**Problem R-65** \((C_{10}H_{10}O_4)\). The 300 MHz \(^1\)H NMR spectrum of phenylsuccinic acid in CDCl\(_3\)-DMSO-d\(_6\) is shown below. From the line positions given, calculate the coupling constants \(J_{ax}\), \(J_{bx}\), and \(J_{ab}\) (Source: Aldrich Spectra Collection).

Phenylsuccinic acid partially labeled with \(^{13}\)C at the carboxyl group marked gave the 100 MHz \(^1\)H NMR spectrum below (\(\delta 2.2-3.3\), acetone-d\(_6\)). What is the fraction of \(^{13}\)C incorporation? Estimate the carbon-proton couplings \(^3J_{C-HA}\) and \(^3J_{C-HB}\) from this spectrum. Source: M. E. Rennekamp, C. A. Kingsbury J. Org. Chem. 1973, 38, 3959 (DOI: 10.1021/jo00962a036).

Draw Newman projections for the three possible staggered conformations of phenylsuccinic acid and determine which is the major one in acetone-d\(_6\) solution.
**Problem R-65** (C\textsubscript{10}H\textsubscript{10}O\textsubscript{4}). The 300 MHz \textsuperscript{1}H NMR spectrum of phenylsuccinic acid in CDCl\textsubscript{3}-DMSO-d\textsubscript{6} is shown below. From the line positions given, calculate the coupling constants \(J_{\text{ax}}\), \(J_{\text{bx}}\) and \(J_{\text{ab}}\) (Source: Aldrich Spectra Collection).

This can be treated as an AMX pattern - first order treatment will give accurate \(J\) values \((\nu_{\text{ab}} \gg 5J_{\text{ab}})\)

The sample is ca 60\% enriched in \textsuperscript{13}C, from the area of the \textsuperscript{13}C satellites vs the central peak.

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