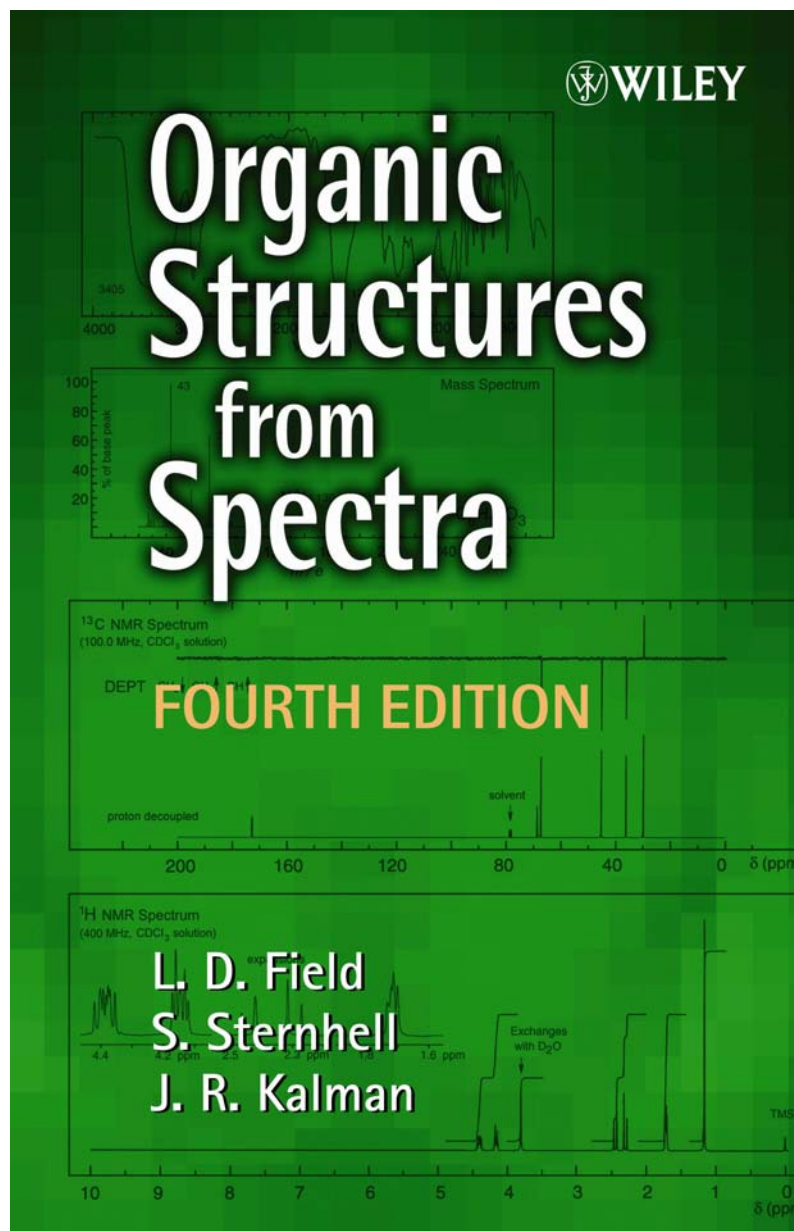


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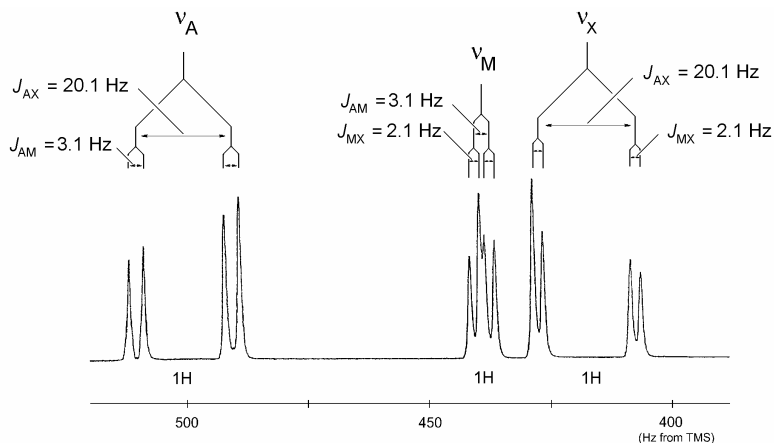
Solutions Manual

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Problem 315 Spin System AMX



Chemical Shifts

$$\begin{aligned}\delta_A &= 501 \text{ Hz} / 100 \text{ MHz} = 5.01 \text{ ppm} \\ \delta_M &= 439 \text{ Hz} / 100 \text{ MHz} = 4.39 \text{ ppm} \\ \delta_X &= 408 \text{ Hz} / 100 \text{ MHz} = 4.08 \text{ ppm}\end{aligned}$$

Coupling constants

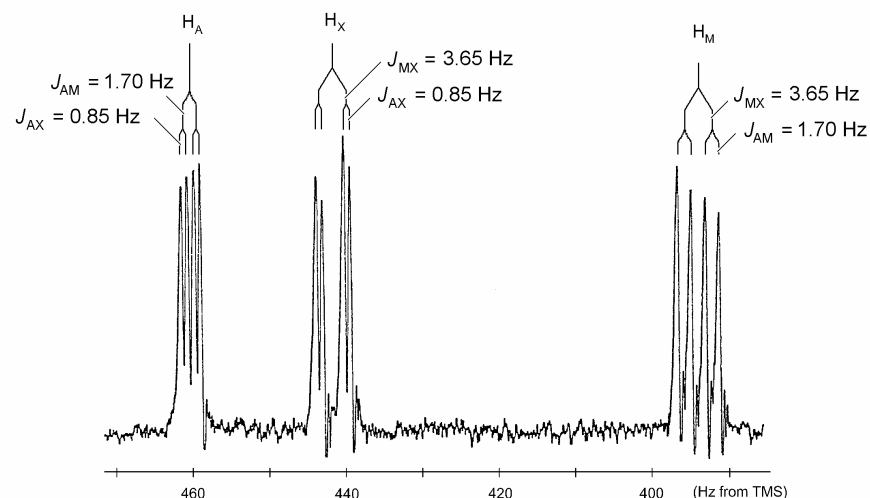
$$\begin{aligned}J_{AM} &= 3.1 \text{ Hz} \\ J_{AX} &= 20.1 \text{ Hz} \\ J_{MX} &= 1.1 \text{ Hz}\end{aligned}$$

1st Order Analysis

$$\begin{aligned}\Delta\nu_{AM} &= \nu_A - \nu_M = 501 - 439 = 62 \text{ Hz} \\ \Delta\nu_{AX} &= \nu_A - \nu_X = 501 - 408 = 93 \text{ Hz} \\ \Delta\nu_{MX} &= \nu_M - \nu_X = 439 - 408 = 31 \text{ Hz} \\ \Delta\nu_{AM} / J_{AM} &= 62 / 3.1 = 20.0 \\ \Delta\nu_{AX} / J_{AX} &= 93 / 20.1 = 4.6 \\ \Delta\nu_{MX} / J_{MX} &= 31 / 2.1 = 14.7\end{aligned}$$

All ratios are greater than 3 so a 1st order analysis is justified.

Problem 316 Spin System AMX



Chemical Shifts

$$\begin{aligned}\delta_A &= 460 \text{ Hz} / 60 \text{ MHz} = 7.67 \text{ ppm} \\ \delta_X &= 442 \text{ Hz} / 60 \text{ MHz} = 7.37 \text{ ppm} \\ \delta_M &= 394 \text{ Hz} / 60 \text{ MHz} = 6.57 \text{ ppm}\end{aligned}$$

Coupling constants

$$\begin{aligned}J_{AM} &= 1.70 \text{ Hz} \\ J_{AX} &= 0.85 \text{ Hz} \\ J_{MX} &= 3.65 \text{ Hz}\end{aligned}$$

1st Order Analysis

$$\begin{aligned}\Delta\nu_{AM} &= \nu_A - \nu_M = 460 - 394 = 66 \text{ Hz} \\ \Delta\nu_{AX} &= \nu_A - \nu_X = 460 - 442 = 18 \text{ Hz} \\ \Delta\nu_{MX} &= \nu_M - \nu_X = 442 - 394 = 48 \text{ Hz} \\ \Delta\nu_{AM} / J_{AM} &= 66 / 1.7 = 38.8 \\ \Delta\nu_{AX} / J_{AX} &= 18 / 0.85 = 21.2 \\ \Delta\nu_{MX} / J_{MX} &= 48 / 3.65 = 13.2\end{aligned}$$

All ratios are greater than 3 so a 1st order analysis is justified.