Who wins the *Chemistry Death Match* between "formal charge" and "oxidation state"? Well, the answer is that both are useful but for different things. Each is nothing more than a kind of "electron bookkeeping".

**Oxidation states** (a.k.a. "oxidation number") were popular in gen chem in dealing with redox reactions. Here is an example:

4 Fe + 3 O₂ -------> 2 Fe₂O₃

For complete rules for assigning oxidation numbers, consult a gen chem text. Stripped down rules are as follows:

1. an atom in its elemental state has an oxidation number = 0.

2. the oxidation number of a monatomic ion is the same as its charge (i.e., chlorine is –1 in Cl–)

3. assume electrons in a covalent bond are "owned" by the more electronegative atom in the bond.

So, in the above redox reaction the iron has gone from an oxidation number of zero (in elemental Fe) to +3 in Fe₂O₃ (hence, an oxidation), and the oxygen has gone from zero (in molecular oxygen, O₂) to –2 in Fe₂O₃ (hence, a reduction).

We also have redox reactions in orgo and oxidation numbers can be employed to allow us to determine which species have been oxidized and which reduced.

**Formal charge** is used more frequently in orgo than oxidation states. It can be thought of as the charge that each atom in a molecule would possess if *all the atoms had the same electronegativity*. This is clearly a bit different than oxidation number. The formal charge of an atom in a molecule can be computed as follows:

formal charge = # of valence e- – (# of lone-pair e- + 1/2 # of bonding e-)

Knowing the formal charge of an atom in a molecule can sometimes give us some idea of whether that atom is "electron rich", "electron poor", or pretty happy with its lot in life! But beware: sometimes formal charge can be misleading, like in the hydronium ion, H₃O⁺. Here the oxygen is +1 formal charge but the electron poor part of the molecule is actually the hydrogens.
**Summary**: both formal charge and oxidation numbers are just attempts at "electron bookkeeping" for the purpose of trying to indicate whether an atom in a molecule is electron rich, poor, or neutral. The oxidation number method seems to sit on one end of the spectrum where electronegativity plays too much of a role (note that the more electronegative element is assumed to "possess" the electron in a bond even when it is only slightly more electronegative than the other atom), but formal charge is at the other end of the spectrum where it treats all atoms as having the same electronegativity when it comes to assigning the charge. Hmmm, kind of makes you wonder if we maybe need a new method that takes some sort of average of the two!