This paper (*J. Am. Chem. Soc.* **1976**, *98*, 846) outlines the proposed mechanism for what has come to be known as the Monsanto acetic acid process. While somewhat subtle, the bottom of the second page does show that this paper is a communication. The paper starts with the salutation “Sir” as communications at the time were viewed as a direct correspondence between the author and the editor of the journal. The practice remained in place in *J. Am. Chem. Soc.* until 1981.

1. At the end of the second paragraph, the author states that the catalytic precursor is a rhodium(III) halide. What is the difference between a catalytic precursor and a catalyst (often called an active catalyst)?
2. The rhodium(III) halide is converted to [Rh(CO)2X2]- by reacting with carbon monoxide in a hydroxylic media. Now we would mostly likely refer to the media as being protic as these solvents (*e.g.* methanol) are much more likely to release H+ than OH-. For the rest of the paper the focus is on [Rh(CO)2X2]- when X = I. Classify [Rh(CO)2(I)2]- (compound I), provide an electron count, the ligand bond number, the valence on rhodium and the dn count for rhodium.
3. How has the valence of the rhodium changed in going from the catalyst precursor to the active catalyst? What is responsible for that change?
4. The drawing of compound I presented in the paper is significantly different from how we would choose to represent it. Draw the structure of compound I.
5. Carbonyl ligands are extremely important in this catalytic system. Describe/depict the orbital interactions between a metal and a terminal CO ligand.
6. Compound I reacts with CH3I to initial generate compound II shown in the paper. Classify compound II, provide an electron count, the ligand bond number, the valence on rhodium and the dn count for rhodium. Using this information, identify the type of reaction that is occurring in going from compound I to compound II.
7. Compound II is proposed to undergo isomerization to give compound III. Classify compound III, provide an electron count, the ligand bond number, the valence on rhodium and the dn count for rhodium. Based on the drawings provided in the paper and the differences in electron number and LBN between compounds II and III, propose the reaction that takes place in this isomerization.
8. Two carbonyl vibrational modes are reported at 2064 and 1989 cm-1 in the IR spectrum of compound I. Upon reacting compound I with CH3I the IR spectrum changes to give two carbonyl vibrational modes at 2062 and 1711 cm-1. The peak at 1711 cm-1 occurs at a significantly different wavenumber from any of the other peaks, account for this difference.
9. Compounds I and III both display peaks around 2060 cm-1 for a carbonyl vibrational mode in the IR spectrum. These two compounds have rhodium in significantly different valences. Account for the similarity in these peaks.
10. The independent synthesis of compound III was performed and the structure of that compound is reported to be “dimerized through a weak Rh-I bridge’. Draw a possible structure of this dimeric compound. Classify this dimer, provide an electron count, the ligand bond number, the valence on rhodium and the dn count for each rhodium. Referring back to your answer to number 7, suggest a reason for this dimerization.
11. Compound III is proposed to undergo a reaction to give compound IV. Classify compound IV, provide an electron count, the ligand bond number, the valence on rhodium and the dn count for rhodium. In comparing this information for compound IV to your answers for question 7, what kind of reaction is taking place in going from compound III to compound IV?
12. The author points out that it is compound III that is observed in the reaction mixture and not either compound II or IV. The independent isolation of III (albeit as the dimer) is certainly excellent evidence of this, but the IR data is more than sufficient to make this determination. Using group theory and you knowledge of the characterization of metal carbonyls, show why the compound observed in the reaction mixture must be compound III.
13. With your answer to number 12, describe what is observed when carbon monoxide is bubbled through solutions of compound III.
14. Comparing your answers to questions 2 and 11, what reaction is taking place in the conversion of compound IV to I?
15. A second possible route for loss of the acyl group is by direct reaction of compound IV with either water or methanol to generate compound 5 which contains a rhodium hydride. Compound V could then undergo reductive elimination of HI to form compound I. What evidence does the author provide to rule out this pathway?
16. Although no data or evidence is presented in this paper, what is proposed to be the rate determining step in this reaction?
17. Unlike this study, in the Monsanto acetic acid process the methyl iodide is generated *in situ* by the reaction of HI with methanol. Going back to your organic chemistry, suggest a mechanism for this reaction. Now you have a chance to really make your organic professor proud, does your mechanism provide any hint as to why iodide is used in this process?
18. Although a classic triumph of organometallic chemistry, the Monsanto acetic acid process has mostly been replaced by the Cativa process which uses an analogous iridium catalyst, [Ir(CO)2(I)2]-. Why did this change happen? You will likely need external sources to answer this question, be sure to cite them properly.