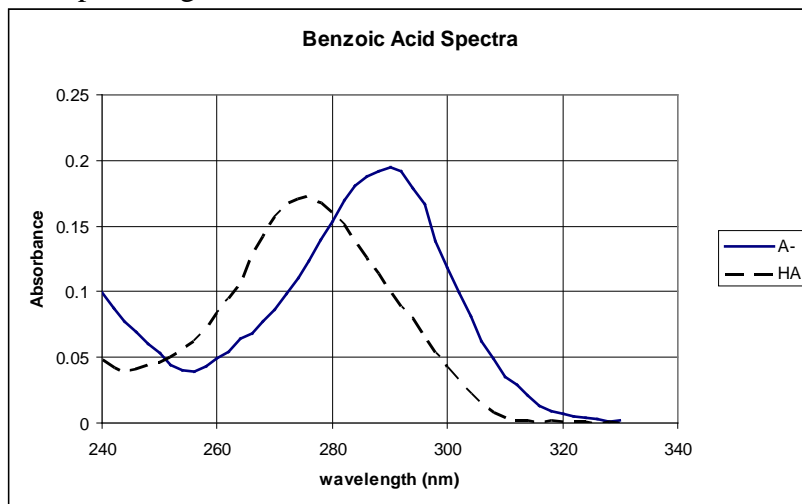


Additional Problem 2.1

Benzoic acid (e.g. HA) is a weak acid with a pK_a of 4.2. The spectra (shown below) are given for both forms with the acid form (assume 100% in acid form) for benzoic acid in an aqueous buffer with a pH of 1.0 and the basic form in an aqueous buffer with pH of 8.0 (assume 100% base form). These spectra were collected for a total benzoic acid concentration of 1.00 mM with a cell path length of 0.5 cm.



a) At a wavelengths of 275 nm and 290 nm estimate the molar absorptivity (in $M^{-1} cm^{-1}$) of the HA species and A^- species (4 values in total).

b) Biochemist A prepares benzoic acid standards by diluting a 1.00 M stock with water to produce solutions of total benzoic acid ($HA + A^-$) concentrations of 0.20, 0.50, 1.0, 2.0, and 5.0 mM. Calculate expected solution absorbances at 290 nm. Be sure to first calculate the concentration of each form of benzoic acid. Will a plot of A_{meas} ($=A_{HA} + A_{A^-}$) with C_{total} be linear?

c) Biochemist B prepares standards at the same concentrations but does so by diluting the stock standard in a $pH = 7.5$ buffer. Redo the calculations done in part b). Is the plot linear now?

bonus) Is there a wavelength where there is no need to buffer the solution to get a linear dependence of A_{meas} on C_{total} ?