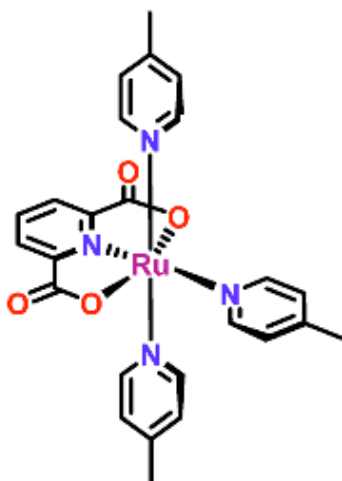


## In Class 13: Coordination Chemistry, Crystal Field theory and Colors

1. (10 pt) The following Ru complex was studied by researchers from Sweden and China and published a recent issue of *Inorganic Chemistry*. It was found to serve as a water oxidation catalyst!



- For each of the ligands below, circle each individual ligand, indicate the charge on each ligand, and indicate the type of ligand binding mode (note that the C's (the corners in the stick diagrams) will not have any formal charges). (4 pt)
  - If the complex (metal + ligand) is neutral, what is the charge on the metal? (2 pt)
  - What is the coordination number of the metal? (2 pt)
  - If this complex (or a derivative of it) is serving as a "water oxidation catalyst," propose a possible change in oxidation state of the Ru that you expect for the reaction. (2 pt)
2. a. A coordination complex of  $\text{Fe}^{2+}$  with  $\text{H}_2\text{O}$  has a  $\Delta_o$  value of  $16,500 \text{ cm}^{-1}$ . The pairing energy ( $P$ ) for  $2e^-$  in for this complex is about  $18,000 \text{ cm}^{-1}$ . How many unpaired electrons should it have? What color should the complex appear? Explain and support your answers carefully. (7 pt)

- b. Calculate the energy of the d-d transition for the complex above in kJ/mol. (6 pt)