

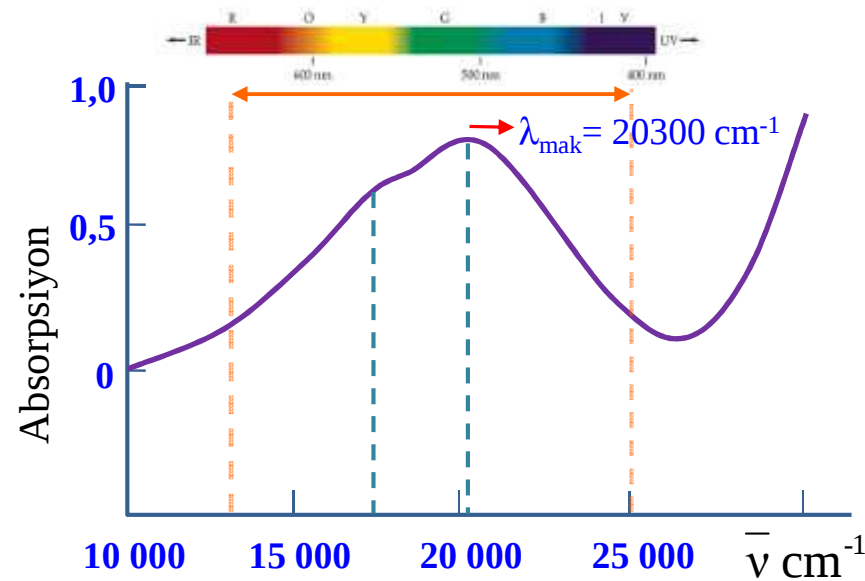
# KOORDİNASYON BİLEŞİKLERİNDE RENK



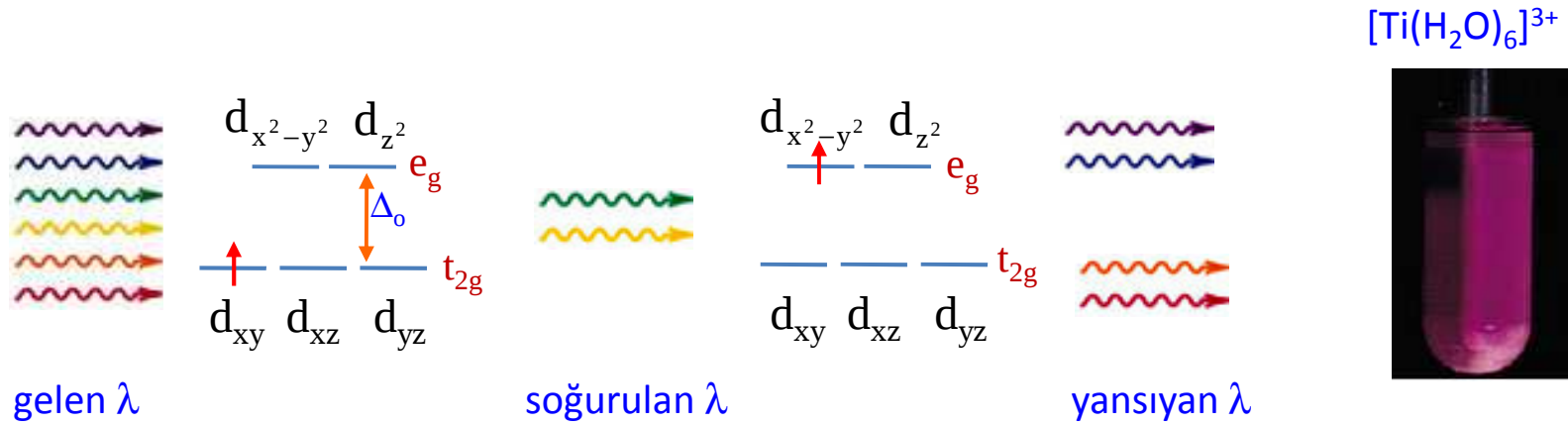
**Yrd.Doç.Dr. İbrahim İsmet ÖZTÜRK**

## KAYE'nin tayini ve renklilik

KAYE, deneysel olarak kompleksin UV-görünür bölge spektrumu alınarak ölçülebilir.  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  kompleks iyonunun sudaki çözeltisinin elektronik spektrumu aşağıda verilmiştir:



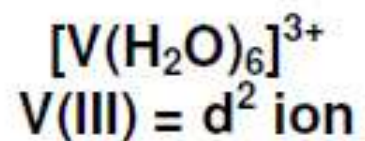
$[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  kompleks iyonunun sulu çözeltisinin  
mor altı-görünür bölge spektrumu



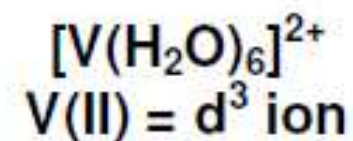
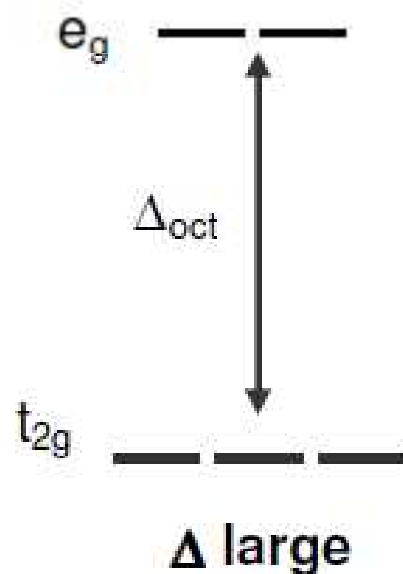
$[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  kompleks iyonunda  $\text{Ti}^{3+}$ ,  $[\text{Ar}]3d^1$  yapısındadır. Tek elektron düşük enerjili  $t_{2g}$  orbitallerinde bulunur. Kompleksin sulu çözeltisinden UV-görünür bölge radyasyonu geçirildiğinde,  $t_{2g}$  düzeyinde bulunan elektron  $\Delta_o$  kadar enerji absorplayarak  $e_g$  düzeyine çıkar. Maksimum molar soğurma  $20\,300\text{ cm}^{-1}$  'de gerçekleşmektedir.

# Color

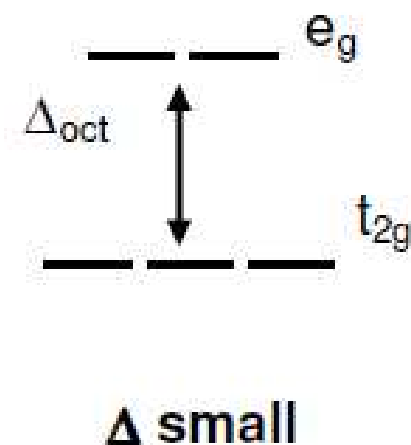




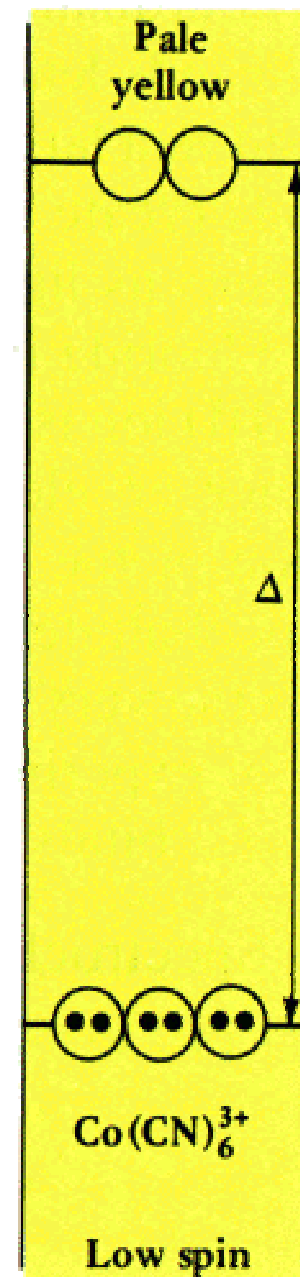
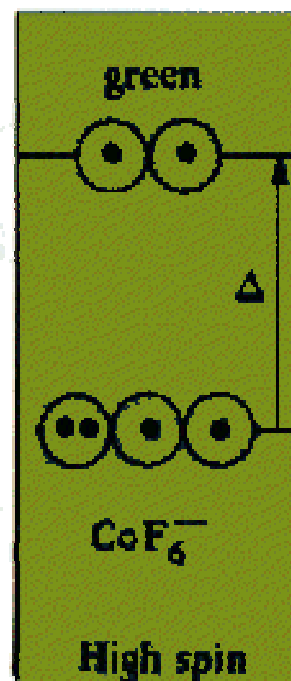
violet light absorbed  
complex appears yellow



yellow light absorbed  
complex appears violet



| $\text{Co}^{3+}$ complex                            | Wavelength of light absorbed (nm) | Color of light absorbed | Color seen                                           |
|-----------------------------------------------------|-----------------------------------|-------------------------|------------------------------------------------------|
| $[\text{CoF}_6]^{3-}$                               | 700                               | red                     | green                                                |
| $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$            | 600                               | orange                  | blue                                                 |
| $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$          | 535                               | yellow                  | violet                                               |
| $[\text{Co}(\text{NH}_3)_5\text{H}_2\text{O}]^{3+}$ | 500                               | blue-green              | red                                                  |
| $[\text{Co}(\text{NH}_3)_6]^{3+}$                   | 475                               | blue                    | yellow-orange                                        |
| $[\text{Co}(\text{CN})_6]^{3-}$                     | 310                               | ultraviolet             | tail of absorption band in visible gives pale yellow |



| Colour of light absorbed | Approx. $\lambda$ ranges / nm | Colour of light transmitted |
|--------------------------|-------------------------------|-----------------------------|
| Red                      | 700-620                       | Green                       |
| Orange                   | 620-580                       | Blue                        |
| Yellow                   | 580-560                       | Violet                      |
| Green                    | 560-490                       | Red                         |
| Blue                     | 490-430                       | Orange                      |
| Violet                   | 430-380                       | Yellow                      |



$$E = h\nu$$

$$E = hc \frac{1}{\lambda}$$

$$E = hc\bar{\nu}$$

$E$  = kristal alan yarılma enerjisi =  $\Delta$  = 6,62E-34 J.s

$c$  = ışık hızı = 3E8 m/s

$\lambda$  = dalga boyu = nm

1 nm = 1E-9 m ve 1E-7 cm

$\nu$  = frekans

$\bar{\nu}$  = dalga sayısı

If a solution appears yellow, what wavelength of light does it absorb?

Would you expect it to be low spin or high spin?

An octahedral metal complex absorbs light that is 535 nm. What is the crystal field splitting  $\Delta$  for the complex? What color is it?

You have two solutions, one that is orange, and another that is blue.

You know that both solutions are made up of a cobalt complex, however one has chloride ions as ligands, while the other has ammonia ligands. Which solution would you expect to be orange?

What color will a complex be that absorbs light that is 600 nm be?

What color will a complex be if it has a  $\Delta$  of  $5.304\text{E-}19$  J?

Would you expect a violet solution to be high spin or low spin? What about a red solution?