Nomenclature

Oxidation Numbers: A hypothetical charge based on the number of electrons each atom would have if all the electrons within a bond were located on the most electronegative atom.

Rules for Determining Oxidation Numbers

- The oxidation number of an atom of a free element is zero.
- The oxidation number of a monatomic ion is equal to its charge.
- The algebraic sum of the oxidation numbers of the atoms in the formula of a compound is zero.
- The oxidation number of hydrogen is +1 except when combined with metals; it is then -1.
- The oxidation number of oxygen is -2.
- Combinations with nonmetals; the oxidation number of the less electronegative element is positive and that of the more electronegative element is negative.
- The algebraic sum of the oxidation numbers of the atoms in the formula of a polyatomic ion is equal to its charge.

Oxidation: An increase in the oxidation number for a given atom

Reduction: A decrease in the oxidation number of a given atom.

METALS & NONMETALS

- Name the positive metal
- Follow with the name of the negatively charged nonmetal
- Drop the ending of the nonmetal and replace with <u>ide</u>

An example: CaO Calcium oxide

Hydrogen & Nonmetals

- Use the name hydrogen
- Follow with the name of the nonmetal
- Drop the nonmetal's ending and replace with <u>ide</u>

An example: HCl Hydrogen chloride

METALS & POLYATOMIC IONS

- Name the positive metal
- Name the polyatomic ion

Polyatomic Ions

Charge	Name	Formula
+1	Ammonium	NH_4^+
−1	Acetate	$C_2H_3O_2^-$
−1	Cyanide	CN^-
−1	Dihydrogen phosphate	$H_2PO_4^-$
−1	Hydrogen carbonate	HCO_3^-
−1	Hydrogen sulfate	HSO_4^-
−1	Hydroxide	OH^-
−1	Nitrate	NO_3^-
−1	Nitrite	NO_2^-
−1	Perchlorate	ClO_4^-
−1	Permanganate	MnO_4^-
−2	Carbonate	CO_3^{2-}
−2	Hydrogen phosphate	HPO_4^{2-}
−2	Peroxide	O_2^{2-}
−2	Sulfate	SO_4^{2-}
−2	Sulfite	SO_3^{2-}
−3	Phosphate	PO_4^{3-}

The Chlorine Family of Polyatomic Ions

ClO^- Hypochlorite

ClO_2^- Chlorite

ClO_3^- Chlorate

ClO_4^- Perchlorate

An example: $Zn(OH)_2$ Zinc Hydroxide

Two Nonmetals

- Use the name of the most electropositive element first
- Follow with the name of the most electronegative element
- Use the ide ending for the most electronegative element
- With more than one combination, use Greek prefixes

Greek prefixes:

1 - mono	6 - hexa
2 - di	7 - hepta
3 - tri	8 - octa
4 - tetra	9 - nona
5 - penta	10- deca

An example: PCl_3 Phosphorous Trichloride and PCl_5 Phosphorous Pentachloride

Binary Nitrogen-Oxygen Compounds

N_2O	dinitrogen monoxide
NO	nitrogen monoxide
N_2O_3	dinitrogen trioxide
NO_2	nitrogen dioxide
N_2O_5	dinitrogen pentoxide

_____

Metals with more than one oxidation number & nonmetals

- Using Roman Numerals
  - Use the name of the metal
  - Use Roman Numerals in parenthesis to give the oxidation number of the metal
  - Use the name of the nonmetal
  - Use the ide ending with the nonmetals

    $FeCl_3$ Iron (III) Chloride and $FeCl_2$ Iron (II) Chloride

- Using latin names
  - Give the latin name root for the metal
    - For the lower oxidation state use the ous suffix
    - For the higher oxidation state use the ic suffix
  - Use the name of the nonmetal
  - Add the ide ending to the nonmetal

  $FeCl_3$ Ferric Chloride and $FeCl_2$ Ferrous Chloride

_____

METALLIC ION NAME EQUIVALENTS			
Old system		*New system*	
chromic	Cr^{+++}	chromium(III)	Cr^{+++}
cobaltous	Co^{++}	cobalt(II)	Co^{++}
cobaltic	Co^{+++}	cobalt(III)	Co^{+++}
ferrous	Fe^{++}	iron(II)	Fe^{++}
ferric	Fe^{+++}	iron(III)	Fe^{+++}
cuprous	Cu^{+}	copper(I)	Cu^{+}
cupric	Cu^{++}	copper(II)	Cu^{++}
mercurous	Hg^{+}	mercury(I)	Hg_2^{++}
mercuric	Hg^{++}	mercury(II)	Hg^{++}
plumbous	Pb^{++}	lead(II)	Pb^{++}
plumbic	Pb^{++++}	lead(IV)	Pb^{++++}
stannous	Sn^{++}	tin(II)	Sn^{++}
stannic	Sn^{++++}	tin(IV)	Sn^{++++}

Binary Acids

- Use the prefix of hydro
- Use the root from the parent element
- Add the ic ending
- Complete with the word acid

$HCl_{(aq)}$ Hydrochloric Acid

Oxyacids

- Use the root of the name of the polyatomic ion from which the acid is derived
- Use the appropriate suffix
  - ic is used if the polyatomic ion ends in ate
  - ous is used if the polyatomic ion ends in ite
- Complete with the word acid

H_2SO_4 Sulfuric Acid and H_2SO_3 Sulfurous Acid

The Family of Acids Containing Chlorine

HCl	Hydrochloric
HClO	Hypochlorous
$HClO_2$	Chlorous
$HClO_3$	Chloric
$HClO_4$	Perchloric

Metals

- React with elemental nonmetals
- Form oxides that, if soluble, react with water to give hydroxides
- Form basic hydroxides
- React with hydrogen to form binary hydrides

- React with other metals forming metallic compounds
- Exhibit lower electronegativity values
- Readily form cations by loss of electrons
- Good conductors of heat & electricity
- Malleable & ductile
- Metallic luster

Nonmetals

- Form oxides that may react with water to give acids
- Form acidic hydroxides (oxyacids)
- React with nonmetals to form covalent compounds
- React with metals to form ionic compounds
- Form binary hydrides, which may be acidic
- Exhibit higher electronegativity values
- Readily form anions by accepting electrons to fill the outermost shell
- Poor conductors of heat & electricity
- Brittle
- Dull in appearance

Metalloids: Elements which have characteristics that resemble both metals and nonmetals