7-1 Chemical Names and Formulas

C_8H_{18} → 8 Carbon & 18 Hydrogen Atoms

$AL_2(SO_4)_3$ → 2 Al atoms & 3 SO_4^{2-} ions

→ 2 Al atoms, 3 S atoms, & 12 O atoms

Monatomic Ions – ions formed from a single atom

Cations (usually metals)			Anions (usually nonmetals)		
Group 1	→ 1+	Li^+, Na^+	Group 15	→ 3-	N^{3-}
Group 2	→ 2+	Ca^{2+}, Mg^{2+}	Group 16	→ 2-	O^{2-}, S^{2-}
Group 13	→ 3+	Al^{3+}	Group 17	→ 1-	F^-, Cl^-

Silicon and Carbon tend to form covalent bonds instead of forming ions.

Some p-block metals like Pb(lead) and Sn(tin) can form multiple ions.

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7-1 Chemical Names and Formulas

d-block and p-block metals may have more than one type of ion. This is because not all valance electrons are always lost.

Lead can be Pb^{2+}, Pb^{3+}, and Pb^{4+} (p205 for table of common ions)

Cations are called by the element's name. For metals with multiple cations, Roman numerals are used to show charge. This is called the Stock System.

Na^+ → sodium Pb^{2+} → lead(II) Pb^{3+} → lead(III) Pb^{4+} → lead(IV)

Anions drop the ending of the name and add "ide"

F^- → fluoride O^{2-} → oxide N^{3-} → nitride

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7-1 Chemical Names and Formulas

Binary Compounds – compounds made of two different elements.

The net charge of all ions must equal 0 for a compound.

$MgCl_2$ is composed of Mg^{2+}, Cl^-, and Cl^-

The total net charge of 2+, 1-, and 1- will be 0.

"Crossing Over" is a way to find the chemical formula from ion charges.

aluminum oxide is composed of Al^{3+} and O^{-2}

The subscripts can be found by crossing over ion charges

Al^{3+} O^{2-} $Al_2^{3+}O_3^{2-}$ Al_2O_3

Cation: aluminum

Anion: oxide

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7-1 Chemical Names and Formulas

Nomenclature – naming system

Ionic compound names do not include ratios of the elements because it is understood based on the charges.

The **Stock System** is used for metals multiple ions. The Roman numeral showing the charge of the metal is placed immediately after the name.

PbO	PbO_2
Pb^{2+} O^{2-}	Pb^{+4} O^{2-}
lead(II) oxide	lead(IV) oxide

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7-1 Chemical Names and Formulas

Most polyatomic ions are anions. NH_4^+ is the only common cation. Most are oxyanions.

Oxyanion – a polyatomic ion that contains oxygen.

Some elements form multiple oxyanions. The most common ion is given the ending "ate".

The oxyanion with one less oxygen atom than the "ate" ends with "ite".

Two less oxygen atoms ends with "ite" and has the prefix "hypo".

One more oxygen atom ends with "ate" and has the prefix "per".

ClO^-	ClO_2^-	ClO_3^-	ClO_4^-
Hypochlorite	Chlorite	Chlorate	Perchlorate

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7-1 Chemical Names and Formulas

Naming binary molecules use prefixes for # of atoms (table p212)

1 = mono 2= di 3=tri 4=tetra 5=penta etc…

1) Less electronegative element first, given prefix if more than one atom
2) Second element has prefix and ends with "ide"
3) Prefix vowel ending is dropped if atom starts with one (pentoxide)

NO	N_2O_4
nitrogen monoxide	dinitrogen tetroxide

General electronegativity order for molecules

C, P, N, H, S, I , Br, Cl, O, F

Covalent-Network compounds use same rules

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7-1 Chemical Names and Formulas

Acid = hydrogen + anion dissolved in water

Binary acid → hydrogen + halogen (HCl)

Name uses word hydro + halogen ending with "ic"

Oxyacid → hydrogen + oxyanion (HNO_3)

Name uses oxyanion name, changes "ate" to "ic" and "ite" to "ous"

HClO	HClO	ClO_3	ClO_4
Hypochlorous acid	Chlorous acid	Chloric acid	Perchloric acid

Salt – ionic compound composed of cation and anion from an acid

ex. $HCl \rightarrow NaCl$

If acid oxyanion can have more than one H, "bi" is prefix to oxyanion if it has an H

H_2CO_3	$NaHCO_3$	Na_2CO_3
Carbonic acid	Sodium bicarbonate	Sodium Carbonate

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