

Handin 5: Mechanistic Kinetics

1. Consider a reaction with the stoichiometry: $A + B \rightarrow C + D$. Assume that both A and B absorb at a specific wavelength, while C and D do not. Assume also that A is the limiting reagent, $[A]_0 < [B]_0$. Remember that the concentration of A is determined by the extent of the reaction: $[A] = [A]_0 - \xi$. Assume that the absorbance of the mixture is the sum of the absorbances: $A = \epsilon_A l [A] + \epsilon_B l [B]$, where ϵ_A and ϵ_B are the molar extinction coefficients of A and B, respectively. Show that:

$$\frac{[A]}{[A]_0} = \frac{[A]_0 - \xi}{[A]_0} = \frac{A - A_\infty}{A_0 - A_\infty}$$

2. Argon lasers operating at 488 nm are useful for photochemical experiments. An argon laser operating with an incident power of 0.00155 W produced 5.46×10^{-6} moles of a photochemical product after irradiation for 100.0 s. The %T for the solution was 24.6% at this wavelength. Calculate the quantum yield for the production of the product.