1) Determine the formal oxidation state for Ru in each of the following:

 

2) The complex below is formally RuIV. Why?



3) Chemists are still debating the mechanism for Ru catalyzed water oxidation reactions. One of the proposed mechanisms is shown below (*JACS* **2010**, *132,* 16094). As the cycle proceeds two water molecules are added in. One molecule of oxygen, four protons, and four electrons come out. One of the water molecules and one of the protons are shown as an example. Fill in the remaining protons, electrons, oxygen molecule, and water molecule.

