Chapter 6
Inorganic and Organic Compounds: Names and Formulas

6.1 Octet Rule and Ions

Octet Rule

An **octet**

- is **8 valence electrons**
- is associated with the stability of the noble gases
- does not occur with He, which is stable with two valence electrons (duet)

		Valence electrons
He	$\mathbf{1s^2}$	2
Ne	$1s^2\mathbf{2s^2 2p^6}$	8
Ar	$1s^2 2s^2 2p^6\mathbf{3s^2 3p^6}$	8
Kr	$1s^2 2s^2 2p^6 3s^2 3p^6\mathbf{4s^2} 3d^{10}\mathbf{4p^6}$	8

Forming Octets

Atoms acquire **octets**

- to become more stable
- by *losing*, *gaining*, or *sharing* valence electrons
- by forming **ionic** or **covalent bonds**

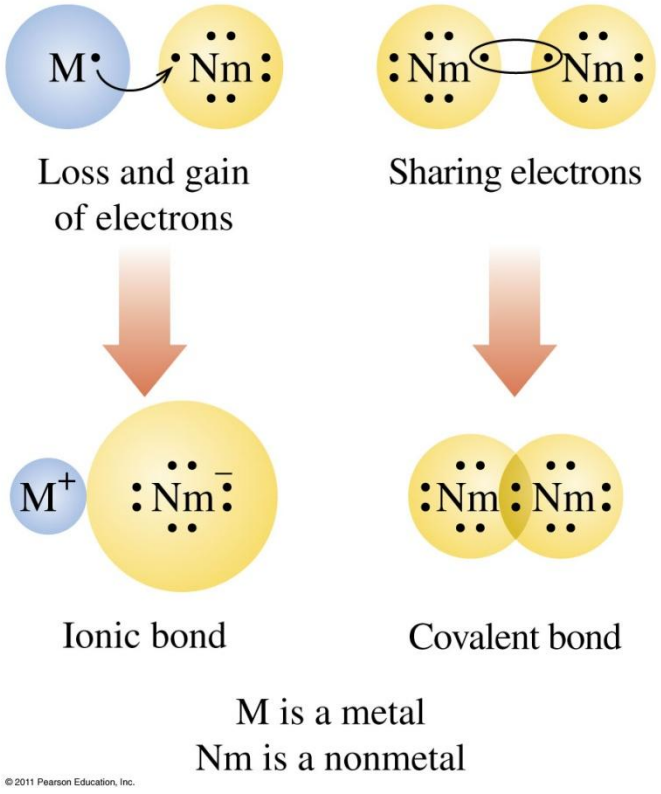
Ionic and Covalent Bonds

Ionic bonds involve

- loss of electrons by a metal
- gain of electrons by a nonmetal

Covalent bonds involve

- a sharing of electrons



Metals Form Positive Ions

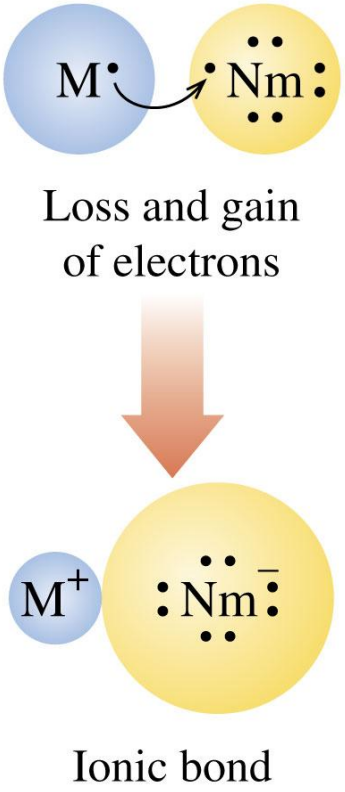
Metals form positive ions (CATIONS)

- by a loss of their valence electrons
- with the electron configuration of their nearest noble gas
- that have fewer electrons than protons.

Group 1A (1) metals $\longrightarrow$ ion^{+}

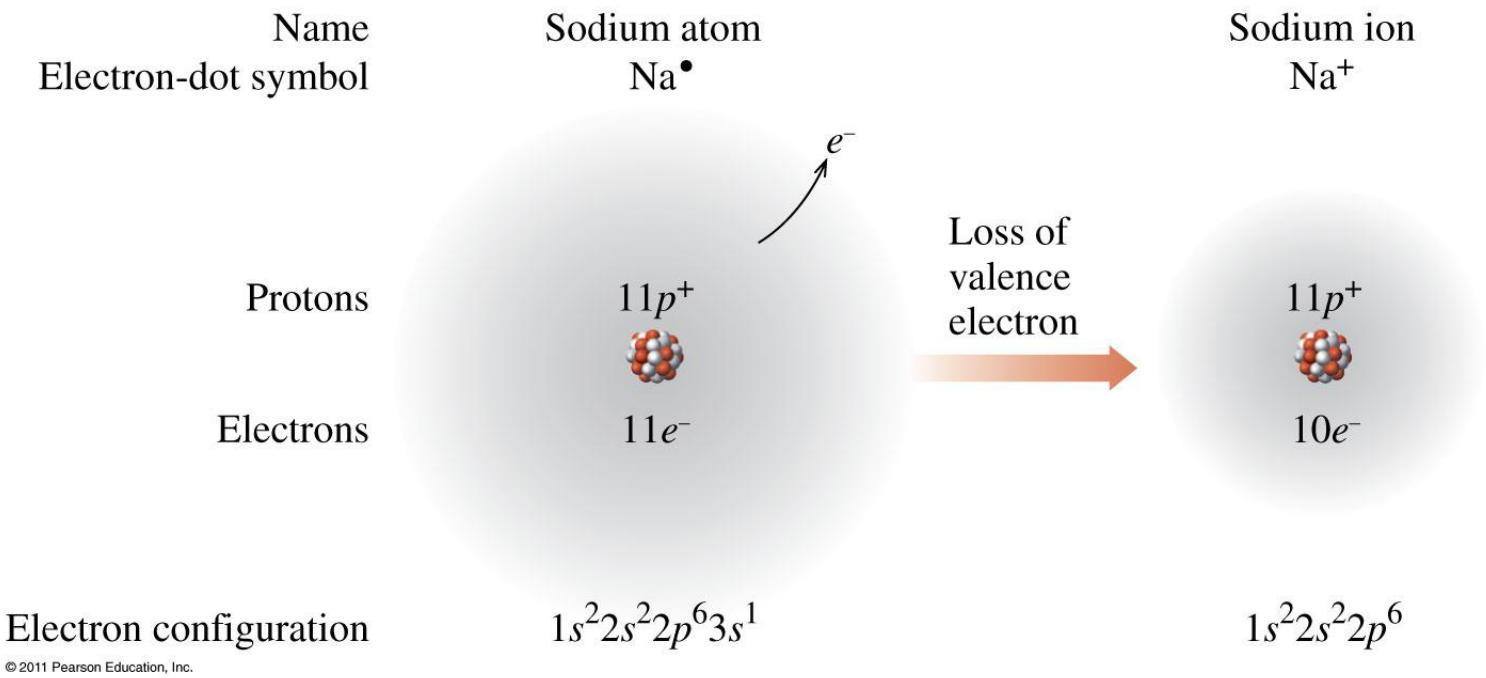
Group 2A (2) metals $\longrightarrow$ ion^{2+}

Group 3A (13) metals $\longrightarrow$ ion^{3+}



Formation of a Sodium Ion, Na^+

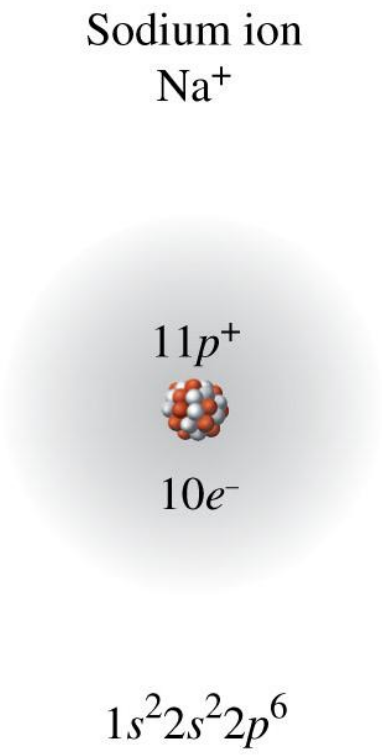
Sodium achieves an octet by losing its one valence electron.



Charge of Sodium Ion, Na^+

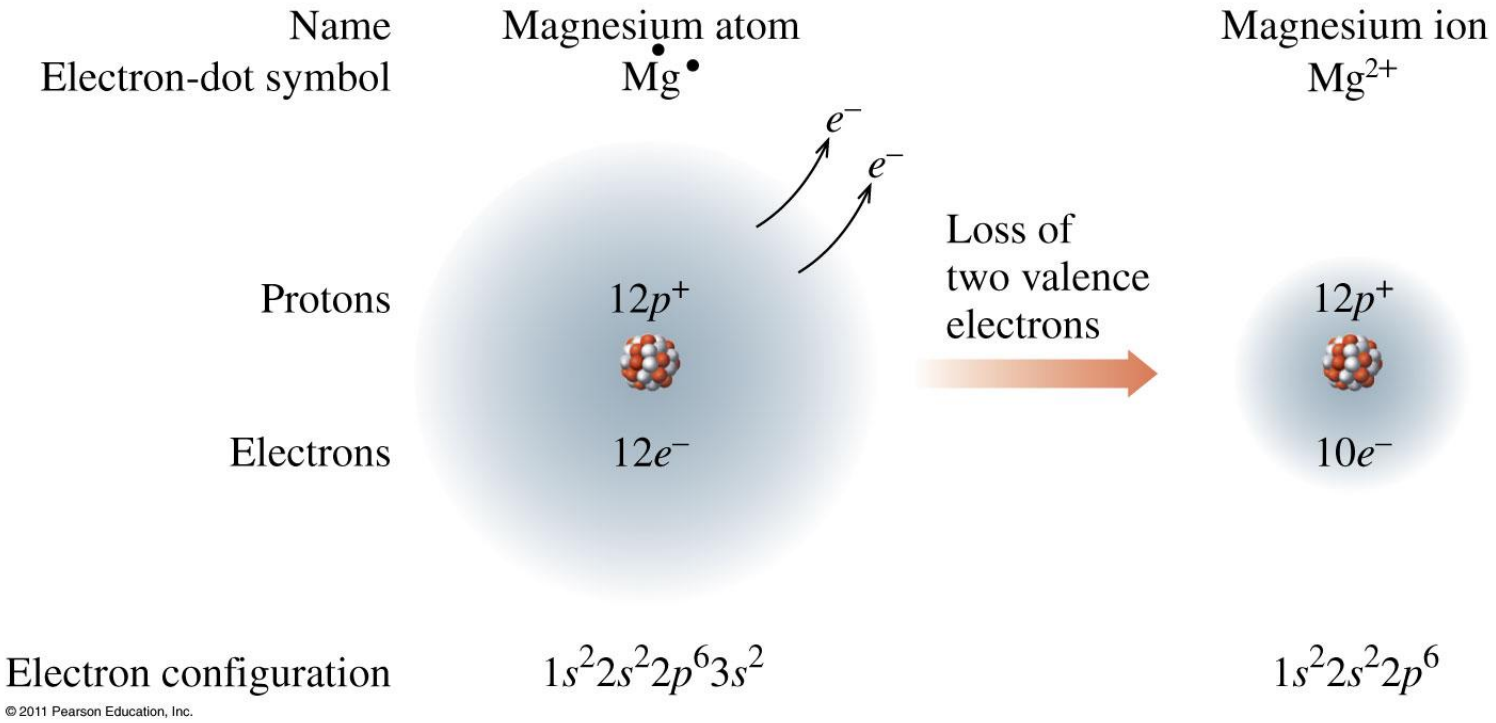
With the loss of its valence electron, the sodium ion has a 1+ charge.

Sodium atom	Sodium ion
11 p^+	11 p^+
11 e^-	10 e^-
0	1+



Formation of Mg^{2+}

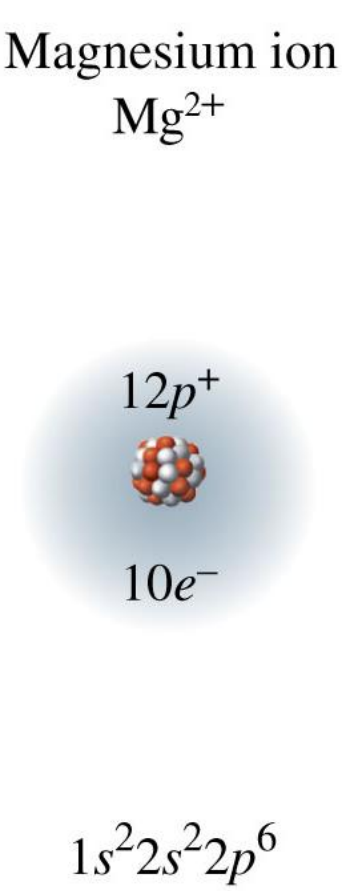
- Magnesium achieves an octet by losing its two valence electrons.



Charge of Magnesium Ion, Mg^{2+}

With the loss of two valence electrons, magnesium forms a positive ion with a 2+ charge.

Mg atom	Mg^{2+} ion
12 p^+	12 p^+
12 e^-	10 e^-
0	2+



Learning Check

Select the correct answer for aluminum.

A. The number of valence electrons is _____.

1) 1 e^- 2) 2 e^- 3) 3 e^-

B. The electron change for the octet is _____.

1) loss of 3 e^- 2) gain of 3 e^- 3) gain of 5 e^-

C. The ionic charge of the aluminum ion is _____.

1) 3– 2) 5– 3) 3^+

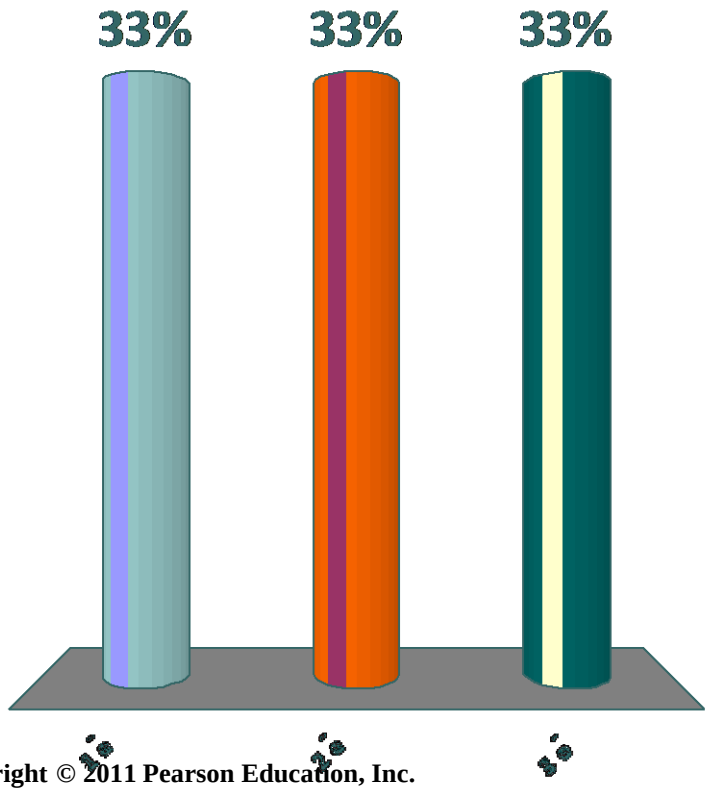
D. The symbol for the aluminum ion is _____.

1) Al^{3+} 2) Al^{3-} 3) Al^+

Select the correct answer for aluminum.

The number of valence electrons is ___.

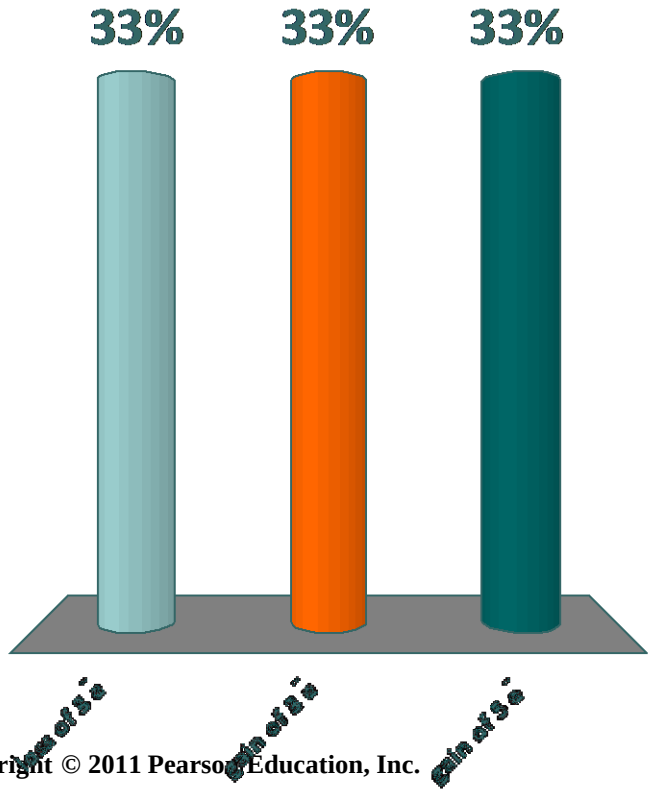
1) 1 e^-
2) 2 e^-
3) 3 e^-



Select the correct answer for aluminum.

The electron change for the octet is _.

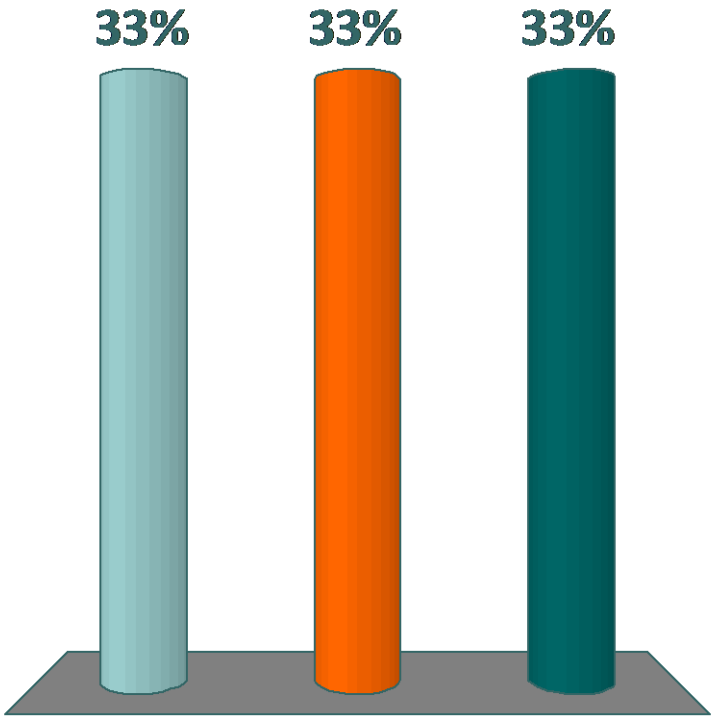
1) loss of 3 e^-
2) gain of 3 e^-
3) gain of 5 e^-



Select the correct answer for aluminum.

The ionic charge of the aluminum ion is

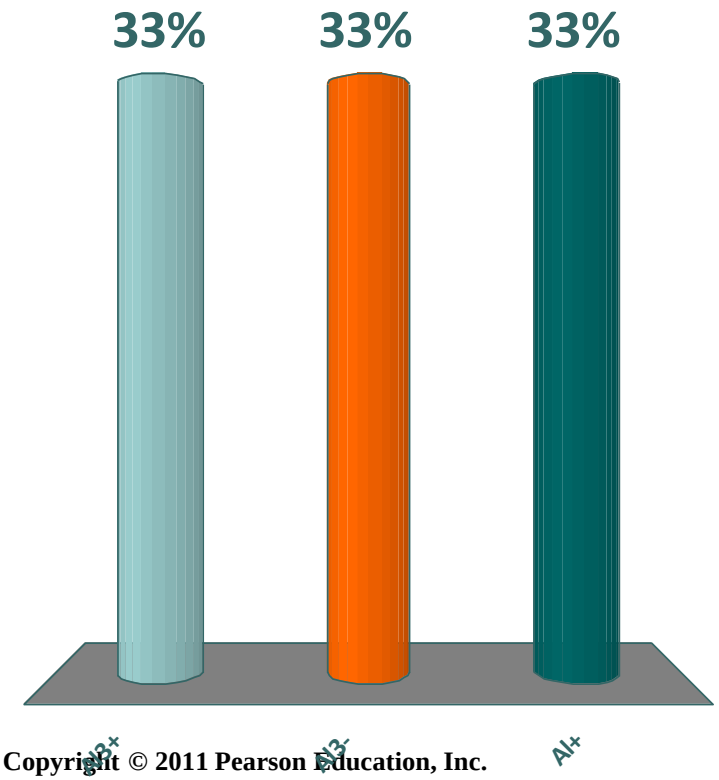
1) $3-$
2) $5-$
3) 3^+



Select the correct answer for aluminum.

The symbol for the aluminum ion is __.

1) Al^{3+}
2) Al^{3-}
3) Al^{+}



Solution

Select the correct answer for aluminum:

A. The number of valence electrons is

3) 3 e^-

B. The electron change for the octet is

1) loss of 3 e^-

C. The ionic charge of the aluminum ion is

3) 3^+

D. The symbol for the aluminum ion is

1) Al^{3+}

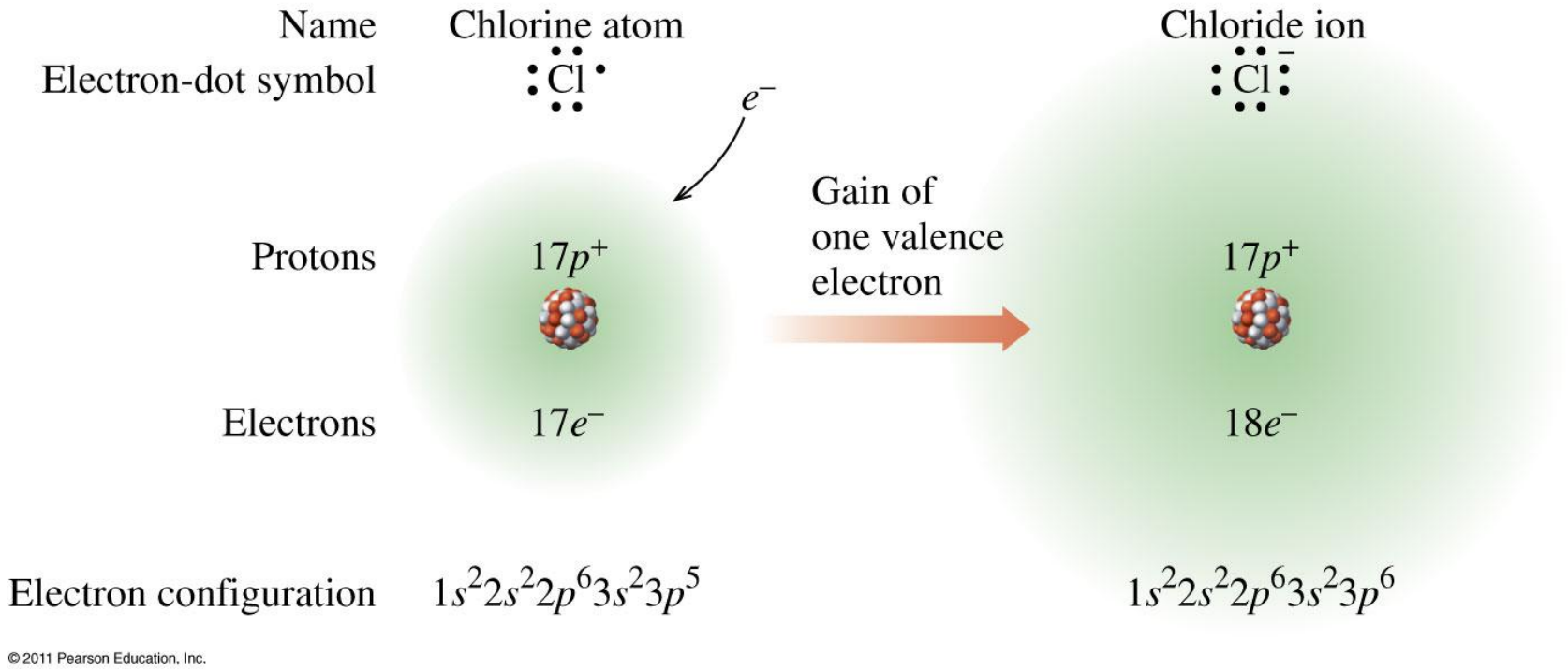
Formation of Negative Ions

In ionic compounds, **nonmetals (FORM ANIONS)**

- achieve an octet arrangement
- gain electrons
- form negatively charged ions with 3–, 2–, or 1– charges

Formation of Chloride Ion, Cl^-

- Chlorine achieves an octet by adding an electron to its valence electrons.

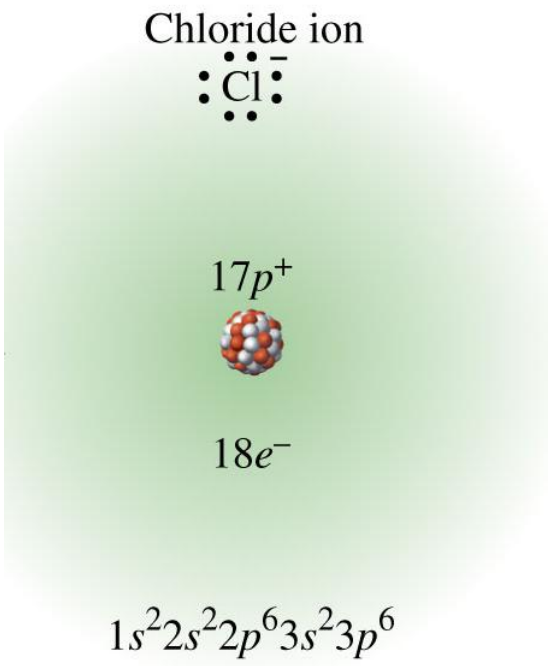


Charge of a Chloride Ion, Cl^-

A chloride ion forms

- when Cl gains one electron
- with a 1– charge

Chlorine atom	Chloride ion
17 p^+	17 p^+
17 e^-	18 e^-
0	1–



Some Typical Ionic Charges

TABLE 6.1 Formulas and Names of Some Common Monatomic Ions

Group Number	Formula of Ion	Name of Ion	Group Number	Formula of Ion	Name of Ion
	Metals			**Nonmetals**	
1A (1)	Li^+	Lithium	5A (15)	N^{3-}	Nitride
	Na^+	Sodium		P^{3-}	Phosphide
	K^+	Potassium	6A (16)	O^{2-}	Oxide
2A (2)	Mg^{2+}	Magnesium		S^{2-}	Sulfide
	Ca^{2+}	Calcium	7A (17)	F^-	Fluoride
	Ba^{2+}	Barium		Cl^-	Chloride
3A (13)	Al^{3+}	Aluminum		Br^-	Bromide
				I^-	Iodide

Ionic Charge from Group Numbers

Ions

- achieve the electron configuration of their nearest noble gas
- of metals in Group 1A (1), Group 2A (2), or Group 3A (13) have positive 1+. 2+, or 3+ charges
- of nonmetals in Groups 5A (15), 6A (16), or 7A (17) have negative 3–, 2–, or 1– charges

The charge of an ion is obtained by subtracting 8 or 18 from its Group number.

Example: Group 6A (16) = 6 – 8 = 2–

or 16 – 18 = 2–

Some Ions and Their Nearest Noble Gases

TABLE 6.2 Examples of Monatomic Ions and Their Nearest Noble Gases

		Metals Lose Valence Electrons				Nonmetals Gain Valence Electrons			
Noble Gases		1A (1)	2A (2)	3A (13)		5A (15)	6A (16)	7A (17)	Noble Gases
He	←	Li^+							
Ne	←	Na^+	Mg^{2+}	Al^{3+}		N^{3-}	O^{2-}	F^-	→ Ne
Ar	←	K^+	Ca^{2+}			P^{3-}	S^{2-}	Cl^-	→ Ar
Kr	←	Rb^+	Sr^{2+}					Br^-	→ Kr
Xe	←	Cs^+	Ba^{2+}					I^-	→ Xe

Learning Check

Select the correct answer for sulfur.

A. The group number for sulfur is _____.

B. The number of valence electrons in sulfur is ____.

1) 4 e^- 2) 6 e^- 3) 8e^-

C. The change in electrons for an octet requires a

1) loss of 2 e^- 2) gain of 2 e^- 3) gain of 4 e^-

D. The ionic charge of a sulfide ion is _____.

1) 2+ 2) 2– 3) 4–

Solution

A. The group number for sulfur is

3) 6A (16)

B. The number of valence electrons in sulfur is

2) 6 e^-

C. The change in electrons for an octet requires a

2) gain of 2 e^-

D. The ionic charge of a sulfide ion

2) 2–

Chapter 6 Inorganic and Organic Compounds: Names and Formulas

6.2 Ionic Compounds

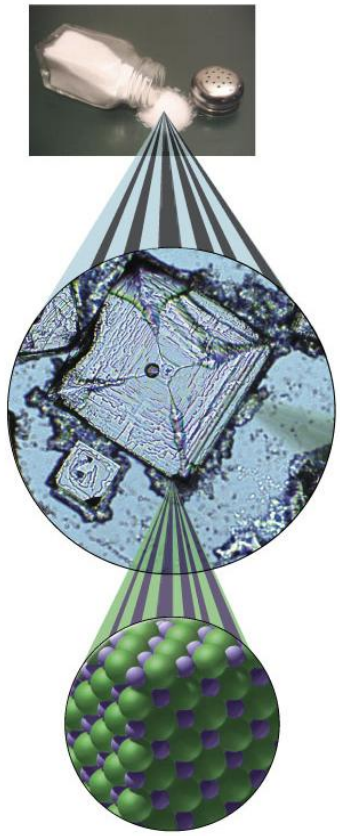
Ionic Compounds

Ionic compounds

- consist of positive and negative ions
- have attractions called **ionic bonds** between positively and negatively charged ions
- have high melting and boiling points
- are solids at room temperature

Salt is an Ionic Compound

Sodium chloride (table salt) is an example of an ionic compound.



Sodium chloride

Ionic Formulas

An **ionic formula**

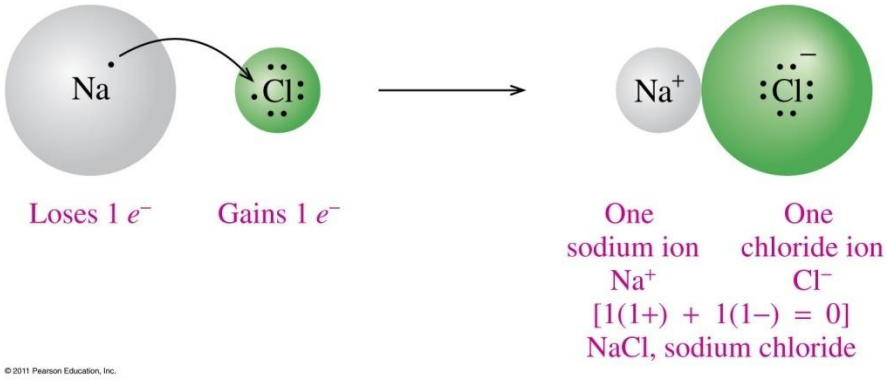
- consists of positively and negatively charged ions
- is neutral
- has charge balance (net charge of zero)

  total positive charge = total negative charge
- uses subscripts to indicate the number of ions needed to give charge balance

Charge Balance for NaCl, "Salt"

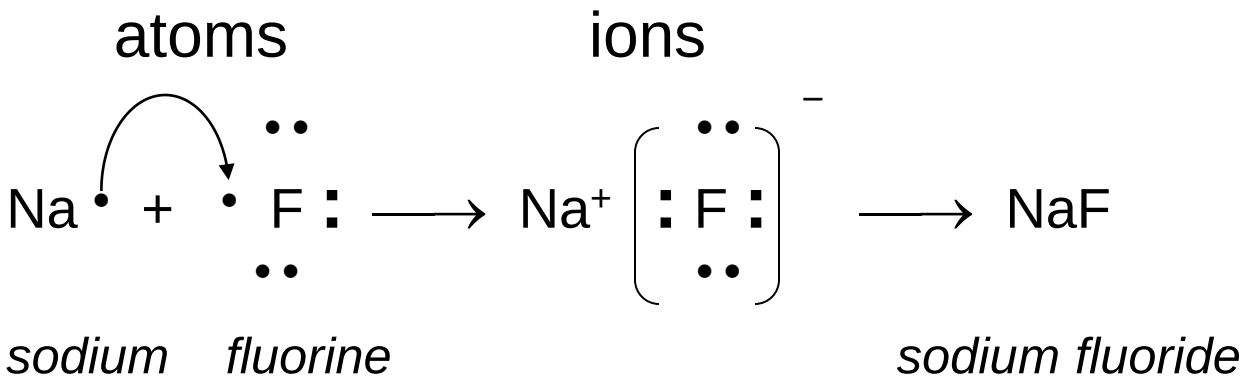
In NaCl,

- a Na atom loses its valence electron
- a Cl atom gains an electron
- the symbol of the metal is written first followed by the symbol of the nonmetal
- the charges of the ions in the compound are not shown



Charge Balance in NaF

- The formulas of ionic compounds are determined from the charges on the ions.



The overall charge of NaF is zero (0).

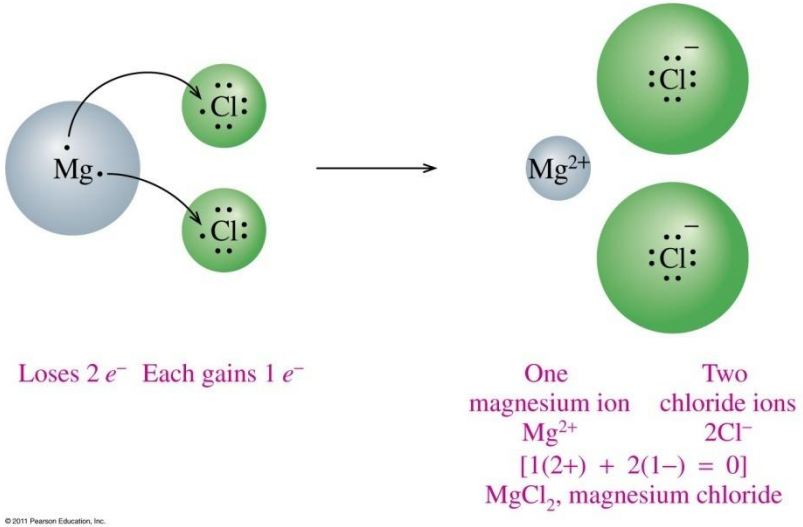
$$Na^+ \quad F^- \quad = NaF$$

$$1(1+) + 1(1-) \quad = \ 0$$

Charge Balance In $MgCl_2$

In $MgCl_2$

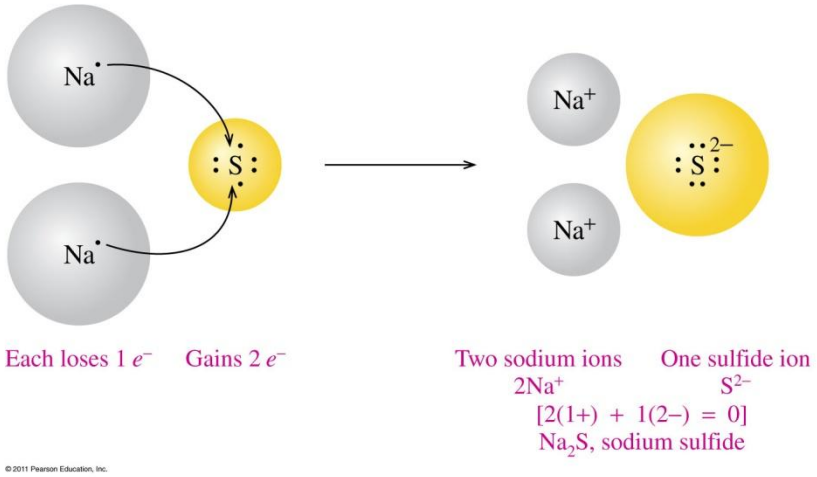
- a Mg atom loses two valence electrons
- two Cl atoms each gain one electron
- subscripts indicate the number of ions needed to give charge balance



Charge Balance In Na_2S

In Na_2S,

- two Na atoms lose one valence electron each
- one S atom gains two electrons
- subscripts show the number of ions needed to give charge balance



Writing Ionic Formulas from Charges

Charge balance is used to write the formula for sodium nitride, a compound containing Na^+ and N^{3-}.

$$3\left\{\begin{matrix}\mathbf{Na^+}\\ \mathbf{Na^+}\\ \mathbf{Na^+}\end{matrix}\right. \quad + \quad \mathbf{N^{3-}} \quad = \quad Na_3N$$

$$3(+1) \quad + \quad 1(3-) \quad = \quad 0$$

Formula from Ionic Charges

Write the ionic formula of the compound containing Ba^{2+} and Cl^-.

- Write the symbols of the ions.

  Ba^{2+} Cl^-

- Balance the charges.

  Ba^{2+} Cl^- *two* Cl^- *needed*
  Cl^-

- Write the ionic formula using a *subscript 2* for two chloride ions that give charge balance.

  $BaCl_2$

Learning Check

Select the correct formula for each of the following ionic compounds:

A. Li^{+} and O^{2-}

1) LiO 2) Li_2O 3) LiO_2

B. Al^{3+} and Cl^{-}

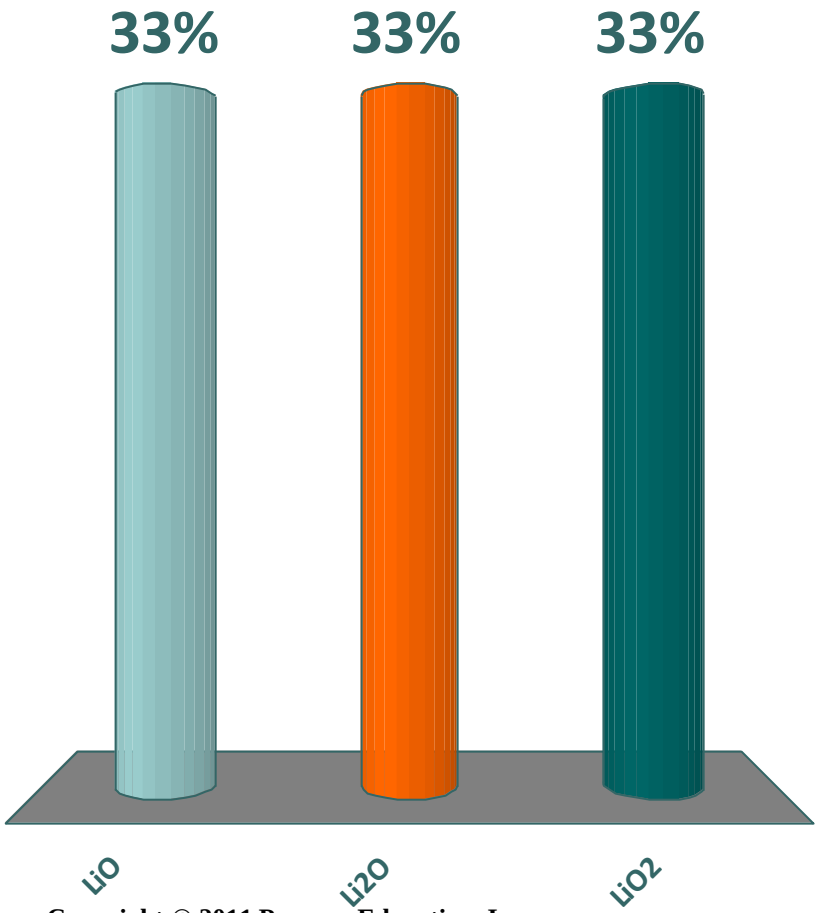
1) $AlCl_3$ 2) AlCl 3) Al_3Cl

C. Mg^{2+} and N^{3-}

1) MgN 2) Mg_2N_3 3) Mg_3N_2

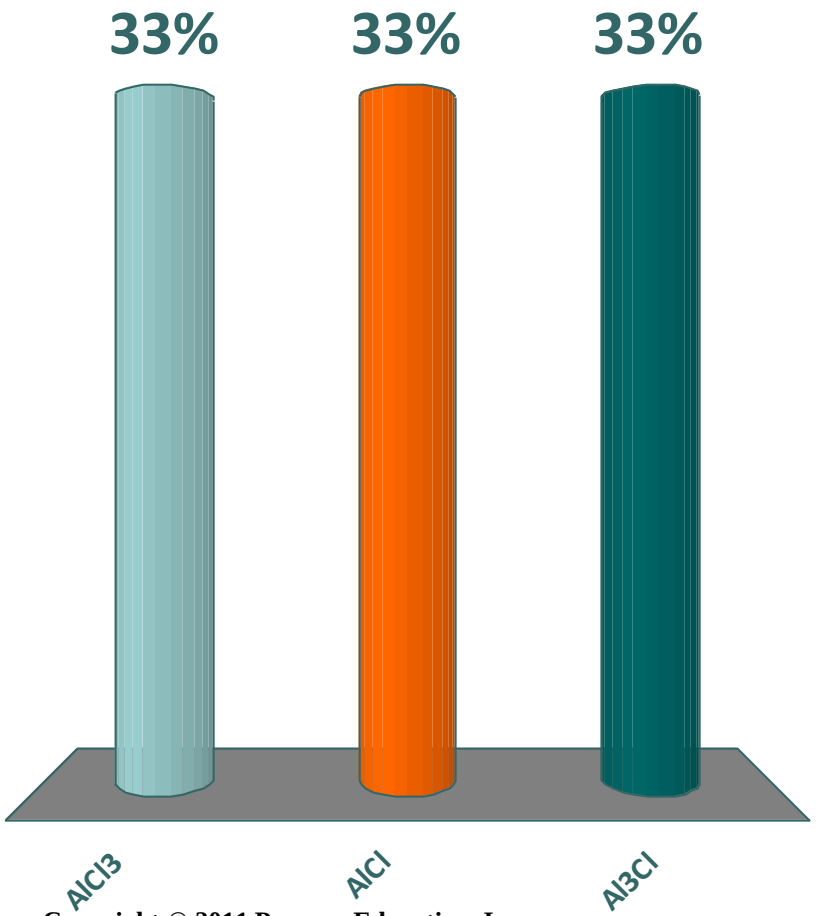
What is the chemical formula for Li^+ and O^{2-}

1. LiO
2. Li_2O
3. LiO_2



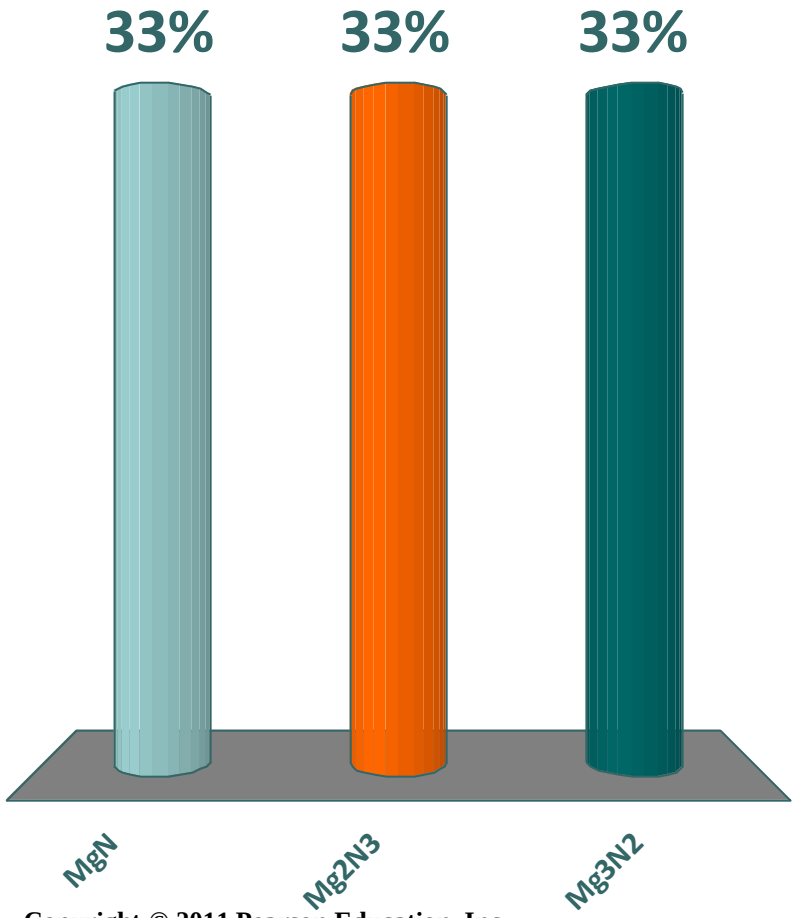
What is the chemical formula for Al^{3+} and Cl^{-}

1. $AlCl_3$
2. $AlCl$
3. Al_3Cl



What is the chemical formula for Mg^{2+} and N^{3-}

1. MgN
2. Mg_2N_3
3. Mg_3N_2



Solution

A. Li^+ and O^{2-}

2) Li_2O

check: $2Li^+ + O^{2-} = 2(1+) + 1(2-) = 0$

B. Al^{3+} and Cl^-

1) $AlCl_3$

check: $Al^{3+} + 3Cl^- = (3+) + 3(1-) = 0$

C. Mg^{2+} and N^{3-}

3) Mg_3N_2

check: $3Mg^{2+} + 2N^{3-} = 3(2+) + 2(3-) = 0$

Chapter 6 Inorganic and Organic Compounds: Names and Formulas

6.3

Naming and Writing Ionic Formulas

Naming of Ionic Compounds

In the name of an ionic compound,

- the **positive ion** (first ion) is named as the element
- the **negative ion** (second ion) is named by changing the end of the element name to *–ide*

Learning Check

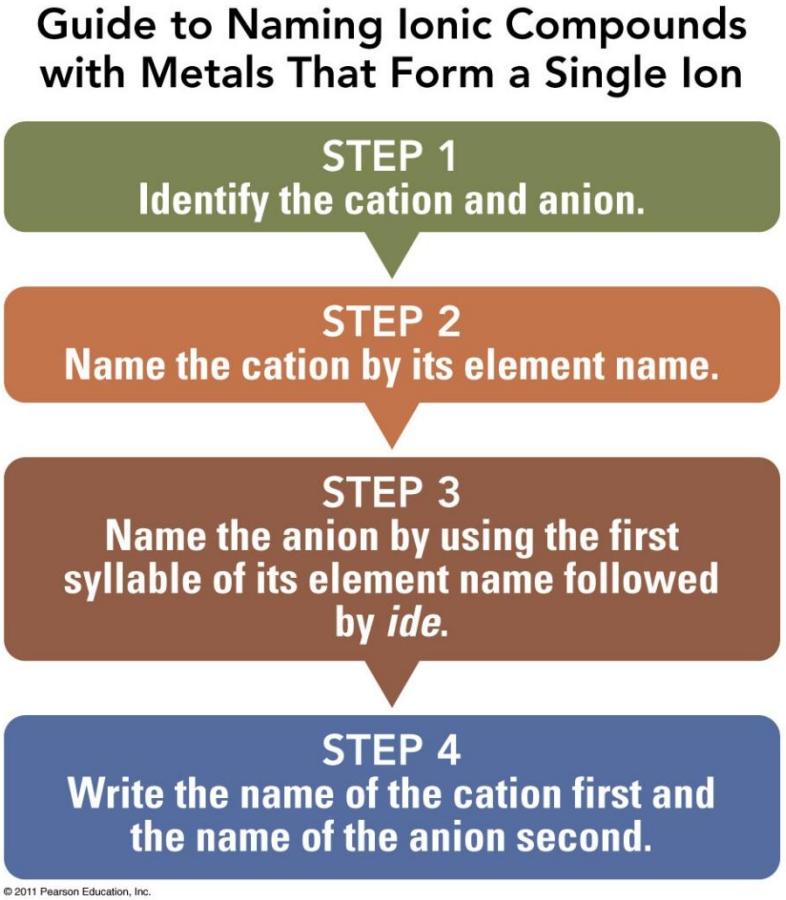
Complete the names of the following ions:

Ba^{2+}	Al^{3+}	K^{+}
_____	_____	_____
N^{3-}	O^{2-}	F^{-}
_____	_____	_____
P^{3-}	S^{2-}	Cl^{-}
_____	_____	_____

Solution

Ba^{2+}	Al^{3+}	K^{+}
barium	aluminum	potassium
N^{3-}	O^{2-}	F^{-}
nitride	oxide	fluoride
P^{3-}	S^{2-}	Cl^{-}
phosphide	sulfide	chloride

Naming Ionic Compounds with Two Elements



Examples of Ionic Compounds with Two Elements

Formula	Ions		Name
	Cation	Anion	
NaCl	Na^+	Cl^-	sodium chloride
K_2S	K^+	S^{2-}	potassium sulfide
MgO	Mg^{2+}	O^{2-}	magnesium oxide
CaI_2	Ca^{2+}	I^-	calcium iodide
Al_2O_3	Al^{3+}	O^{2-}	aluminum oxide

Some Ionic Compounds

Compound	Metal Ion	Nonmetal Ion	Name
KI	K^+	I^-	
	Potassium	Iodide	Potassium iodide
$MgBr_2$	Mg^{2+}	Br^-	
	Magnesium	Bromide	Magnesium bromide
Al_2O_3	Al^{3+}	O^{2-}	
	Aluminum	Oxide	Aluminum oxide

Learning Check

Write the formulas and names for compounds of the following ions:

	Br^-	S^{2-}	N^{3-}
Na^+			
Al^{3+}			

Solution

	Br^-	S^{2-}	N^{3-}
Na^+	$NaBr$ sodium bromide	Na_2S sodium sulfide	Na_3N sodium nitride
Al^{3+}	$AlBr_3$ aluminum bromide	Al_2S_3 aluminum sulfide	AlN aluminum nitride

Learning Check

Write the names of each of the following compounds:

1) CaO _____

2) KBr _____

3) Al_2O_3 _____

4) $MgCl_2$ _____

Solution

Write the names of each of the following compounds:

1) CaO calcium oxide

2) KBr potassium bromide

3) Al_2O_3 aluminum oxide

4) $MgCl_2$ magnesium chloride

Transition Metals That Form Two or More Positive Ions

Most **transition metals** and **Group 4 (14) metals**

- form two or more positive ions
- Zn^{2+}, Ag^{+}, and Cd^{2+} form only one ion

Examples:

Copper forms Cu^{+} and Cu^{2+}

Iron forms Fe^{2+} and Fe^{3+}

Gold forms Au^{+} and Au^{3+}

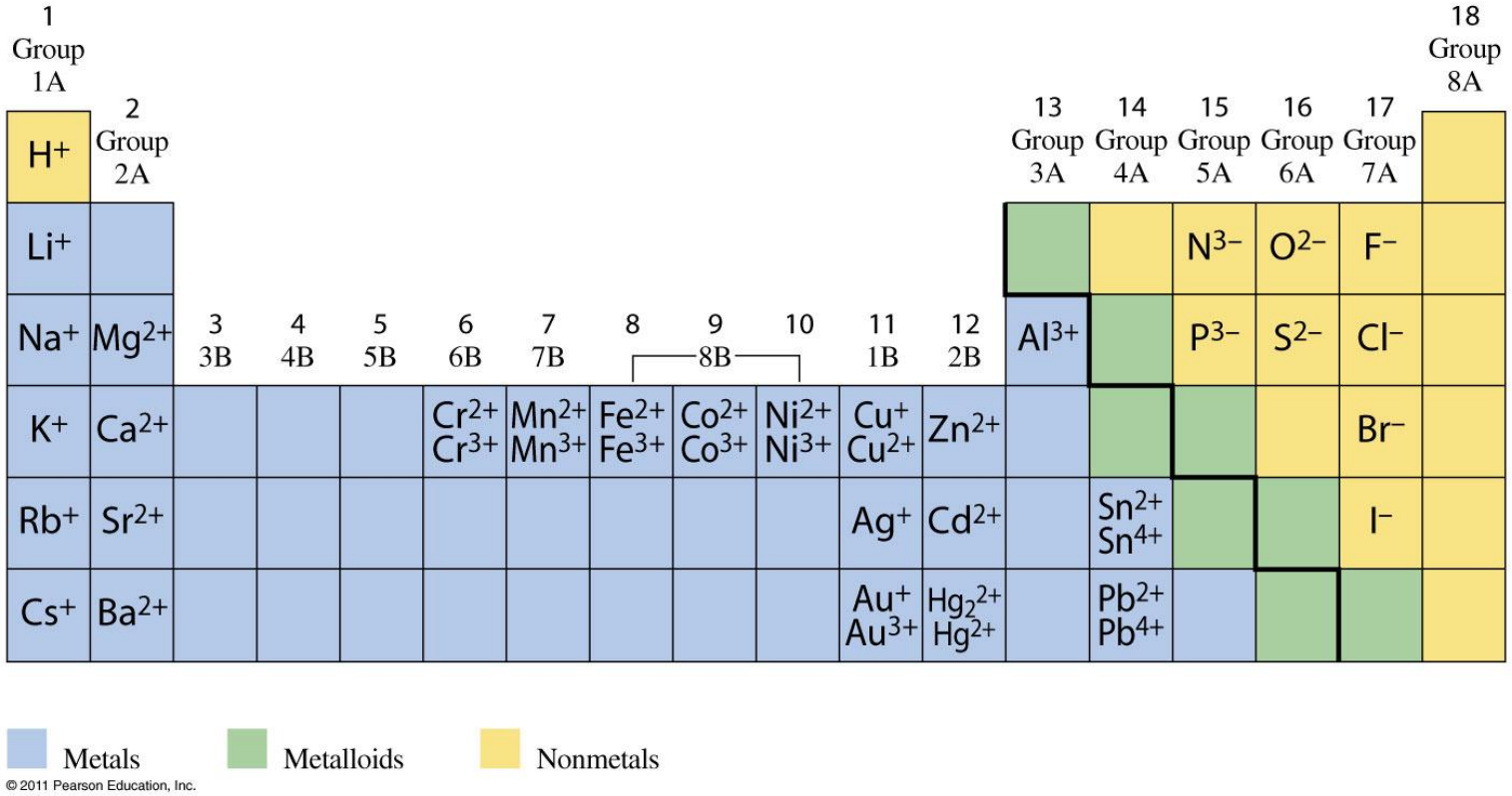
Metals with Variable Charge

TABLE 6.4 Some Metals That Form More Than One Positive Ion

Element	Possible Ions	Name of Ion
Chromium	Cr^{2+}	Chromium(II)
	Cr^{3+}	Chromium(III)
Cobalt	Co^{2+}	Cobalt(II)
	Co^{3+}	Cobalt(III)
Copper	Cu^{+}	Copper(I)
	Cu^{2+}	Copper(II)
Gold	Au^{+}	Gold(I)
	Au^{3+}	Gold(III)
Iron	Fe^{2+}	Iron(II)
	Fe^{3+}	Iron(III)
Lead	Pb^{2+}	Lead(II)
	Pb^{4+}	Lead(IV)
Manganese	Mn^{2+}	Manganese(II)
	Mn^{3+}	Manganese(III)
Mercury	Hg_2^{2+}	Mercury(I)*
	Hg^{2+}	Mercury(II)
Nickel	Ni^{2+}	Nickel(II)
	Ni^{3+}	Nickel(III)
Tin	Sn^{2+}	Tin(II)
	Sn^{4+}	Tin(IV)

*Mercury(I) ions form pairs with a 2+ charge

Periodic Table and Typical Ions



Examples of Names of Compounds with Variable Charge Metals

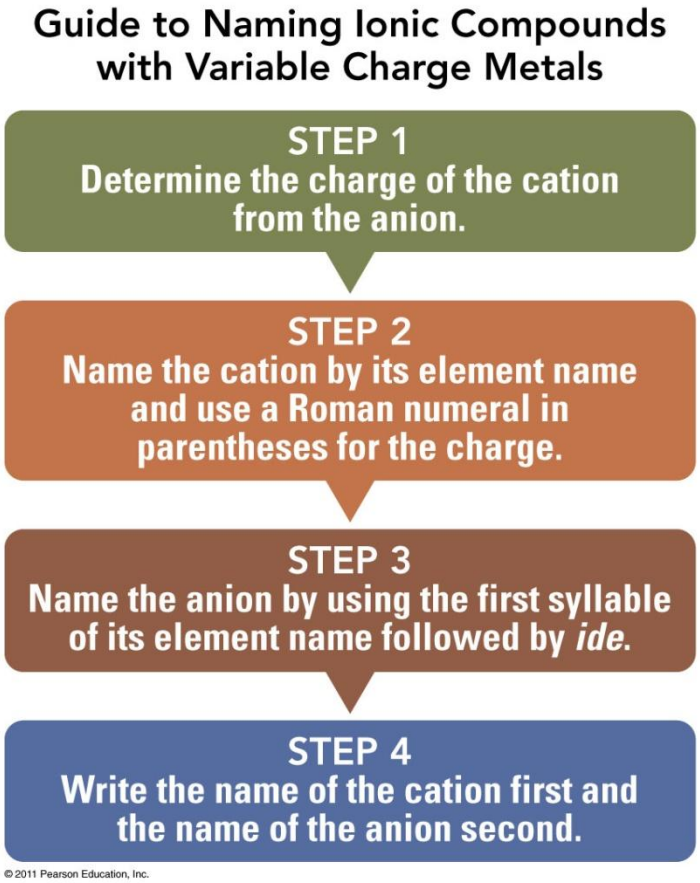
Transition metals

- with two different ions use a **Roman numeral** after the name of the metal to indicate the ionic charge
- only zinc, silver, and cadmium do not use a Roman numeral because they form only one ion (Zn^{2+}, Ag^{+}, and Cd^{2+})

TABLE 6.5 Some Ionic Compounds of Metals That Form Two Kinds of Positive Ions

Compound	Systematic Name
$FeCl_2$	Iron(II) chloride
Fe_2O_3	Iron(III) oxide
Cu_3P	Copper(I) phosphide
$CuBr_2$	Copper(II) bromide
$SnCl_2$	Tin(II) chloride
PbS_2	Lead(IV) sulfide

Naming Ionic Compounds with Variable Charge Metals



Naming $FeCl_2$

STEP1 **Determine the charge of the cation from the anion.**

$Fe\ (?) + 2Cl^- = Fe\ (?) + 2(1-) = 0$

$Fe\ (?) = 2+ = Fe^{2+}$

STEP 2 **Name the cation by its element name and use a Roman numeral in parentheses for the charge.**

Fe^{2+} = iron(II)

Naming $FeCl_2$ (continued)

STEP 3 **Name the anion by using the first syllable of its element name followed by *ide*.**

chloride

STEP 4 **Write the name of the cation first and the name of the anion second.**

iron(II) chloride = $FeCl_2$

Naming Cr_2O_3

STEP1 **Determine the charge of the cation from the anion.**

$2Cr(?) + 3O^{2-} = 2Cr(?) + 3(2-) = 0$

$2Cr(?) = 6+ \quad Cr(?) = 3+ = Cr^{3+}$

STEP 2 **Name the cation by its element name and use a Roman numeral in parentheses for the charge.**

Cr^{3+} = chromium(III)

Naming $FeCl_2$ (continued)

STEP 3 **Name the anion by using the first syllable of its element name followed by *ide*.**

oxide

STEP 4 **Write the name of the cation first and the name of the anion second.**

chromium(III) oxide

Learning Check

Select the correct name for each.

A. Fe_2S_3

1) iron sulfide
2) iron(II) sulfide
3) iron (III) sulfide

B. CuO

1) copper oxide
2) copper(I) oxide
3) copper (II) oxide

Solution

Select the correct name for each.

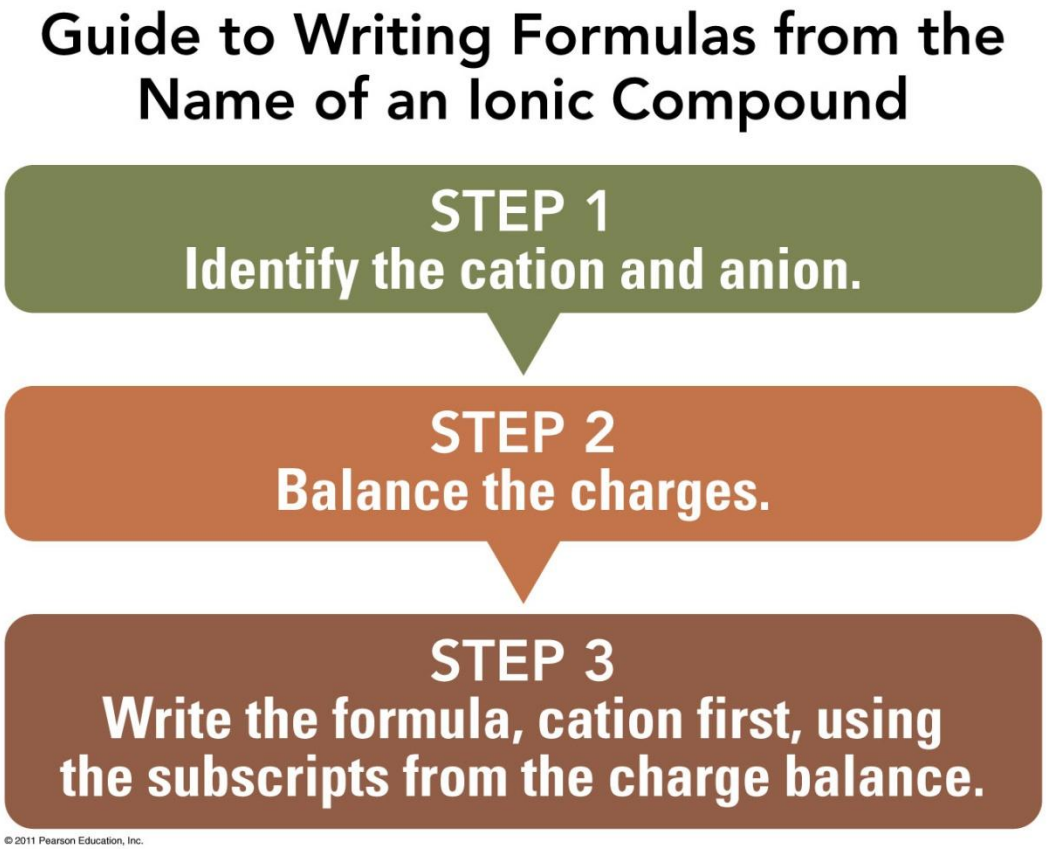
A. Fe_2S_3

3) iron (III) sulfide Fe^{3+} S^{2-}

B. CuO

3) copper (II) oxide Cu^{2+} O^{2-}

Guide to Writing Formulas from the Name



Writing Formulas

Write the formula of potassium sulfide.

STEP1 **Identify the cation and anion.**

potassium = K^+

sulfide = S^{2-}

STEP 2 **Balance the charges.**

K^+ S^{2-}

K^+

$2(1+) + 2(1-) = 0$

STEP 3 **Write the formula, cation first, using the subscripts from the charge balance.**

2 K^+ and 1 S^{2-} = K_2S

Writing Formulas

Write the formula of cobalt(III) chloride.

STEP1 **Identify the cation and anion.**

cobalt (III) = Co^{3+} (III = charge of 3+)

chloride = Cl^-

STEP 2 **Balance the charges.**

Co^{3+} and $3Cl^-$ = (3+) + 3(1-) = 0

STEP 3 **Write the formula, cation first, using the subscripts from the charge balance.**

1 Co^{3+} and 3 Cl^- = $CoCl_3$

Learning Check

Select the correct formula for each of the following:

A. copper (I) nitride

1) CuN 2) CuN_3 3) Cu_3N

B. lead (IV) oxide

1) PbO_2 2) PbO 3) Pb_2O_4

Solution

A. copper (I) nitride

3) Cu_3N $3Cu^{+}$ and N^{3-}

B. lead (IV) oxide

1) PbO_2 Pb^{4+} and $2O^{2-}$

Chapter 6 Inorganic and Organic Compounds: Names and Formulas

6.4 Polyatomic Ions

Polyatomic Ions

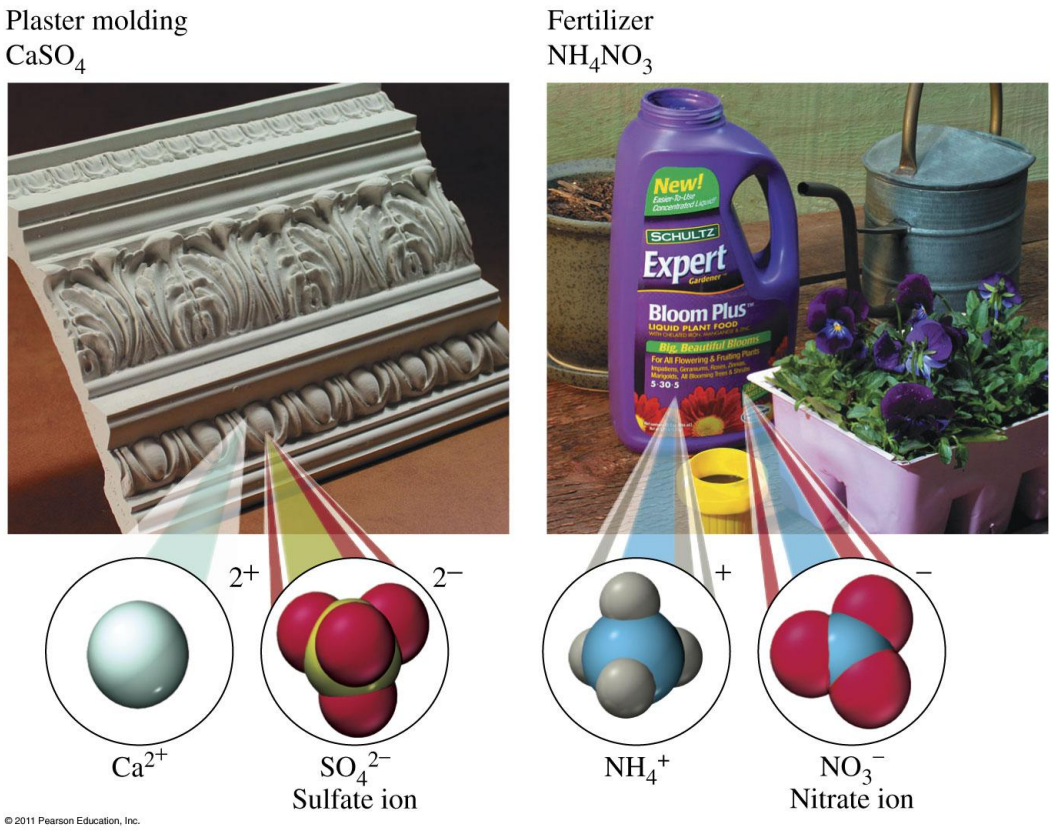
A **polyatomic ion**

- is a group of atoms
- has an overall ionic charge

Examples:

NH_4^+	ammonium	OH^-	hydroxide
NO_3^-	nitrate	NO_2^-	nitrite
CO_3^{2-}	carbonate	PO_4^{3-}	phosphate
HCO_3^-	hydrogen carbonate (bicarbonate)		

Some Compounds with Polyatomic Ions



More Names of Polyatomic Ions

The names of the common polyatomic anions

- end in *ate*

  NO_3^- nitr**ate** PO_4^{3-} phosph**ate**

- with one oxygen less end in *ite*

  NO_2^- nitr**ite** PO_3^{3-} phosph**ite**

- with hydrogen use prefix hydrogen (or bi)

  HCO_3^- **hydrogen** carbonate (**bi**carbonate)

  HSO_3^- **hydrogen** sulfite (**bi**sulfite)

Names and Formulas of Common Polyatomic Ions

TABLE 6.6 Names and Formulas of Some Common Polyatomic Ions

Nonmetal	Formula of Ion[a]	Name of Ion
Hydrogen	OH^-	Hydroxide
Nitrogen	NH_4^+	Ammonium
	$\boxed{NO_3^-}$	**Nitrate**
	NO_2^-	Nitrite
Chlorine	ClO_4^-	Perchlorate
	$\boxed{ClO_3^-}$	**Chlorate**
	ClO_2^-	Chlorite
	ClO^-	Hypochlorite
Carbon	$\boxed{CO_3^{2-}}$	**Carbonate**
	HCO_3^-	Hydrogen carbonate (or bicarbonate)
	CN^-	Cyanide
	$C_2H_3O_2^-$	Acetate
	SCN^-	Thiocyanate
Sulfur	$\boxed{SO_4^{2-}}$	**Sulfate**
	HSO_4^-	Hydrogen sulfate (or bisulfate)
	SO_3^{2-}	Sulfite
	HSO_3^-	Hydrogen sulfite (or bisulfite)
Phosphorus	$\boxed{PO_4^{3-}}$	**Phosphate**
	HPO_4^{2-}	Hydrogen phosphate
	$H_2PO_4^-$	Dihydrogen phosphate
	PO_3^{3-}	Phosphite
Chromium	$\boxed{CrO_4^{2-}}$	**Chromate**
	$Cr_2O_7^{2-}$	Dichromate
Manganese	MnO_4^-	Permanganate

[a]Boxed formulas are the most common polyatomic ion for that element.

Some Compounds Containing Polyatomic Ions

TABLE 6.7 Some Compounds That Contain Polyatomic Ions

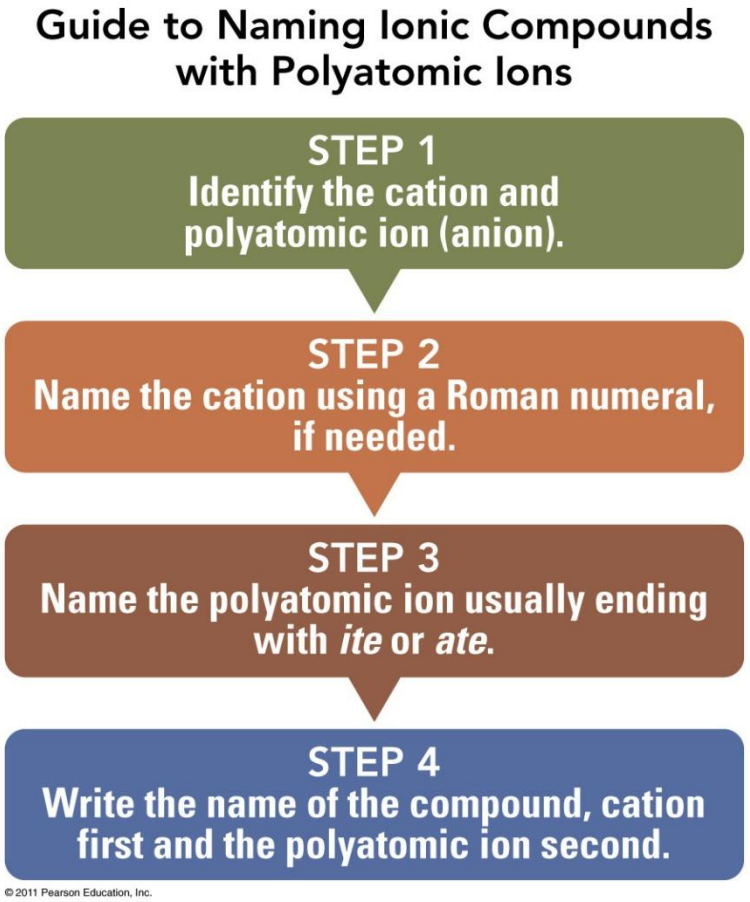
Formula	Name	Use
$BaSO_4$	Barium sulfate	Contrast medium for X-rays
$CaCO_3$	Calcium carbonate	Antacid, calcium supplement
$CaSO_3$	Calcium sulfite	Preservative in cider and fruit juices
$CaSO_4$	Calcium sulfate	Plaster casts
$AgNO_3$	Silver nitrate	Topical anti-infective
$NaHCO_3$	Sodium bicarbonate	Antacid
$Zn_3(PO_4)_2$	Zinc phosphate	Dental cements
$FePO_4$	Iron(III) phosphate	Food and bread enrichment
K_2CO_3	Potassium carbonate	Alkalizer, diuretic
$Al_2(SO_4)_3$	Aluminum sulfate	Antiperspirant, anti-infective
$AlPO_4$	Aluminum phosphate	Antacid
$MgSO_4$	Magnesium sulfate	Cathartic, Epsom salts

Prefixes for Names of Polyatomic Ions of Halogens

Some polyatomic ions of the halogens require prefixes.

ClO_4^-	perchlorate	one oxygen more
ClO_3^-	**chlorate**	**most common form**
ClO_2^-	chlorite	one oxygen less
ClO^-	hypochlorite	two oxygens less

Guide to Naming Compounds with Polyatomic Ions



Examples of Naming Compounds with Polyatomic Ions

In a compound with a negatively charged polyatomic,

- the positive ion is named first
- followed by the name of the polyatomic ion

$NaNO_3$	sodium nitrate
K_2SO_4	potassium sulfate
$Fe(HCO_3)_3$	iron(III) bicarbonate
	or iron(III) hydrogen carbonate
$(NH_4)_3PO_3$	ammonium phosphite

Learning Check

Select the correct formula for each:

A. aluminum nitrate

1) $AlNO_3$ 2) $Al(NO)_3$ 3) $Al(NO_3)_3$

B. copper(II) nitrate

1) $CuNO_3$ 2) $Cu(NO_3)_2$ 3) $Cu_2(NO_3)$

C. iron (III) hydroxide

1) $FeOH$ 2) Fe_3OH 3) $Fe(OH)_3$

D. tin(IV) hydroxide

1) $Sn(OH)_4$ 2) $Sn(OH)_2$ 3) $Sn_4(OH)$

Solution

Select the correct formula for each:

A. aluminum nitrate

3) $Al(NO_3)_3$

B. copper(II) nitrate

2) $Cu(NO_3)_2$

C. iron(III) hydroxide

3) $Fe(OH)_3$

D. tin(IV) hydroxide

1) $Sn(OH)_4$

Learning Check

Match each formula with the correct name:

A.	MgS	1)	magnesium sulfite
	$MgSO_3$	2)	magnesium sulfate
	$MgSO_4$	3)	magnesium sulfide
B.	$Ca(ClO_3)_2$	1)	calcium chlorate
	$Ca(ClO)_2$	2)	calcium chlorite
	$Ca(ClO_2)_2$	3)	calcium hypochlorite

Solution

Match each formula with the correct name:

A.	MgS	3)	magnesium sulfide
	$MgSO_3$	1)	magnesium sulfite
	$MgSO_4$	2)	magnesium sulfate
B.	$Ca(ClO_3)_2$	1)	calcium chlorate
	$Ca(ClO)_2$	3)	calcium hypochlorite
	$Ca(ClO_2)_2$	2)	calcium chlorite

Learning Check

Name each of the following compounds:

A. $Mg(NO_3)_2$

B. $Cu(ClO_3)_2$

C. PbO_2

D. $Fe_2(SO_4)_3$

E. $Ba_3(PO_3)_2$

Solution

Name each of the following compounds:

A.	$Mg(NO_3)_2$	magnesium nitrate
B.	$Cu(ClO_3)_2$	copper(II) chlorate
C.	PbO_2	lead (IV) oxide
D.	$Fe_2(SO_4)_3$	iron(III) sulfate
E.	$Ba_3(PO_3)_2$	barium phosphite

Writing Formulas with Polyatomic Ions

The **formula of an ionic compound**

- containing a polyatomic ion must have a charge balance that equals zero(0)

  Na^+ and NO_3^- → $NaNO_3$

- with two or more polyatomic ions encloses the polyatomic ions in parentheses

  Mg^{2+} and $2NO_3^-$ → $Mg(NO_3)_2$

  subscript 2 for charge balance

Learning Check

Write the correct formula for each:

A. potassium bromate

B. calcium carbonate

C. sodium phosphate

D. iron(III) oxide

E. iron (II) nitrite

Solution

Write the correct formula for each:

A. potassium bromate $KBrO_3$

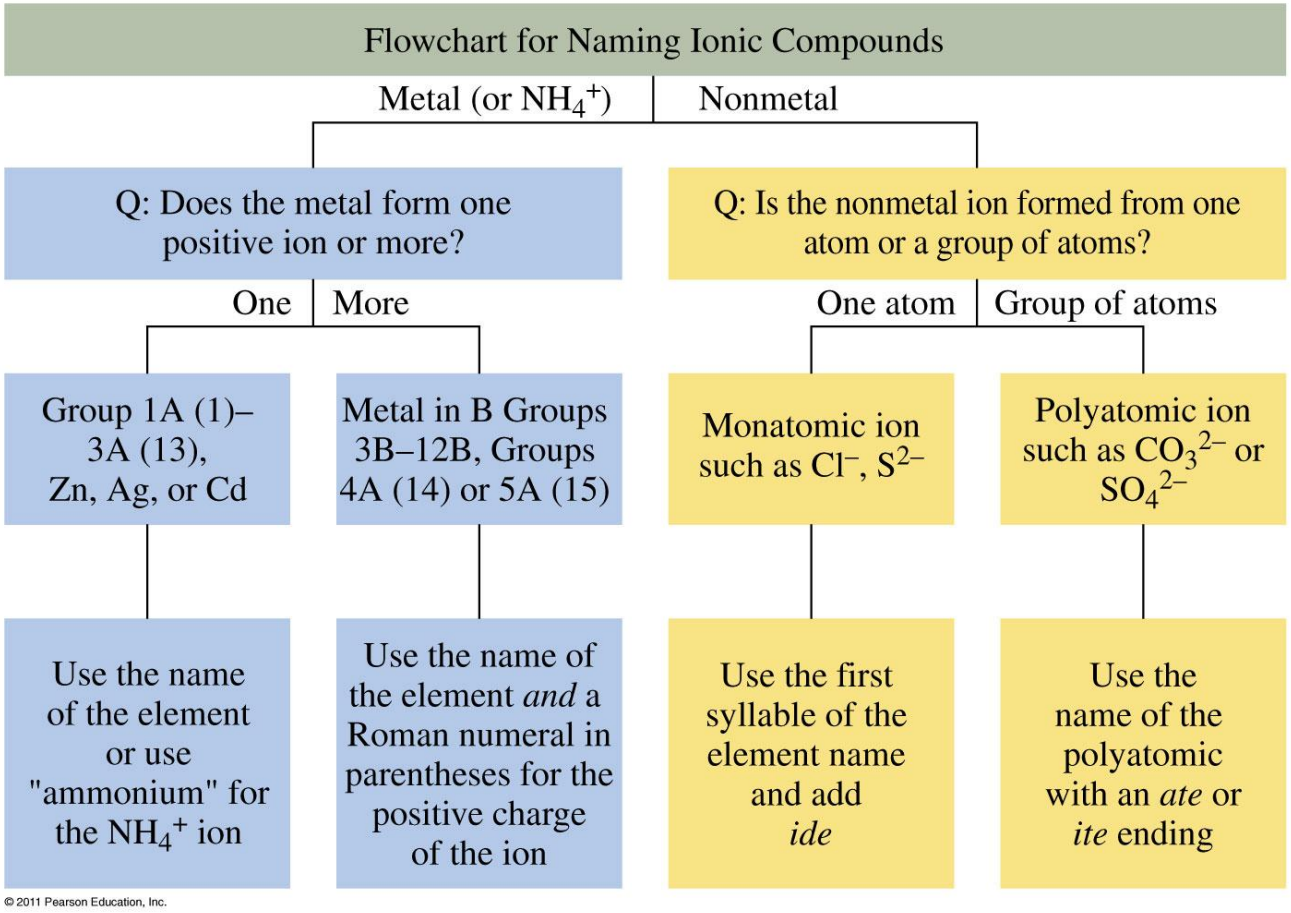
B. calcium carbonate $CaCO_3$

C. sodium phosphate Na_3PO_4

D. iron(III) oxide Fe_2O_3

E. iron (II) nitrite $Fe(NO_2)_2$

Flowchart for Naming Ionic Compounds



Learning Check

Name the following compounds:

A. $Ca_3(PO_4)_2$

B. $FeBr_3$

C. Al_2S_3

D. $Mn(NO_2)_2$

E. $NaHCO_3$

Solution

Name the following compounds:

A. $Ca_3(PO_4)_2$ Ca^{2+} PO_4^{3-} calcium phosphate

B. $FeBr_3$ Fe^{3+} Br^- iron(III) bromide

C. Al_2S_3 Al^{3+} S^{2-} aluminum sulfide

D. $Mn(NO_2)_2$ Mn^{2+} NO_2^- manganese(II) nitrite

E. $NaHCO_3$ Na^+ HCO_3^- sodium hydrogen carbonate

(sodium bicarbonate)

Learning Check

Write the formulas for the following:

A. calcium nitrate

B. iron(II) hydroxide

C. aluminum carbonate

D. copper(II) hypobromite

E. lithium phosphate

Solution

Write the formulas for the following:

A.	calcium nitrate	Ca^{2+}, NO_3^-	$Ca(NO_3)_2$
B.	iron(II) hydroxide	Fe^{2+}, OH^-	$Fe(OH)_2$
C.	aluminum carbonate	Al^{3+}, CO_3^{2-}	$Al_2(CO_3)_3$
D.	copper(II) hypobromite	Cu^{2+}, BrO^-	$Cu(BrO)_2$
E.	lithium phosphate	Li^+, PO_4^{3-}	Li_3PO_4