

## THE OXIDATION NUMBER - HALF REACTION METHOD FOR BALANCING REDOX EQUATIONS

The redox-balancing methods many of you learned previously involve unproductively repetitive work, and/or involve using different methods for acidic and for basic solutions. The following method *may be used in all cases*, and ***it is strongly recommended***.

### Steps

1. Assign oxidation states to each element in the reaction and *identify* the species being oxidized and reduced.
2. Write separate half reactions for the oxidation and reduction processes.
3. Balance the separate half reactions:
  - a) with respect to the element being oxidized or reduced, and
  - b) by adding electrons to one side or the other to account for the number of electrons produced (oxidation) or consumed (reduction).
4. Combine the half reactions algebraically in a way which causes the total number of electrons to cancel out. This makes:
$$(\text{total amount oxidation}) = (\text{total amount reduction})$$
5. If necessary, add 'spectator' ions or molecules to balance the equation with respect to atoms *other* than O and H.  
[Here 'spectator' means they involve atoms whose oxidation states do not change.]
6. Balance the net charge by either adding  $\text{OH}^-$  to one side of the equation (for basic solutions) or  $\text{H}^+$  to the other (for acidic solutions).
7. Balance the O and H atoms by adding  $\text{H}_2\text{O}$  .
8. Check both the charge balance and the overall mass balance in the final result.