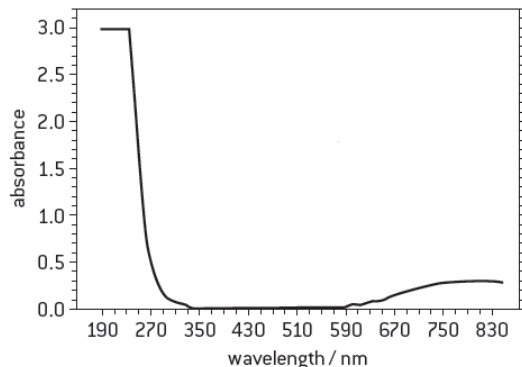
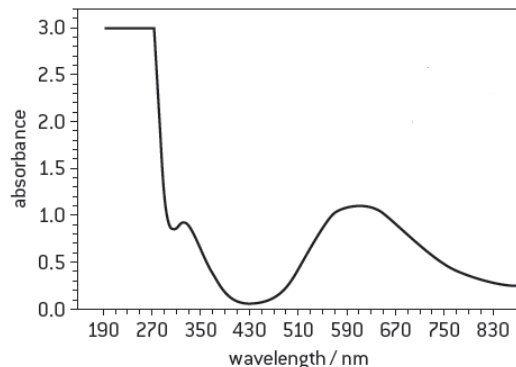


HL Questions on Coloured complexes

- Suggest why compounds of copper(I) and compounds of scandium(III) are colourless whilst compounds of copper(II) and iron(III) are coloured.
- The hexahydrated iron(III) ion, $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$, is yellowish brown in colour. Explain:
 - why it is coloured
 - why it has a different colour to the iron(III) hexacyanide ion, $[\text{Fe}(\text{CN})_6]^{3-}$.
- The thiocyanate ion, SCN^- and the hydroxide ion, OH^- are both monodentate ligands. The thiocyanate ion is higher in the spectrochemical series than the hydroxide ion.
 - Explain what is meant by the term *monodentate ligand*.
 - What information about the splitting of the d orbitals can be deduced from the fact that the thiocyanate ion is higher in the spectrochemical series than the hydroxide ion?
- Consider the following absorption spectra of two different complex ions of copper(II).



Absorption spectrum of $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$



Absorption spectrum of $[\text{Cu}(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{2+}$

- Using the colour wheel in Section 17 of the IB data booklet deduce what colour is absorbed by (a) $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ and (b) $[\text{Cu}(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{2+}$.
- Using the colour wheel in Section 17 of the IB data booklet deduce what colour is transmitted by (a) $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ and (b) $[\text{Cu}(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{2+}$.
- Use the spectra to deduce which is higher in the spectrochemical series, NH_3 or H_2O .
- Explain why $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ has a different colour to $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$