Problems

1. For a d^7 metal ion determine the energy ratios for allowed transitions at Δ_{oct}/B of 20.
2. For a d^6metal ion of Δ_{oct}/B = 30 and B=530 cm^{-1} what would the energies of the 5 allowed transitions be? How many are in the UV-Vis range? How many are in the IR range?
3. Write out the allowed transitions for a d^5 metal ion in a $E/B > 28$ ligand field.
4. A d^4 complex exhibits absorptions at 5500 cm^{-1} (strong) and 31350 cm^{-1} (weak). What are the transitions that are being exhibited in the complex? What is the corresponding Δ_{oct} for the complex?
5. A spectrum of d^7 metal complex seemingly exhibits only two intense transitions. What is the Δ_{oct}/B that this situation occurs? Please use reference to specific transitions and energy splitting.

Answers

1. Δ_{oct}/B of 20 yields E/*B* values of 38, 32, 18. Ratios then are 2.11 and 1.78
2. Δ_{oct}/B = 30 yields E/*B* heights of 27, 40, 57, 65, 85. Energies are then 14310, 21200, 30210, 34450 and 45050 cm^{-1}. All are in the UV-Vis range. *note you need to infer the E/*B* value for the last transition as the diagram does not extend that far up.
3. $^2A_{2g}$<-$^2T_{2g}$, $^2T_{1g}$<-$^2T_{2g}$, ^2E_g<-$^2T_{2g}$, and $^2A_{1g}$<-$^2T_{2g}$.
4. 31,350/5,500 gives a ratio of 5.7/1. The only Δ_{oct}/B value that matches is at 10. *B* value is then 550 cm^{-1}. Δ_{oct}equals 5500 cm^{-1}.
5. Three transitions are generated at low Δ_{oct}/B. However, at about a value of Δ_{oct}/B = 13 the transitions $^4A_{2g}$<-$^4T_{1g}$, and $^4T_{1g}$<-$^4T_{1g}$ have the same energies which results in the appearance of only two absorptions.