**Hydrogenation by Wilkinson's Catalyst**

**Fill in the reaction class in each box and relevant characteristics of each complex in the table below:**



|  |  |  |
| --- | --- | --- |
| **Complex** | **Valence Number/Oxidation state*****d*-electron count** | **Valence e– count** |
|  |  |  |
|  |  |  |
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**Monsanto Acetic Acid Process**

**Identify the intermediates B and C and the classes of reaction responsible for B→C and D→A:**



**Whited Formimidate Synthesis**

**Identify the intermediates C and F and the classes of reaction responsible for A→B, C→D, and D→E:**



***What is the overall balanced equation for the catalytic reaction?***

**Questions to Consider:**

1. What effect would you expect for added triphenylphosphine to have on cycle #1 (hydrogenation by Wilkinson’s catalyst)?
2. As shown in the scheme, Wilkinson’s reacts first with H2, then with alkene. However, cationic relatives of Wilkinson’s catalyst react first with alkene, then with H2. Explain why reaction with H2 is disfavored for cationic versions of Wilkinson’s catalyst.
3. What is the role of HI in the Monsanto process? If the reactants and products do not incorporate HI, why can’t the reaction run in its absence?
4. Formation of intermediate **C2** in the Monsanto process slows down the reaction. Explain why and give a solution to minimizing the concentration of **C2** when the reaction is run.
5. In the formimidate synthesis of cycle #3, the regiochemistry of the α-hydrogen elimination to give **C** rather than another isomer is critically important. Explain how the structure of **C** is important in allowing the next step (release of H2) to occur, and how α-hydrogen elimination could occur to give an off-cycle isomer of **C**.