Spectral properties of 2nd and 3rd Transition Series:- (Ligand field)

As discussed earlier, heavier metal down the group form low-spin Complexes due to their high Crystal field splitting and reduced pairing energy. The 4d and 5d metal also readily attain higher oxidation States as the electron are loosely bound Compared to 3d.

Generally Transition metal Complexes give UV-Vis bands.

Ligand field bands of 2nd and 3rd are quite Complicated because of the following reasons.

1) Overlap of bands of Charge transfer band (CT) and ligand field bands.

2) The Spin-orbit Coupling interaction increases for heavier metal ions.

Then, peak splitting due to spin orbit coupling interaction is quite predominant for heavier metal.

Metal ions like Mo^{3+}, Rh^{3+}, Ir^{3+}, the ligand field band are sufficiently free from the effect of charge transfer band and spin orbit Coupling interaction.

Examples :-

$[Rh(NH_3)_6]^{3+}$ → Rh (III) → Low spin → t_{2g}^6

Totally Symmetric { $^1A_{1g}$ ↿⇂ ↿⇂ ↿⇂

Ground state is $^1A_{1g}$

Next higher level → $^1T_{1g}$, $^1T_{2g}$ (allowed Transition) $\Delta S = 0$

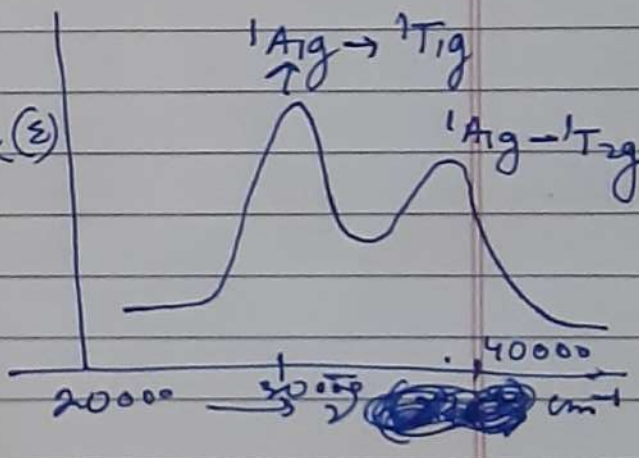
(Though $^3T_{1g}$ & $^3T_{2g}$ are lower than $^1T_{1g}$ & $^1T_{2g}$)

$^1A_{1g} \xrightarrow{\nu_1} {}^1T_{1g}$, $\nu_1 = 32,700\ cm^{-1}$

$^1A_{1g} \xrightarrow{\nu_2} {}^1T_{2g}$, $\nu_2 = 39,100\ cm^{-1}$

Generally orange, red, yellow or brown color in Rh (III).

(Transition metal spectra are broad.)



Audience of This lecture :-

a) The idea of ligand field theory, Charge transfer transition should be in basic level.

*b) ~~The idea of~~ Having the concept of the spectral properties of 1st transition series.