This paper (*Organometallics* **2015**, *34*, 4626) presents reactions of [Cp\*Ir(arene)]2+ compounds. While not a fully catalytic system, it does show potential for a pathway to the catalytic conversion of arenes to phenols.

1. The primary focus of this paper is the reaction of the coordinated arene ligand. Depict the orbital interactions between the metal center and a η6-benzene ligand.
2. The starting material in this study is the dimeric compound [CpIr(Cl)2]2. It is a symmetric dimer and the iridium atoms have an 18 electron count. Classify [CpIr(Cl)2]2, determine the ligand bond number, the valence on iridium and the dn count for iridium. Clearly indicate how you are classifying the chloride ligand and whether or not this compound possesses an Ir-Ir bond.
3. The compound of interest in this study is compound 1. The synthesis of compound 1 is shown in the upper left portion of scheme 3. Is the stoichiometry presented in scheme 3 for the synthesis of compound 1 in agreement with the information available in the experimental section? Why or why not? As part of your answer you should clearly identify the role of the AgBF4 in this reaction.
4. Classify compound 1, determine the electron number, the ligand bond number, the valence on iridium and the dn count for iridium.
5. The first series of reactions in scheme two presents the substitution of an H for a CR3 group on a coordinated arene. That type of substitution is accomplished in one step in this paper as shown in scheme 4. The first step in pathway a in scheme 4 is nucleophilic attack at the coordinated arene. Classify the proposed intermediate, determine the ligand bond number, the valence on iridium and the dn count for iridium. Clearly specify how you reached the overall charge on the compound.
6. Would nucleophilic attack at a coordinated arene be more or less likely than at the free arene? Why?
7. Compound 1 has both an η6-arene and an η5-Cp\* ligand. Both are drawn as being aromatic. Why does the nucleophilic attack occur at only one of the ligands?
8. In scheme 2 the nucleophilic attack is followed by an oxidation step to generate the substituted product. How is this step removed in the conversion of compound 1 to compound 2?
9. What purpose does the 2-methyl-2-butene serve in the conversion of compound 1 to compound 2?
10. The conversion of compound 2 to compound 3 can be thought of as occurring in two steps. Describe what is happening in this conversion.
11. The authors performed a few studies examining the selectivity of nucleophilic attack based on substituting the arene ring. What substituents were examined and how did they impact product formation? As part of your discussion, account for the differences in substitution. Hint: drawing various resonance structures may help you in formulating your answer.
12. In scheme 5, the authors present the direct conversion of compound 2 to compound 1. The conditions are somewhat different than that presented in scheme 2. Account for this difference.