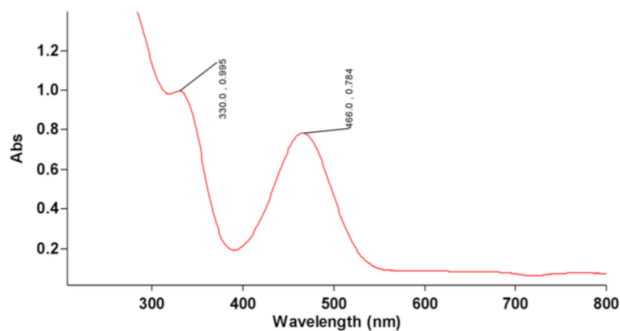


Interpreting the d⁶ Tanabe-Sugano diagram

The UV-Vis spectrum of a 0.0081 M solution of [Co(en)₃]³⁺ is shown below. You will need a copy of the d⁶ Tanabe-Sugano diagram (https://en.wikipedia.org/wiki/Tanabe-Sugano_diagram).



- What are the molar absorptivities of the absorptions at 330 and 466 nm?
- Based on the ϵ values, are these d-d transitions?
- Is this a high-spin d⁶ or a low-spin d⁶ complex? How do you know?
- What are the energies of the two bands in wavenumbers? What is their ratio (greater than one)?

- e) Let's determine Δ_o for Co(en)_3^{3+} . If you did part c correctly, you should find that the ratio of the two absorptions is 1.41, and the value where this holds is $\Delta_o/B \sim 39$
- What are the E/B values for the two lowest energy transitions ($^1A_{1g}$ to $^1T_{1g}$ and $^1A_{1g}$ to $^1T_{2g}$) when $\Delta_o/B = 39$?
 - Use these values to determine B for each transition (to make sure you do the math correctly, E_1 is $30,300 \text{ cm}^{-1}$ and E_2 is $21,500 \text{ cm}^{-1}$).
 - What is the average B value?
 - Use this B value to determine Δ_o .