

# Rules of Balancing Redox Reaction by the Half-Reaction Method

Because it is very difficult to balance most redox equations by trial and error, it is more convenient to use the half-reaction method. The half-reaction method consists of five basic steps:

1. Write the skeleton equations for oxidation and reduction half reactions.
2. For each half-reaction in turn perform the following steps:

### **In Acidic Solutions**

- a. Balance the half-reaction with respect to electrons.
- b. Balance all the atoms except hydrogen and oxygen.
- c. Balance oxygen atoms by adding  $\text{H}_2\text{O}$ .
- d. Balance the hydrogen atoms by adding  $\text{H}^+$ .
- e. Check to see that charges are balanced.

### **In Basic Solutions**

- a. Balance the half-reaction with respect to electrons.
- b. Balance all the atoms except hydrogen and oxygen.
- c. Balance oxygen atoms by adding  $\text{OH}^-$ .
- d. Balance hydrogen atoms by adding  $\text{H}_2\text{O}$ .
- e. Check to see that the charges are balanced.

3. Balance the total number of electrons in the two half-reactions by finding the least common multiple of electrons lost and gained. Multiply the appropriate half-reaction(s) by the appropriate factor(s).
4. Add the two half-reaction equation and simplify.
5. Perform a final check on the equation to make sure that the number of atoms and the charge are balanced.