C20 J Problem Set # 3
Spectroscopy

1. A solution thiourea and Bi(III) has a molar extinction coefficient of 9.32×10^3 L.cm-1.mol-1 at 470 nm.

    a. Calculate the absorbance of a 6.24×10^{-5} M solution of the complex at 470 nm in a 0.5 cm cell.

    b. Calculate the % transmitance of the solution described in a.

    c. Calculate the molar concentration of the mixture in a solution that has an absorbance of 0.9 when measured at 470 nm in a 2 cm cell.

2. A mixture of 1.5×10^{-4} M Zn(II) and 1.00×10^{-3} M L has an absorbance of 0.5 in a 1.00 cm cell at 600 nm. Calculate

    a. the % transmitance of the mixture.

    b. the % transmittance in a 2.0 cm cell.

    c. the molar absorptivity of the complex.

3. Molar absorptivity data for Co and Ni compounds of 2,3-quinoxalinedithiol are ε_{Co} = 36,400 and ε_{Ni} =5520 at 510 nm, and ε_{Co} = 1240 and ε_{Ni} = 17,500 $M^{-1}cm^{-1}$ at 656 nm. A 0.425 g sample was dissolved and diluted to 50 mL. A 25.0 mL aliquot was treated to eliminate interference after addition of 2,3-quinoxalinedithiol, the volume was adjusted to 50.00 mL. This solution had an absorbance of 0.50 at 510 nm and 0.3 at 656 nm in a 1.00 cm-cell. Calculate the concentration of Co and Ni in solution.

4. Calculate the equilibrium concentrations of the acid base indicator HIn and its conjugate base if unbuffered solution of the indicator had an absorbance of 0.4 at 430 nm and 0.08 at 580 nm. The following extinction coefficient were determined $\varepsilon_{430} = 2.00 \times 10^4$ and 6.3×10^2 and $\varepsilon_{580} = 9.70 \times 10^2$ and 7.10×10^3 $M^{-1}cm^{-1}$ for the acid and its conjugate base.