*Instructions:*

Please read the article titled “Efficient Hydrogenation of Ketones Catalyzed by an Iron Pincer Complex” (*Angew. Chem. Int. Ed.* **2011**, *50,* 2120–2124), and answer the following questions.

1. Please identify the organometallic reaction(s) involved in the synthesis of the Fe complexes **1** and **2** in Scheme 1. When possible, please draw electron pushing arrows to illustrate the mechanisms of the reactions.
2. Both Fe complexes **1** and **2** were characterized by IR spectroscopy which revealed a strong absorption of the coordinated CO ligand at 1944 cm–1 and 1892 cm–1, respectively. Please account for the difference in the CO absorptions of these complexes.
3. The authors determined that the Fe complex **1** exhibits a Cs or C2 symmetry based on the 1H NMR data.
4. Please locate the C2 axis and the σv planes of this complex.
5. What is the point group of this complex?

1. The Fe complex **1** was fully characterized by NMR spectroscopy (Supporting Information). The resonance of the ***C*** atoms in P***C***H(CH3)2 groups of the PNP ligand was observed at δ = 25.85 ppm as a triplet in the 13C{1H} NMR spectrum. Please explain the splitting pattern of this signal.
2. The reactivities of the catalyst under different reaction conditions were determined by turnover numbers (TONs) and turnover frequencies (TOFs) as presented in Table 1. For example, the authors reported the TON and the TOF for the trial 2 as 1880 and 87 h–1, respectively.
3. Do you agree with the authors? Please perform a relevant calculation to support your answer.
4. Based on the TONs and the TOFs reported in the Table, which trial that you believe is the most effective?
5. The authors proposed the catalytic cycle in Scheme 4. The authors determined that, at first, the Fe complex **2** undergoes deprotonative dearomatization of the PNP pincer ligand with KtBuO to yield the Fe complex **A**. What additional experiments that the authors performed and what was the evidence that supports the formation of the complex **A**?
6. From the proposed catalytic cycle presented in Scheme 4, identify the oxidation state and the total electron count for every Fe complex.
7. Please describe the reactions that take place in each step in the proposed catalytic cycle starting from the Fe complex **A**.