

**Electrochemistry examines redox reactions.**  
**These are reactions that involve the transfer of electrons**

Loss of electrons is oxidation

Gain of electrons is reduction  $\longrightarrow$  remember "LEO" the lion goes "GER"

Oxidation and reduction occur simultaneously, and there is no net change in the number of electrons.

Oxidation numbers facilitate the "book-keeping" of electrons. Understand that this is an artificial concept--not a real change of charge that occurs during a redox reaction.

In a redox reaction, the species that is reduced (gains electrons) is called the oxidizing agent (it causes the oxidation. The species that is oxidized (loses electrons) is called the reducing agent (it causes the reduction. In a redox reaction, you need to use oxidation numbers to identify the molecule or atom that undergoes oxidation and reduction. This allows you to break the overall redox reaction into an oxidation half-reaction and a reduction half-reaction. Looking at the half-reactions becomes important when we want to tie in thermodynamics and determine if the redox couple will spontaneously reaction ( $\Delta G < 0$ ).

### Oxidation Number Rules

Know these rules; you need to memorize them.

Use them to assign as many oxidation states of atoms in the reaction as possible. Then look at the rest of the molecule and use them to calculate all the other oxidation numbers of atoms that you don't know.

Follow these, in order!

1. Pure elements have an oxidation number = 0
2. The oxidation number of a pure elemental ion = charge of the ion
3. Group IA metals have oxidation number = +1
4. Group IIA metals have oxidation number = +2
5. Fluorine has oxidation number = -1
6. Oxygen has oxidation number = -2 except in  $O_2^{2-}$  (peroxide) where it = -1
7. Hydrogen has an oxidation number = +1 except in metal hydrides where it = -1
8. The sum of all the oxidation numbers in a neutral molecule = 0
9. The sum of all the oxidation numbers in an ion = charge of the ion

#### Examples

From the rules you know:

