Tutorial two

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Question #1

There are two distinct $\lambda_{\max}$ values:

1. $\lambda_{\max} = 260nm$
2. $\lambda_{\max} = 350nm$

By Beer-Lambert Law[1]

1. $1.2 = 3.62 \cdot 10^{-3} mol \cdot dm^{-3} \cdot 5.00cm \cdot \epsilon_{max}$
   $\rightarrow \epsilon_{max} = 66.3$
2. $0.625 = 3.62 \cdot 10^{-3} mol \cdot dm^{-3} \cdot 5.00cm \cdot \epsilon_{max}$
   $\rightarrow \epsilon_{max} = 34.5$

Question #2

a) $\sigma \rightarrow \sigma^*$

b) $\sigma \rightarrow \sigma^*$

c) $n \rightarrow \pi^*$

d) $\pi \rightarrow \pi^*$

e) $d \rightarrow d$

Part #4

Question #1

(i)

90Mhz was used for measurments which implies 1δ=90Hz.

a) 2.01

b) 4.86

c) 8.4

[1] See appendix

(ii)

$32MHz$ was used for the experiment which implies $1\delta = 50.32Hz$

a) 1021

b) 7850

c) 10250

Question #2

1. 3 different signals.
   (a) $\delta = 2.3$ $(-C - CH_2 = C$)
   (b) $\delta = 4.5 - 6$ $(-C = CH-)$
   (c) $\delta = 2.3$ $(-C - CH_2 - C)$
2. 4 different environments
   (a) $\delta = 3.3$ $(CH_3 - OR$)
   (b) $\delta = 2.4$ $(-C - CH_2 - CO - R)$
   (c) $\delta = 1.2$ $(-C - CH_2 - C)$
   (d) $\delta = 0.9$ $(CH_3 - C)$
3. 3 different environments.
4. $\delta = 5 - 6$ (acyclic non conjugated)
5. δ
6. δ
7. 4 different environments
   (a) $\delta = 3.3$ $(CH_3 - OR$)
   (b) $\delta = 2.4$ $(-C - CH_2 - CO - R)$
   (c) $\delta = 1.2$ $(-C - CH_2 - C)$
   (d) $\delta = 0.9$ $(CH_3 - C)$
8. 3 different environments.
   (a) $\delta = 2.0$ $(CH_3 - CO - OR$)
   (b) $\delta = 4.1$ $(-C - CH_2 - O)$
   (c) $\delta = 1.4$ $(CH_3 - C - O)$

Question #3

1. 3 different environments.
   (a) $\delta = 100 - 150$ (=C-)
   (b) $\delta = 15 - 50$ (R_2CH_2) (adjacent the the carbons involved in the double bond)
   (c) $\delta = 15 - 50$ (R_2CH_2) (opposite the carbons involved in the double bond)
2. 3 different environments.
   (a) $\delta = 50 - 80$ $(C - O)$ (of the $CH_3 - O$ side
   (b) $\delta = 50 - 80$ $(C - O)$ (of the $CH_3 - CH_2 - O$ side
   (c) $\delta = 8 - 35$ $(CH_3 - R)$
3. 2 different environments.

   (a) $\delta = 100 - 150$ $(= C-)$ on the side of the bromide
   (b) $\delta = 50 - 80$ $(= C-)$ (on the CH_2 side
4. 6 different environments.
   (a) $\delta = 8 - 35$ $(R - CH_3)$
   (b) $\delta = 30 - 40$ (R_4C) (in the propyl side group)
   (c) $\delta = 110 - 170$ C within the benzene ring dirrectly attatched to the propyl group
   (d) $\delta = 110 - 170$ C within the benzene ring adjacent to the C dirrectly attatched to the propyl group
   (e) $\delta = 110 - 170$ C within the benzene ring a C away from to the C dirrectly attatched to the propyl group
   (f) $\delta = 110 - 170$ C within the benzene ring opposite the C away from to the C dirrectly attatched to the propyl group
5. 4 different environments.
   (a) $\delta = 165 - 175$ $(R - CO - OR)$
   (b) $\delta = 50 - 80$ $(C - O)$
   (c) $\delta = 110 - 17$ C within the benzene ring dirrectly attatched to the propyl group
   (d) $\delta = 8 - 35$ $R - CH_3$ nearer to the $C = O$
   (e) $\delta = 8 - 35$ $R - CH_3$ further form the $C = O$

Question 4

1.
2. $CH_3 - C \equiv C - CH_3$
3. CH_3CBr_3

Question #5

Spectrum 1 corresponds to 4-heptanol, becuase as 4-hepthanol is symetricall about the COH region only 4 distinct environments are seen. In 3-hepthanol however there is no symetry so 7 distict environments are seen for the 7 different carbons present.

Question #6

1. dectuplet
2. singlet
3. triplet
4. there are two distinct H environments each of which will correspond to a doublet.

Question #7

1. Triplet, $J = 4.00Hz$
2. Septuplet $18.0Hz$
3.

Appendix

Beer-Lamber Law.

The Beer Lambert law related the attenuation of electromagnetic waves to the properties of the material through which they are propagating and the distance which they have propagated through the material.

Equation.

For a particular wavelength the Beer Lambert law is given by:

$A = \epsilon bC$

Where:
A = Absorbance
ϵ = Molar absorptivity $(L \cdot mol^{1-} \cdot cm^{-1})$