Oxidation Numbers

- The oxidation numbers that are assigned to elements (and polyatomic ions) come from the charge they aquire after bonding has occurred.

- **Atoms** are electrically balanced (neutral) because they have an equal number of protons and electrons. For instance, aluminum (Al) has 13 protons (13+) and 13 electrons (13-). The positive and negative charges cancel each other out.

  Aluminum
  13 protons 13+
  13 electrons 13-
  charge = 0

- If an atom loses 1 electron, it is no longer an atom... it is an **ion**. In fact, it is an ion with a charge of 1+. It has a 1+ charge because it now has 1 less electron that it has protons and is no longer electrically balanced.

- Using aluminum as an example again, we find that in a chemical reaction, aluminum normally **loses 3 electrons** which results in a **postively charged aluminum ion** with 13 protons (13+) and only 10 electrons (10-).

  Aluminum
  13 protons 13+
  10 electrons 10-
  charge = 3+

- This aluminum ion now has three positive charges that are unopposed by negative charges. It has a 3+ charge. **Aluminum is said to have a 3+ oxidation number**.

OXIDATION NUMBERS OF SOME COMMON ELEMENTS AND POLYATOMIC IONS

ELEMENTS

Al	aluminum	3+
Ba	barium	2+
Be	beryllium	2+
B	boron	3+
Bi	bismuth	3+
Br	bromine	1-, 5+
C	carbon	4+,2+
Ca	calcium	2+
Cd	cadmium	2+
Cl	chlorine	1-, 5+, 7+
Cr	chromium	3+,2+,6+
Co	cobalt	2+,3+
Cs	cesium	1+
Cu	copper (I)	1+
Cu	copper (II)	2+
Fe	iron (II)	2+
Fe	iron (III)	3+
F	fluorine	1-
Ge	germanium	4+
Au	gold(I)	1+
Au	gold(III)	3+
H	hydrogen	1+,1-
I	iodine	1-
P	phosphorus	5+, 3+, 3-
Pb	lead(II)	2+,3+,3-
Pb	lead (IV)	4+
Li	lithium	1+
Mg	magnesium	2+
Mn	manganese	2+,7+,4+
Hg	mercury(I)	1+
Hg	mercury(III)	3+
N	nitrogen	3-
Ni	nickel	2+
O	oxygen	2-
K	potassium	1+
Se	selenium	2-
Si	silicon	4+
Ag	silver	1+
Na	sodium	1+
S	sulfur	2-, 4+, 6+
Sn	tin(II)	2+
Sn	tin(IV)	4+
W	tungsten	6+
U	uranium	6+, 4+
Zn	zinc	2+

SOME COMMON POLYATOMIC IONS

acetate	$C_2H_3O_2$	1-
ammonium	NH_4	1+
bicarbonate	HCO_3	1-
bisulfate	HSO_4	1-
carbonate	CO_3	2-
chlorate	ClO_3	1-
cyanide	CN	1-
hydroxide	OH	1-
nitrate	NO_3	1-
permanganate	MnO_4	1-
phosphate	$P0_4$	3-
sulfate	SO_4	2-

Note: bicarbonate is also called hydrogen carbonate and bisulfate is also called hydrogen sulfate.