MHz} = 60\text{Hz in } 1\text{ppm}$$

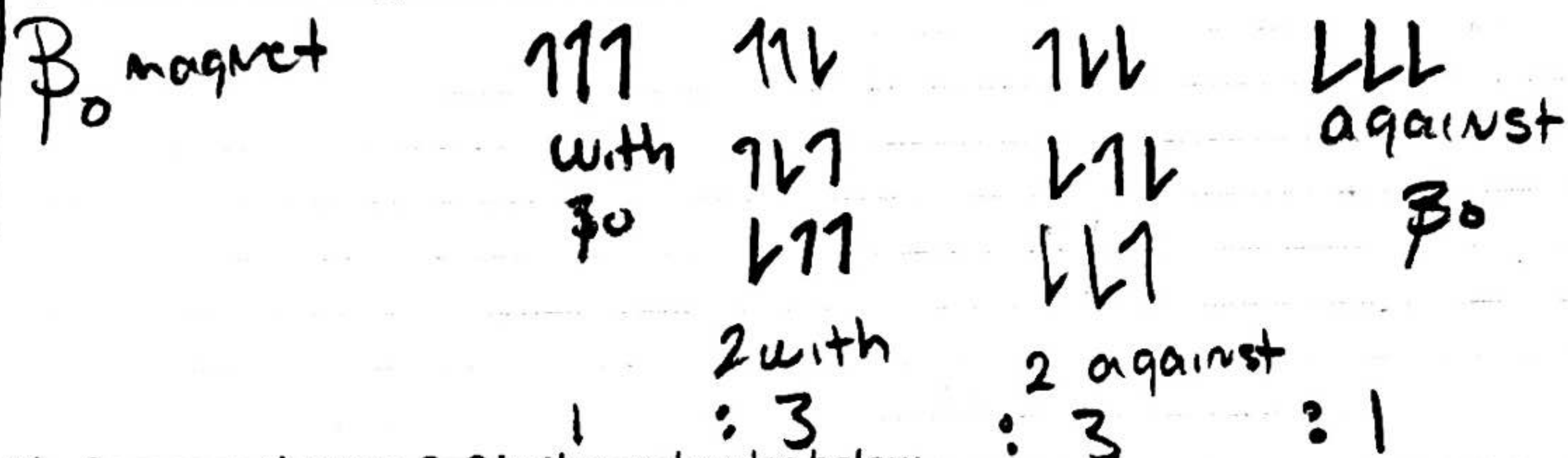
$$60\text{Hz} = 1\text{ppm}$$

$$126\text{Hz} = x\text{ppm}$$

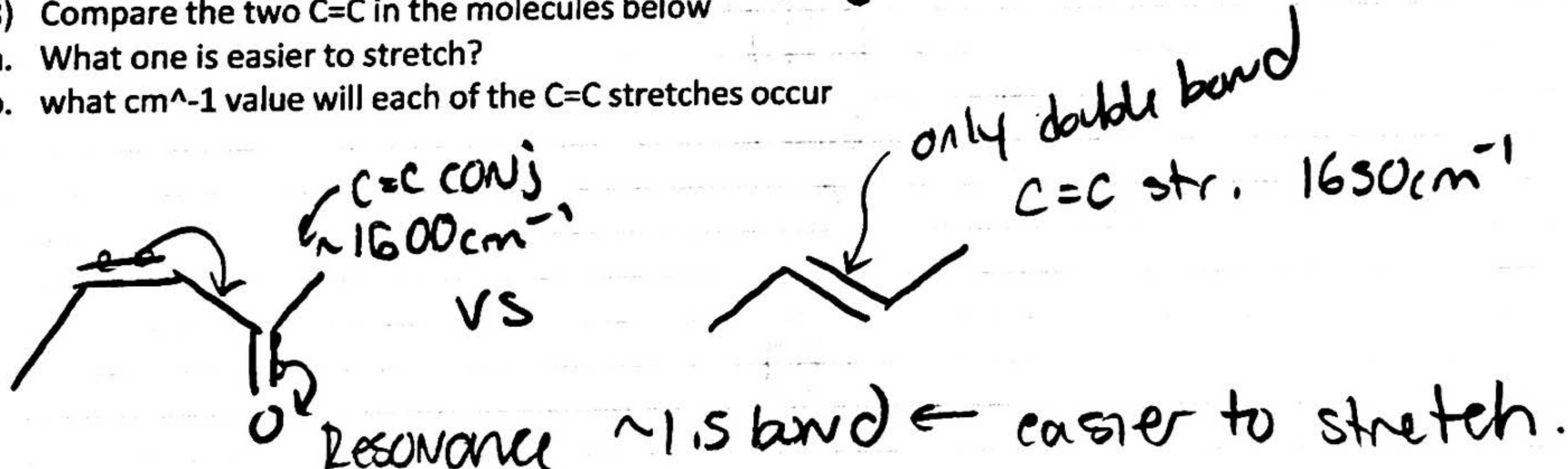
$$\sim x = 2.1\text{ppm}$$



6) Draw all the magnetic moment combinations for a quartet with the ratio 1:3:3:1.



8) Compare the two C=C in the molecules below
 a. What one is easier to stretch?
 b. what cm^{-1} value will each of the C=C stretches occur

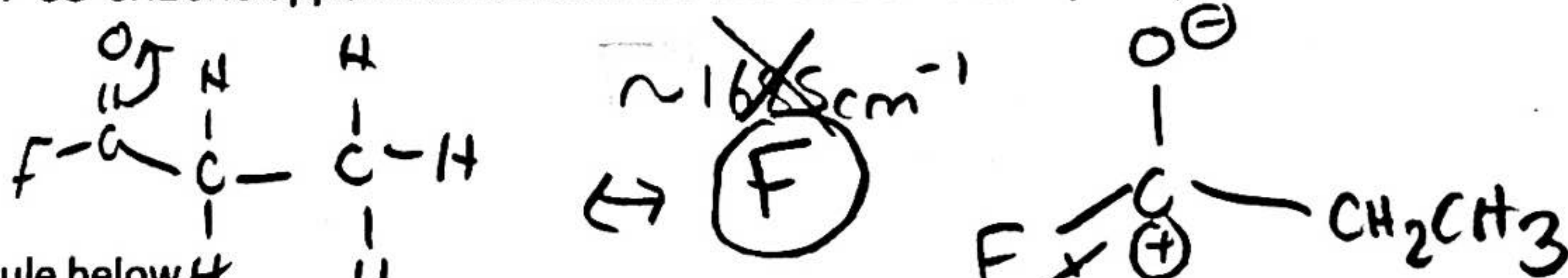


9) In a C-13 NMR spectrum the solvent CDCl_3 appears as a 1:1:1 triplet centered at 77ppm. However, the solvent CD_2Cl_2 appears as a pentet. Explain this using pascals triangle.



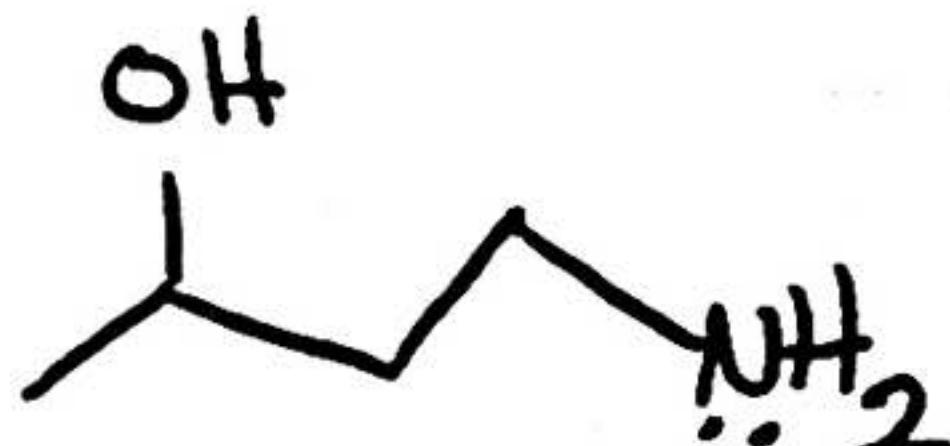
Spin type = 1
 splitting $2(I+1) = 3$
 vs 4
 pentet!

10) The C=O stretch of $\text{F-CO-CH}_2\text{CH}_3$ appears at 1685cm^{-1} is this true or false explain your answer



$2(I_2)+1$
 $= 1+1$
 $= 2$

11) Consider the molecule below
 a. What is the integration of the "acidic" hydrogen peak on a H NMR

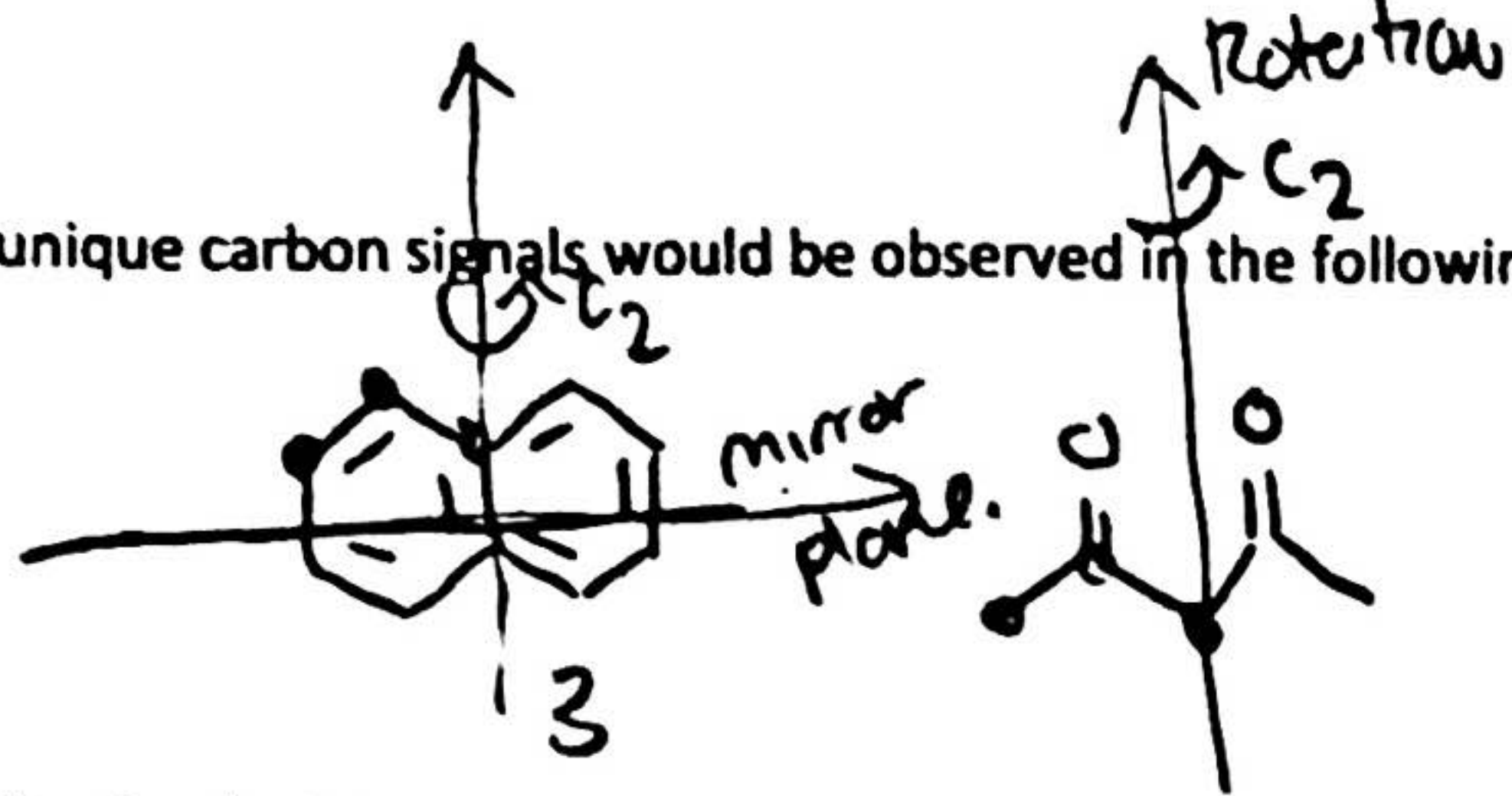


$I = 3!$ three H's can participate in A, B \rightleftharpoons
 unstable carbocation
 more character!

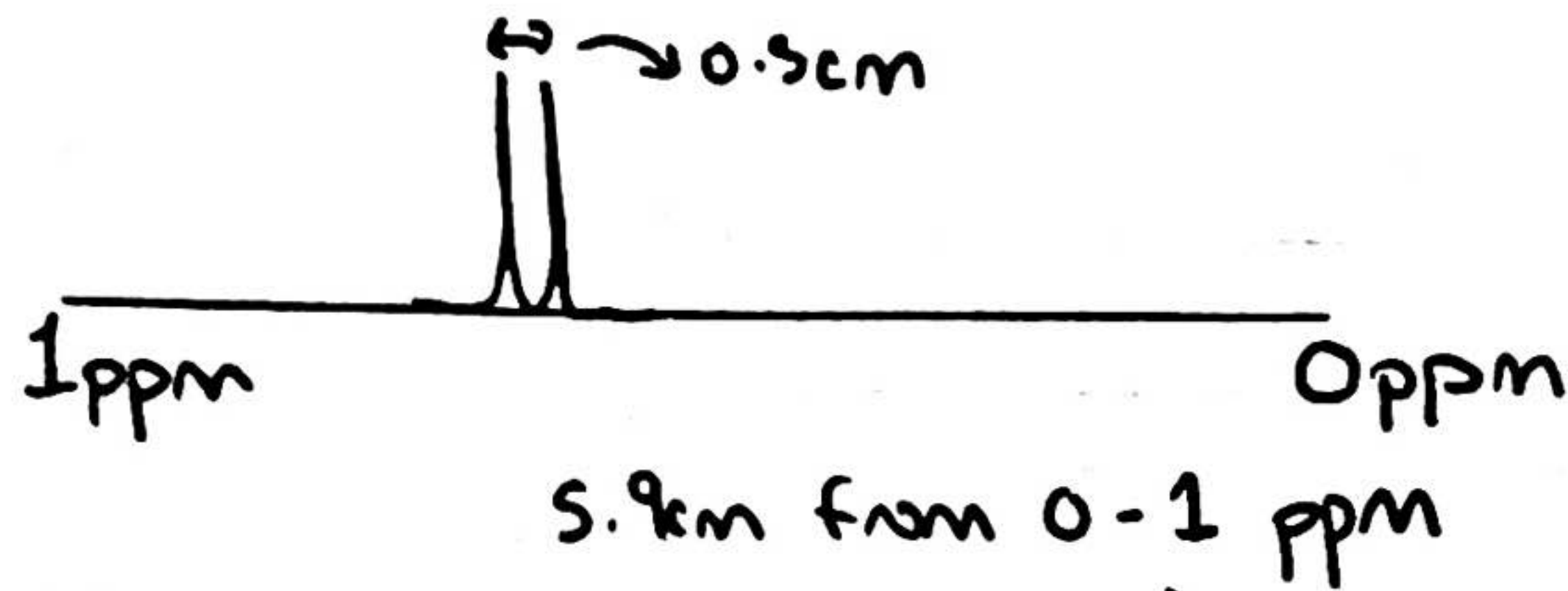
12) How many unique carbon signals would be observed in the following molecules



12) How many unique carbon signals would be observed in the following molecules



13) The J value for the doublet is 7.5 Hz. Calculate and circle the resonance frequency for the NMR instrument

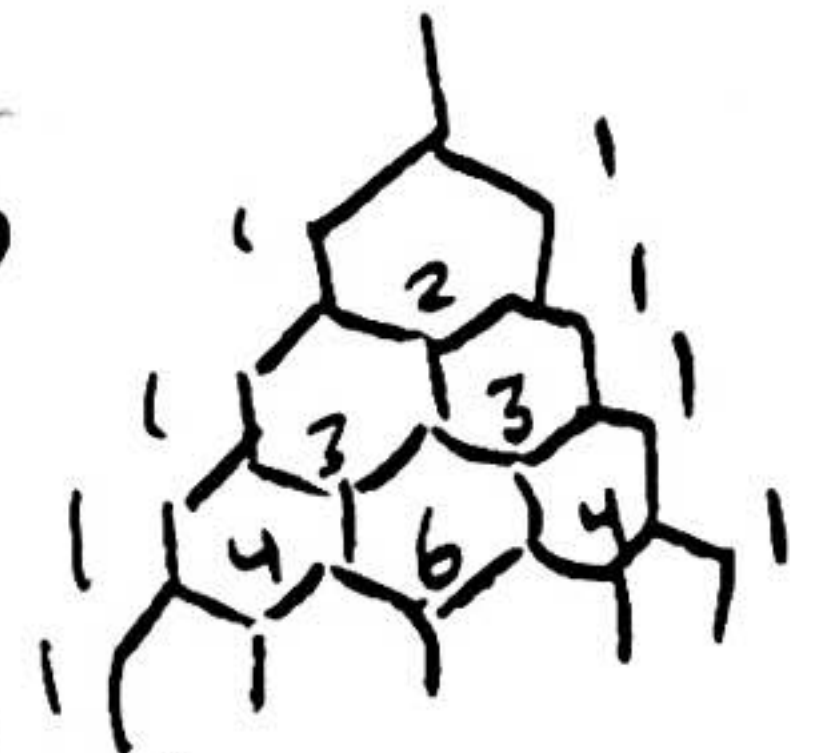
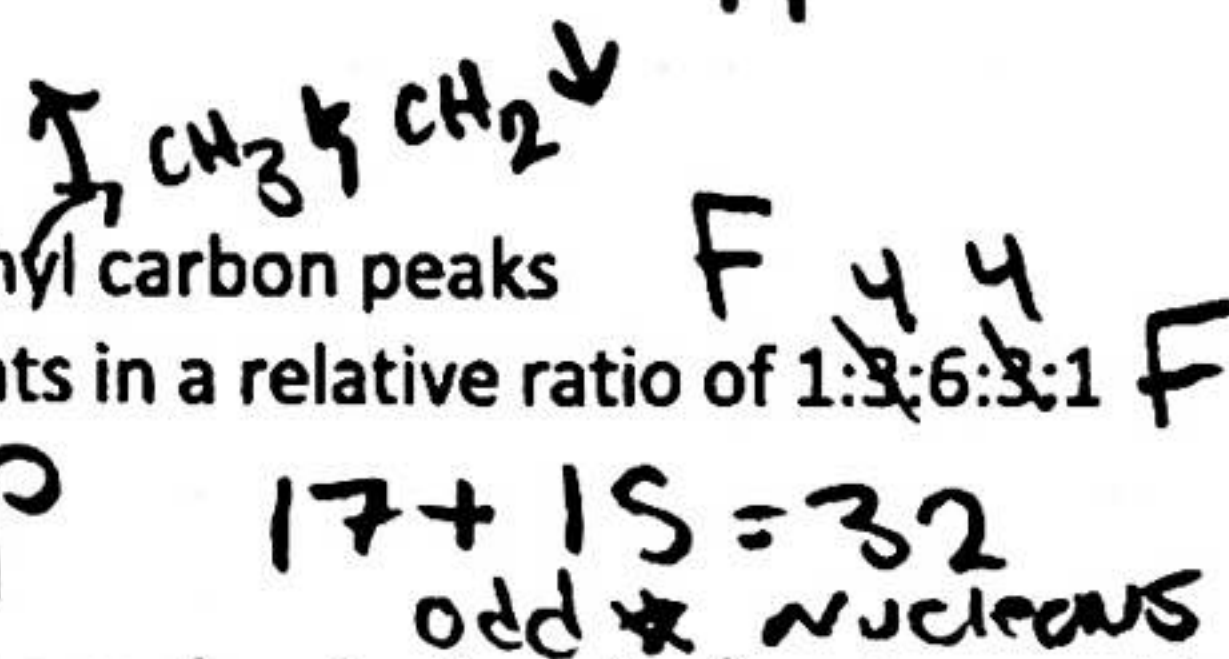


- a) 40 MHz
- b) 90 MHz**
- c) 600 MHz

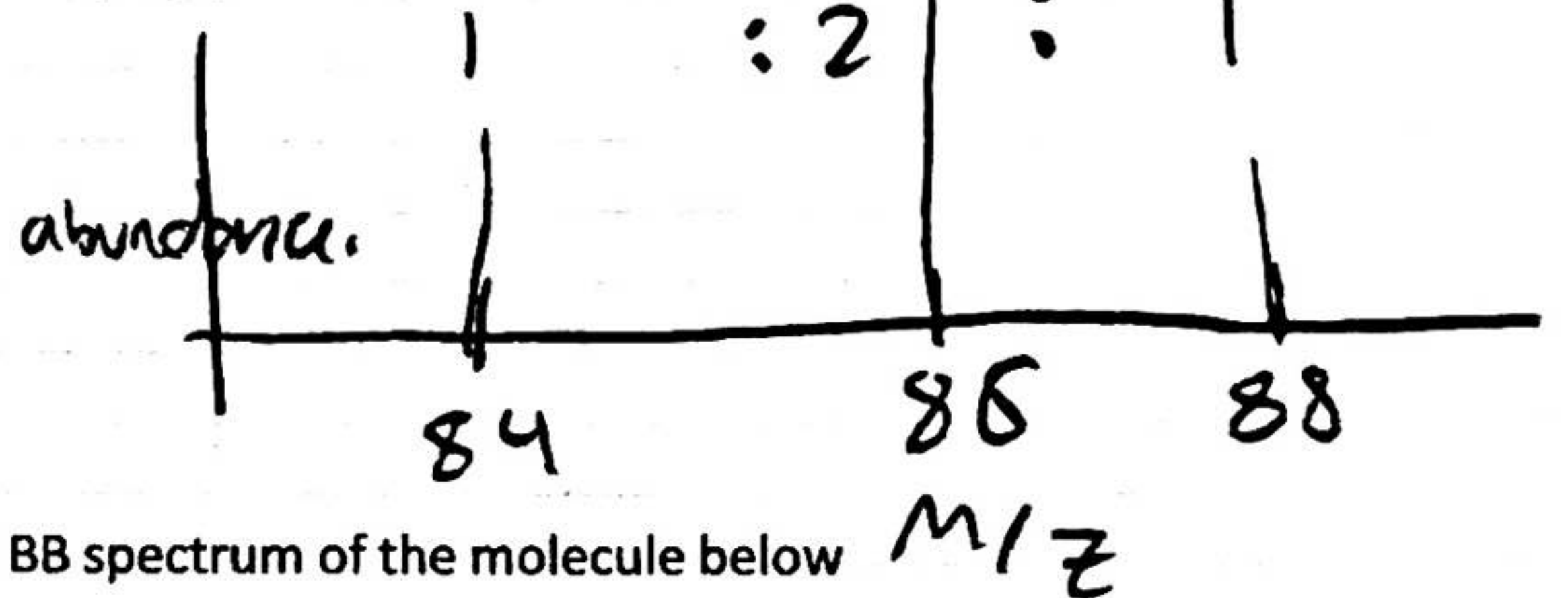
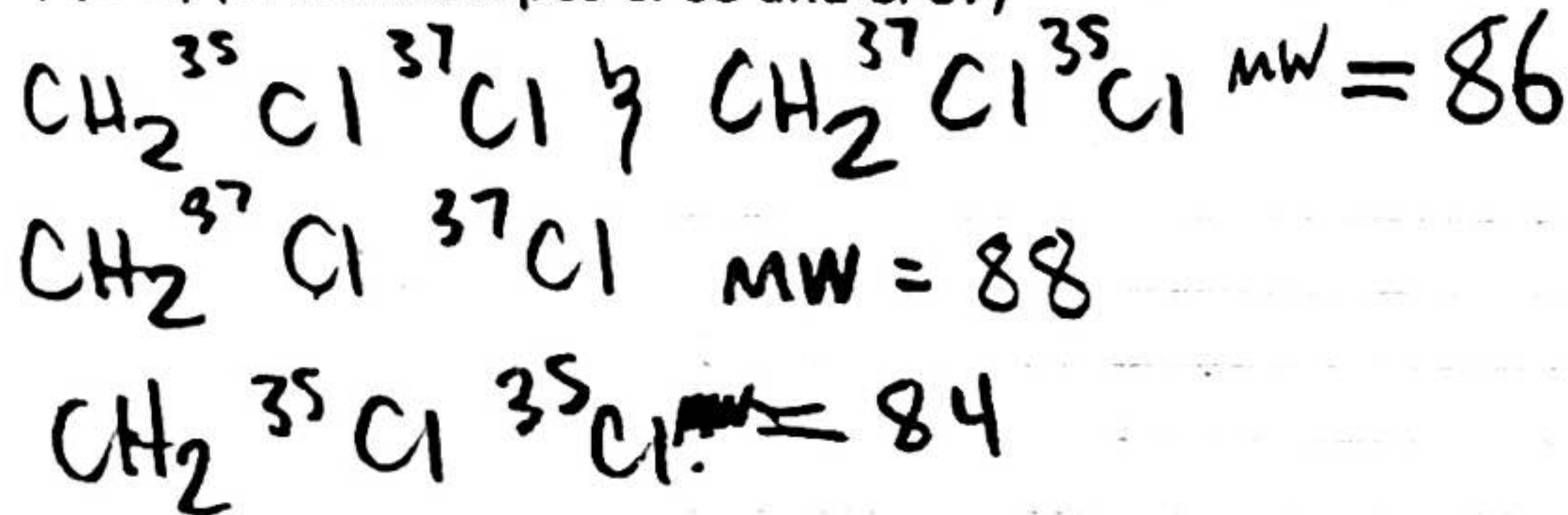
$7.5 \text{ Hz} = 0.5 \text{ cm}$
 $0.5 \text{ cm} \times \text{MHz} = 5.9 \text{ cm}$
 $\sim 88.5 \text{ Hz} \times 10^6$
 $\sim 90 \text{ MHz}$

14) T/F

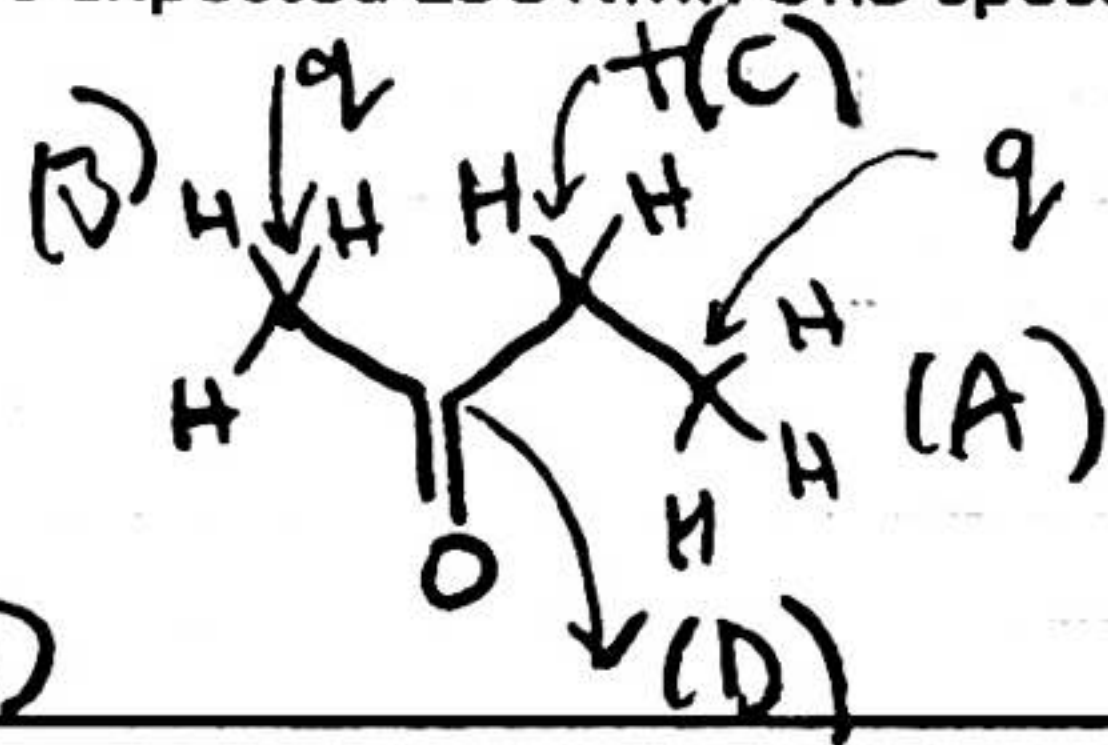
- a. the C-13 DEPT NMR spectrum shows only methyl carbon peaks
- b. In an H NMR spectrum a pentet has peak heights in a relative ratio of 1:3:6:3:1
- c. P-32 is an NMR active nucleus



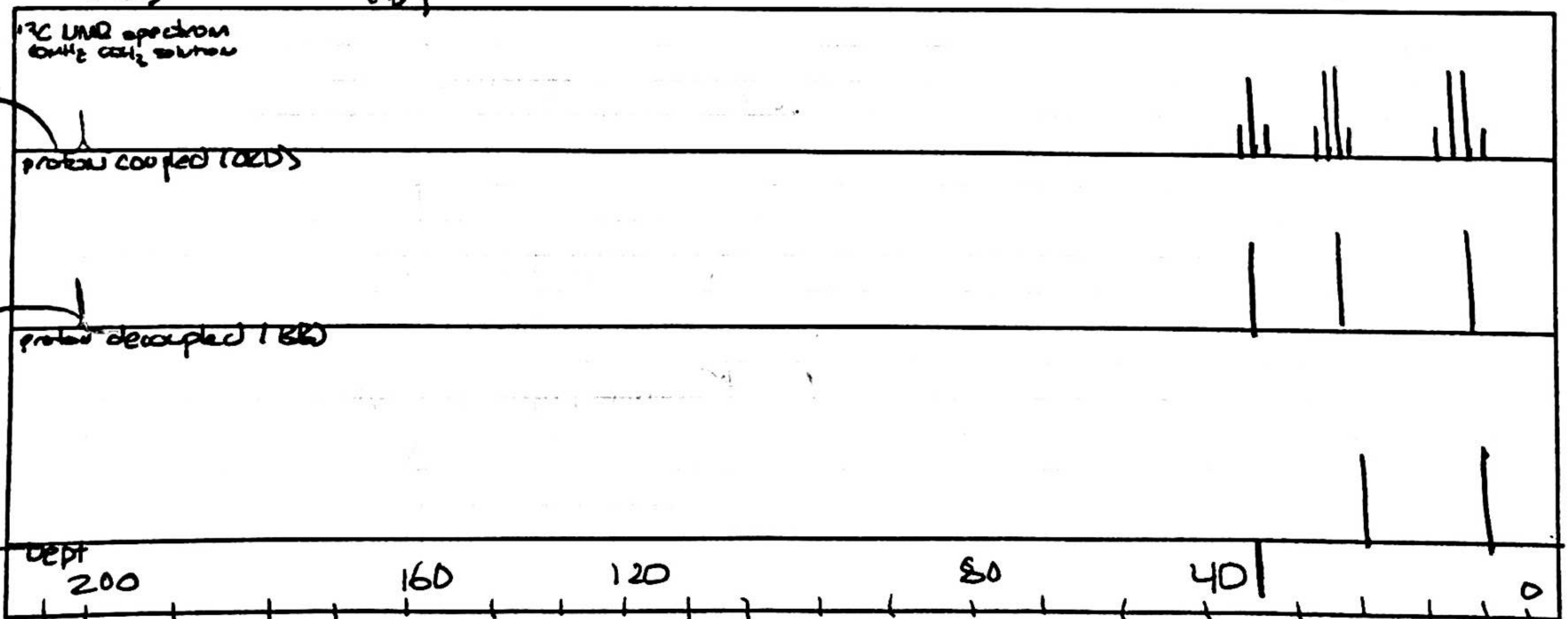
15) In a mass spectrum, draw the appearance of the molecular ions (m/z values and intensities) for CH₂Cl₂ (12-C) (1-H) (Cl has isotopes Cl-35 and Cl-37)



17) Draw the expected ¹³C NMR ORD spectrum and DEPT spectrum and BB spectrum of the molecule below



Trip
 CH₂ CH₃ CH₃
 C B A



J coupling
alligned
C-H

singlets

CH/CH₃ ↑
CH₂ ↓
NO₄

18) The parent ion from a mass spectrum is 14mm high and a second peak (one mass unit heavier) is 2.15mm high. Calculate the number of carbon atoms present in this hydrocarbon molecule.

$$\frac{\% \text{ (height)} M+1}{\% \text{ (height)} M} = 1.1 \times \#C$$

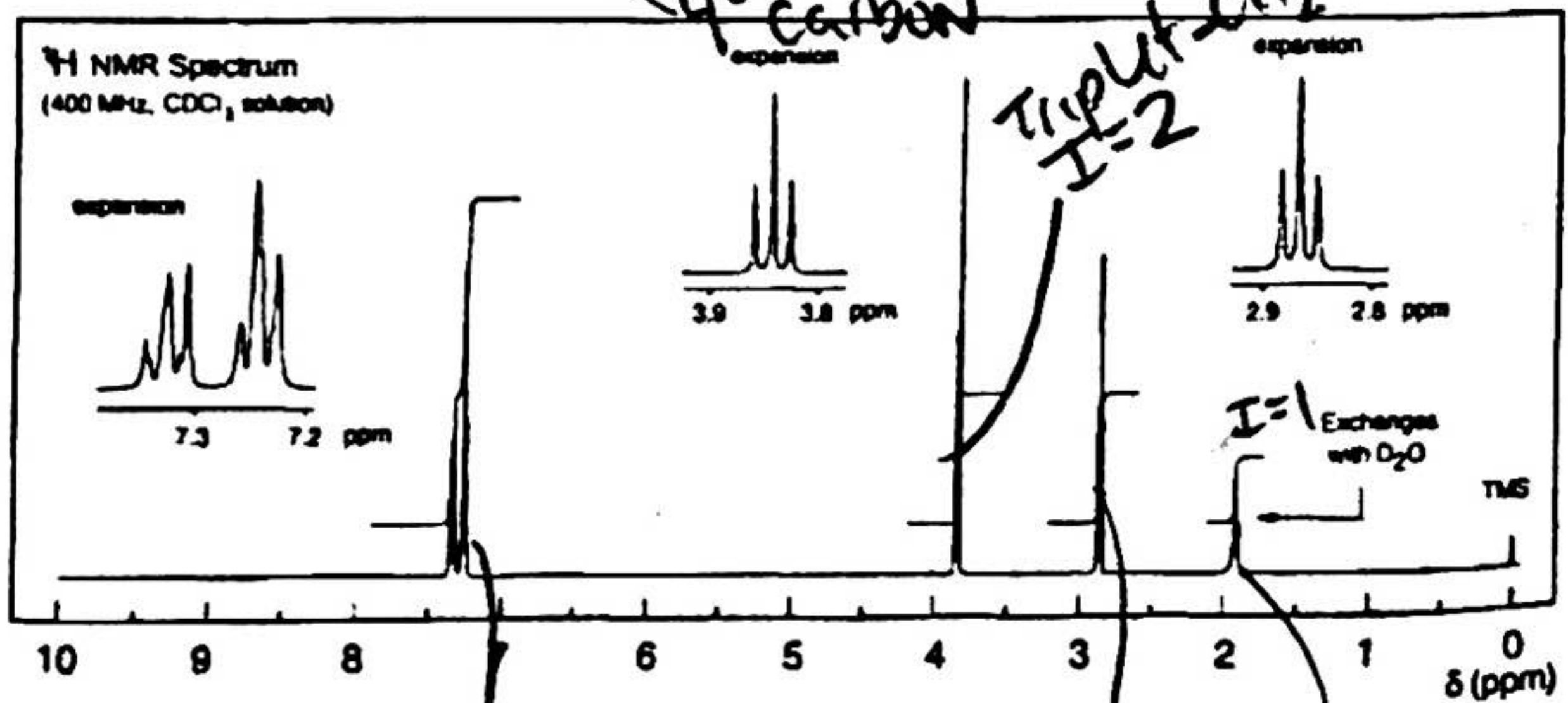
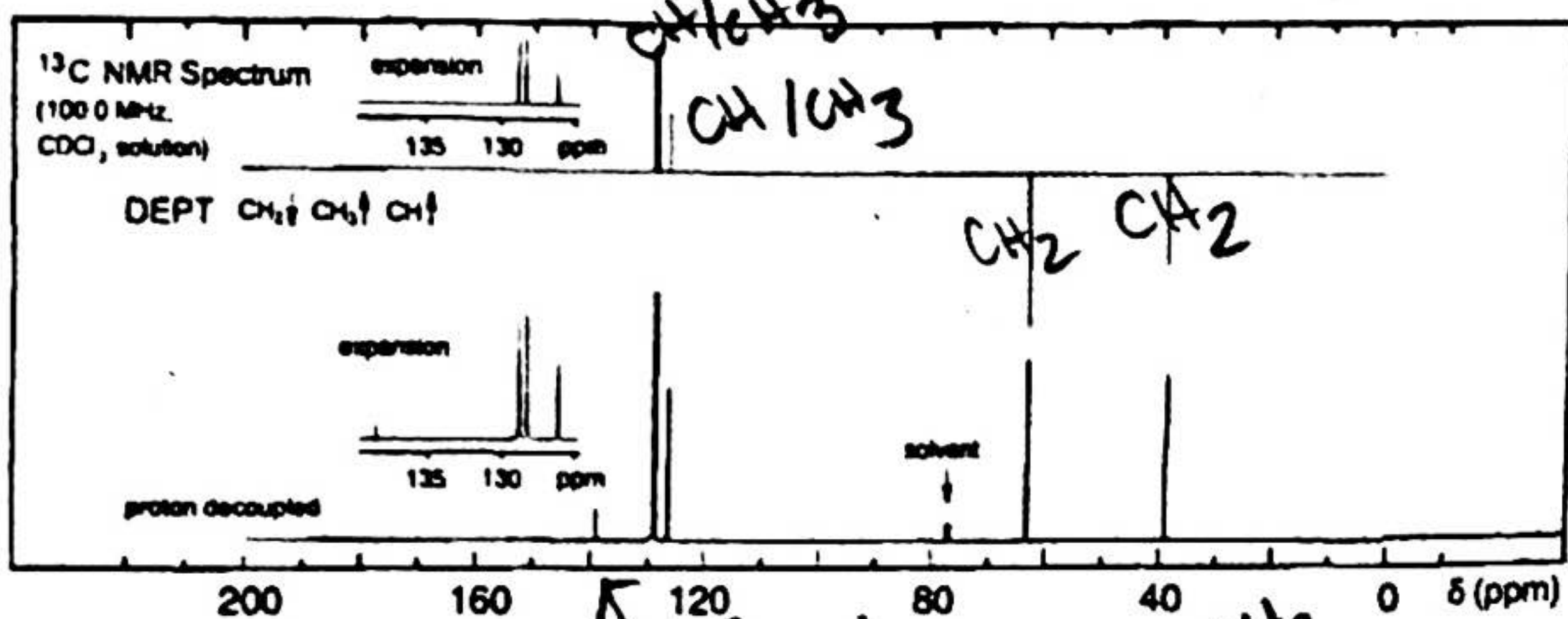
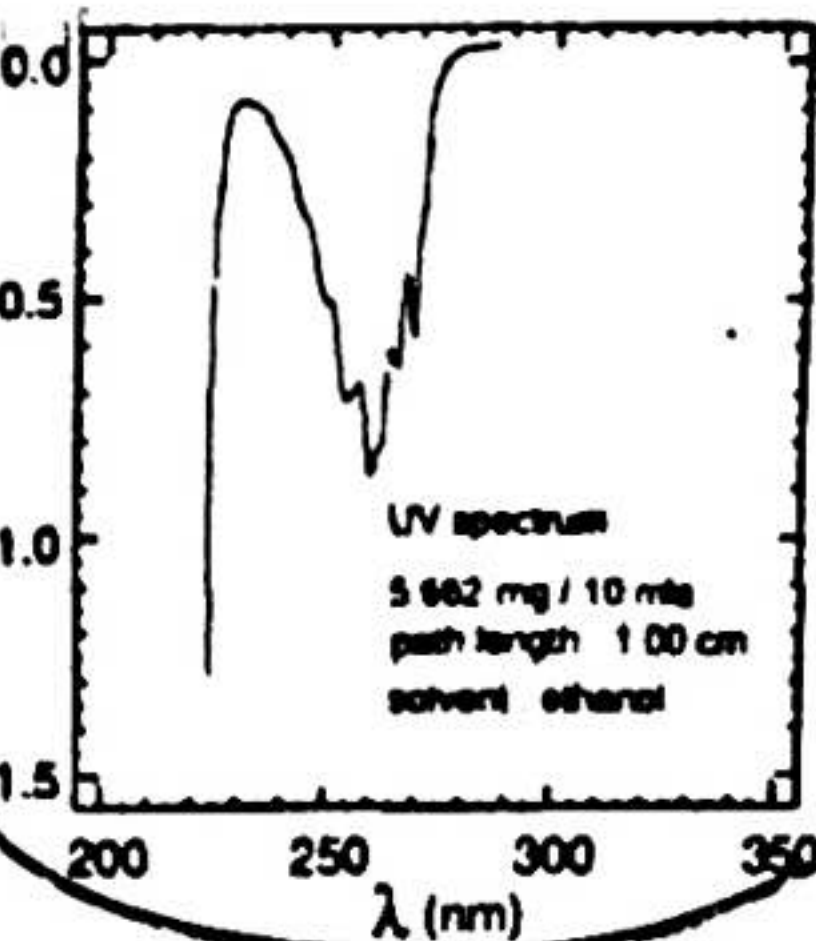
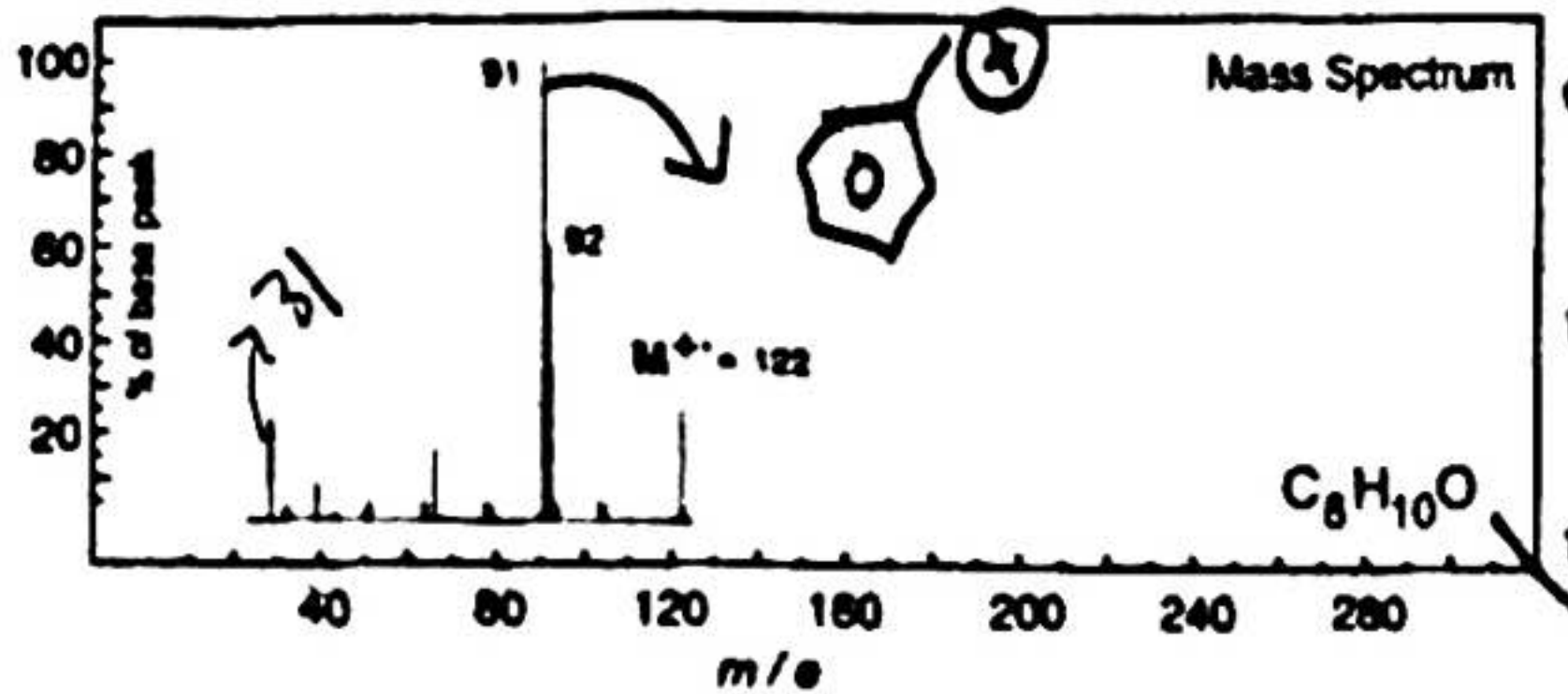
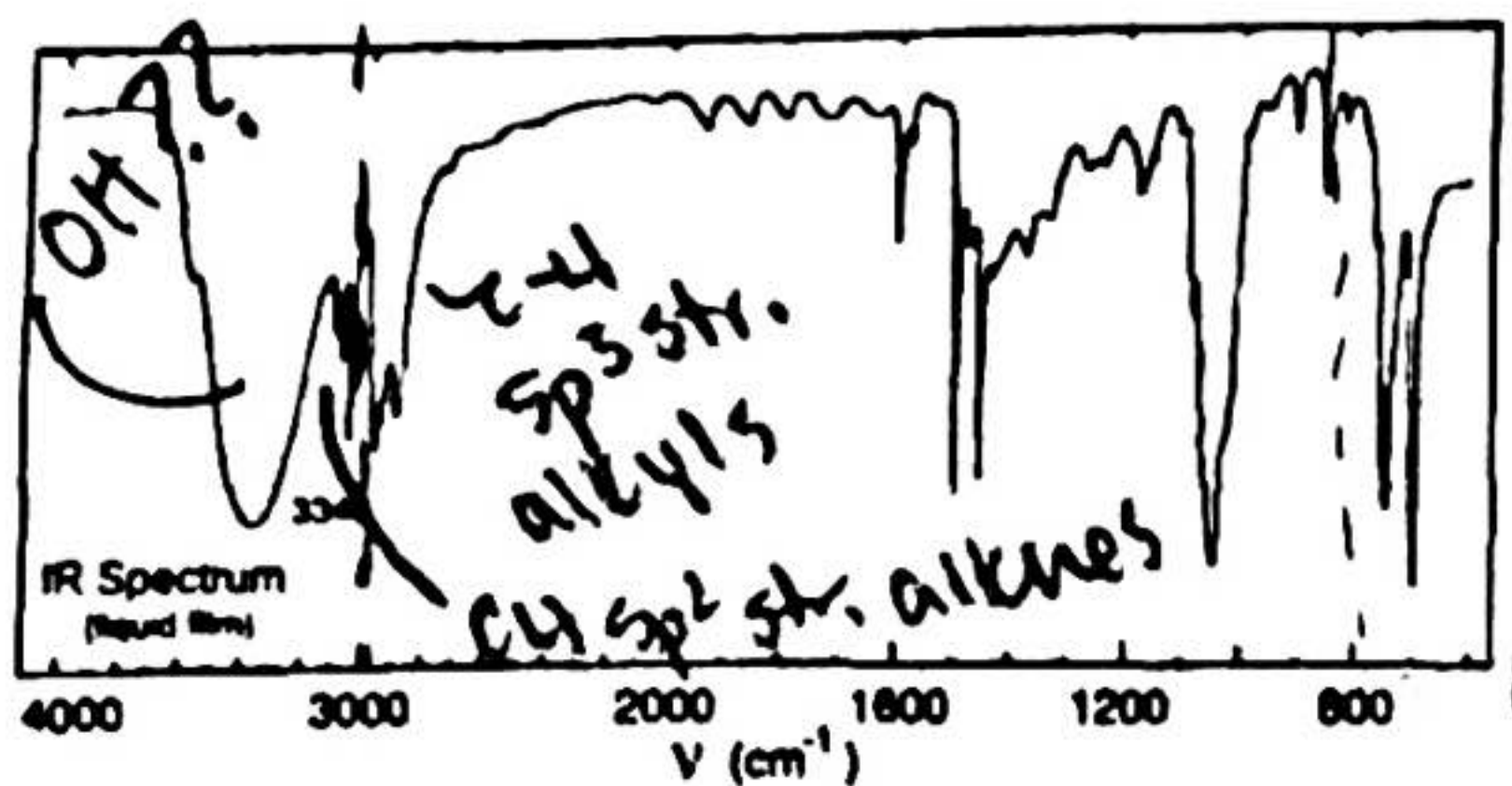
$M+1 = 2.15 \text{ mm}$
 $M = 14 \text{ mm}$

$$\left(\frac{2.15 \text{ mm}}{14 \text{ mm}} \times 100 \right) = \frac{1.1 \times \#C}{1.1}$$

19) Meal deal question

C = 14

Problem 27



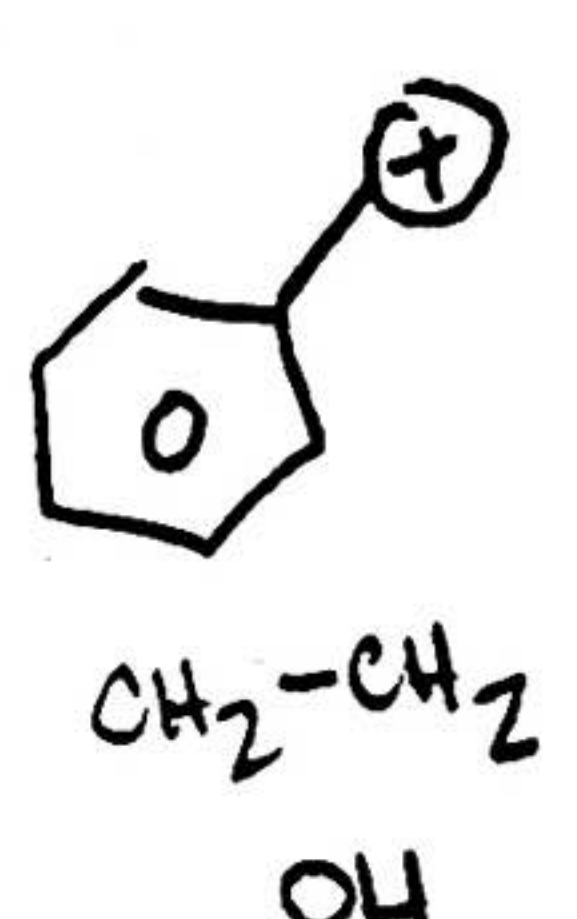
I=5 multiplet.

I=2 triplet ∴ -CH₂

acidic peak? singlet

$$\begin{aligned}
 \text{DBE} &= \frac{1}{2} [2(8) - 10 + 2] \\
 &= \frac{1}{2} [16 - 10 + 2] \\
 &= \frac{1}{2} [6 + 2] \\
 &= \frac{1}{2} [8] \\
 &= 4
 \end{aligned}$$

BENZENE??



CH₂-CH₂
OH? NH?
 BENZENE!

