OXIDATION-REDUCTION

http://www.csun.edu/~hcchm001/IntroChemHandouts.html

Oxidation-reductions reactions are prelevant in all aspects of our daily lives:

- ★ Extracting energy from foods (for all living things)
- ★ Burning of fossil fuels to drive our cars, heat our homes, and cook our foods (combustion)
- ★ Running of batteries to operate automobiles, lights, calculators, computers, etc.
- ★ Preparing materials for clothing, homes, computers, pharmaceuticals, etc.
- ★ Testing of blood, urine, and tissue samples

DEFINITIONS		
★ ★ ★ ★ **OXIDATION ALWAYS OCCURS WITH REDUCTION** ★ ★ ★ ★		
Example reaction: $Mg + O_2 \rightarrow MgO$ (not balanced)		
Oxidation is a process of losing e^-	decrease in ox. no.	$Mg^0 \rightarrow Mg^{2+} + 2\ e^-$ (Note: 0 to +2 is an increase)
Reduction is a process of gaining e^-	increase in ox. no.	$4\ e^- + O_2^0 \rightarrow 2\ O^{2-}$ (Note: 0 to -2 is a decrease)

HALF-REACTIONS

A special method using "half-reactions" is used to balance complex oxidation-reduction reactions:

1. Half reaction for oxidation: $Mg^0 \rightarrow Mg^{2+} + 2\ e^-$

- electrons are always written on the product side
- the element undergoing oxidation always experiences an increase in ox. no.

2. Half reaction for reduction: $4\ e^- + O_2^0 \rightarrow 2\ O^{2-}$ (* balance by inspection)

- electrons are always written on the reactant side
- the element undergoing reduction always experiences a decrease in ox. no.
- * balance by inspection

3. OXIDATION ALWAYS OCCURS WITH REDUCTION: e^- lost = e^- gained

- Multiply one or both half reactions by a whole number to balance electrons lost with electrons gained:

$2 \times [\ Mg^0 \rightarrow Mg^{2+} + 2\ e^-\ ] =$ **$2\ Mg^0 \rightarrow 2\ Mg^{2+} + 4\ e^-$**

$4\ e^- + O_2^0 \rightarrow 2\ O^{2-}$

- Add half reactions together, cancel electrons, and simplify if necessary to obtain the final balanced equation:

$2\ Mg^0 + O_2^0 \rightarrow 2\ Mg^{2+} + 2\ O^{2-}$ or **$2\ Mg + O_2 \rightarrow 2\ MgO$**