CH4514 - Advanced Metals Chemistry
Tutorial 2

1. The ligand, L (Fig. 1), reacts with Nd^{3+} and Yb^{3+} salts in water to form coordination complexes that display strong infra-red emission when sensitised with visible light. The electronic process that produces this fluorescence in the Yb complex (Fig. 2) involves a transition from the first excited state to the ground state.

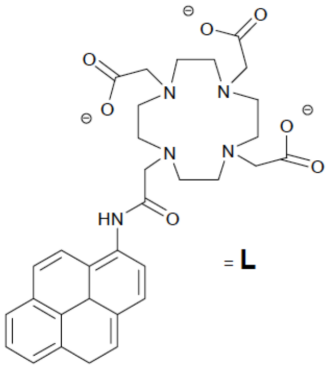

Figure 1

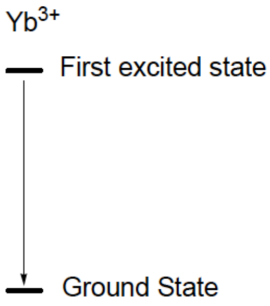

Figure 2

(i) Describe the features of the macrocyclic ligand, which make it suitable for the purpose described.

(ii) State which complex (Nd or Yb) will have the higher stability constant in aqueous solution and explain your reasoning.

(iii) Use Hund's rules to determine the term symbols $^{(2S+1)}L_J$ of the ground and first excited states of the Yb complex.

2. The colour of SmI_2 is intense purple while that of SmI_3 is pale orange. Explain this difference with reference to the appearance of their absorption spectra.

3. Explain why $[WS_4]^{2-}$ is red while $[WO_4]^{2-}$ is white.

4. Why are the physical properties of Ln^{3+} species very similar?

5. $[Ru(bpy)_3]^{2+}$ is a very commonly used photoredox catalyst but $[Fe(bpy)_3]^{2+}$ is not. Based on the electronic structure of the two complexes rationalize why the latter would not work as well.