

Take-Home Examination 2**Chemistry 262 - 60 points**

Name: _____

December 6, 1996**Dr. Jay H. Baltisberger****Please answer all questions, showing all calculations**

1. Suppose two molecules (A and B) dissolve in solution such that they form a complex (C) in the reaction: $A + 2 B \rightarrow C$. The molar absorptivities are $\epsilon_A = 325 \text{ M}^{-1} \text{ cm}^{-1}$, $\epsilon_B = 0 \text{ M}^{-1} \text{ cm}^{-1}$, $\epsilon_C = 15500 \text{ M}^{-1} \text{ cm}^{-1}$. Calculate the equilibrium constant for the reaction, as well as the concentration of all species in solution, given that the absorbance of an equilibrium mixture is 1.970 in a 1 cm cell if the initial concentrations of both A and B were $5.92 \times 10^{-3} \text{ M}$. (15 points)
2. Suppose the fluorescence of a molecule is quenched by Na^+ ions. If the measured lifetime is 8.1 ns in the absence of Na^+ and 2.3 ns when $[\text{Na}^+] = 0.0005 \text{ M}$, calculate the rate constant k_Q . Calculate the intensity of a solution where $[\text{Na}^+] = 0.0002 \text{ M}$ given that an unquenched solution has an intensity of 100. (15 points)
3. Which of the following molecules will exhibit a pure rotational (microwave) spectrum? Which will exhibit a rotational raman spectrum? (15 points)

SF_6 (octahedral), CO_2 (linear), NNO (linear), XeF_4 (sugar planar)

4. Draw your expectation of what the 1D spectrum (i.e. what are the multiplicities for each different hydrogen type) as well as the 2D-COSY spectrum (i.e. what are the COSY connectivities between various hydrogens) for 2-chloro-4-ethyl-5-methyl-3-octanone would look like, assume that all protons are fully resolved. (15 points)

