NOTES FOR NAMING IONIC COMPOUNDS

The following are rules for naming ionic compounds. These are basic rules, which allow for the naming of many, but not all ionic compounds.

This post is divided into the following sections:

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1. In Section **[A]**, I review the basics of using the Periodic Table for determining the charge for monatomic cations and anions.

   For ionic compounds, metal atoms will lose electrons and non-metal atoms will gain electrons, thus forming charged ions (ref: Silberberg, Chemistry, 5th Edition, p. 60).

   A Periodic Table has the elements sectioned into metals and non-metals. For metals in Group IA (Group 1) and Group IIA (Group 2), the ion that can be formed will have a charge that is the same as the group number, i.e., Na^+, (Group 1) and Mg^{2+} (Group 2) respectively and is based on the number of electrons that the element can lose to another element.

   When using these elements for naming an ionic compound, retain the element name, e.g., Na^+ in an ionic compound would be sodium, refer to **Table II**.

   For non-metals in Group IVA (Group 14), Group VA (Group 15), Group VIA (Group 16) and Group VIIA (Group 17), the ion that can be formed will have a charge that is equal to the group number *minus* 8, for example, O^{2-} = 6 - 8 = -2 and Cl^- = 7 - 8 = -1, respectively and is based on the number of electrons that it can gain from another element. Using this rule, the ***most negative*** oxidation state is obtained and additionally, it is noted that these elements can have more than one oxidation state (ref: Silberberg, Chemistry, 5th Edition, p. 561).

   When using these elements for naming an ionic compound, the non-metal element name ends in "ide", e.g., chlorine → chloride, refer to **Table II**.

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1. It is also noted that the ***most positive*** oxidation state of the group A elements is equal to the group number, e.g., magnesium (Group 2) = Mg^{2+} (O.N. = +2). Carbon (Group 4) has at least two oxidation states, i.e., C^{4-} {4 - 8 = -4, i.e. charge 4^- or O.N. = -4} and O.N. = +4 {Group 4}. Likewise for nitrogen {N^{3-}, 5-8 = -3 , i.e. charge 3^- or O.N. = -3} and O.N. = +5 *and* phosphorus {P^{3-}, 5-8 = -3, i.e. charge 3^- and O.N. = -3} and O.N. = +5 in Group 5. For sulfur: {S^{2-}, 6-8 = -2, i.e. charge 2^- and O.N. = -2} and O.N. = +6, Group 6.

   The carbide ion (methanide), C^{4-} , is worth noting. Metal elements can form ionic compounds with carbon, e.g., beryllium carbide (Be_2C) and aluminum carbide (Al_4C_3), (ref: Mortimer, Chemistry, 5th Edition, p. 570). Carbon can also form the acetylide ion (C_2^{2-}), which can form ionic compounds with the Group 1 and Group 2 metals, e.g., calcium carbide (CaC_2), {ref: Mortimer, p.570}.

   For the polyatomic anions, I use the acronym **SCO** to help me remember the ions of **2^-** charge from other ions of **1^-** charge. Refer to **Table I (B)** and **III**.

   For polyatomic anions that differ by one oxygen atom, the name of the ion ends in either "ate" or "ite", e.g., SO_4^{2-} → sulfate and SO_3^{2-} → sulfite. Also, the prefix - suffix "per - ate" and hypo - ite" refer to ions that contain either 1 more oxygen than the "ate" ion or 1 less oxygen than the "ite" ion. These conventions are used for families that contain either 2 or 4 oxoanions.

2. **Table IV** provides some basic rules for naming ionic compounds.
   Note: The oxidation state and oxidation number (O.N.) are the same term.
   The ion with the higher charge has the suffix "ic" and the lower charge has the suffix "ous".

3. Section **[B]** reviews the cross-over rule for determining the formula of a compound, when the name of the compound is provided. For example, magnesium nitride:

   Mg^{2+}, N^{3-} → Mg__N___ → Mg_3N_2

   Since magnesium has a charge of **2^+**, nitrogen will be subscript **2**. Since nitride has a charge of **3^-**, magnesium will be subscript **3**.

   Furthermore, if the resulting subscripts are of *equal* numeric value, reduce the formula to its simplest form, e.g.,

   Zn^{2+}, O^{2-} → Zn__O___ → Zn_2O_2 → ZnO {simplest form or *empirical* formula}

4. Section **[C1]** reviews the procedure for naming ionic compounds with either one polyatomic anion (no brackets needed around the anion) or more than one polyatomic anion (brackets needed around the anion). Section **[C2]** provides some practise examples.

5. Section **[D]** reviews the procedure for determining the formula for an ionic compound which contains a metal ion that can have more than one charge (i.e., has more than one oxidation state), e.g.,

   Iron (III) chloride:

   $\underline{Fe^{3+,\,2+}}$, Cl^- → Fe^{3+} , Cl^- , Fe__Cl__ → Fe_1Cl_3 → $FeCl_3$

   Since iron can have two oxidation states, i.e., **3^+** and **2^+**, one has to refer to the name of the compound in order to proceed with the cross-over rule. In this case, the name indicates that the charge is **3^+**, based on the Roman numeral III.

6. Section **[E]** reviews the procedure for determining the charge of an ion, if the formula is known.

7. Section **[F]** reviews the oxoacids / oxoanions for the elements Chlorine, Nitrogen, Sulfur and Phosphorous.

8. Sections **[G]** & **[H]** provide practise problems, with answers.

9. As indicated at various points in the text, the following references were used:

   1. Silberberg, Chemistry, 5th Edition, 2009.
   2. Mortimer, Chemistry, 5th Edition, 1983.
   3. Harris, Quantitative Chemical Analysis, 7th Edition, 2007.

NOTES FOR NAMING IONIC COMPOUNDS

[A] Resource page of monatomic and polyatomic ions

(1) Notes on Ions

1. Ions are divided into Cations & Anions
   - monatomic – ions that contain only 1 atom, e.g., Na^+, Cl^-
   - polyatomic – ions that contain 2 or more atoms, e.g., NH_4^+ , NO_3^-, SO_4^{2-}
2. Charges on Cations can be determined from the Group number on the Periodic Table
   1. Group IA (Group 1) – has a charge of 1^+, Na^+
   2. Group IIA (Group 2) – has a charge of 2^+, Mg^{2+}
   3. The charge is based on the number of electrons that it can lose to another element.
3. Charges on Anions can be determined from the Group number on Periodic Table
   1. Group IVA (Group 14) – has a charge of 4^-, C^{4-} ; (ref: Mortimer, p.570; Silberberg, p.561)
   2. Group VA (Group 15) – has a charge of 3^-, N^{3-}
   3. Group VIA (Group 16) – has a charge of 2^-, O^{2-}
   4. Group VIIA (Group 17) – has a charge of 1^-, Cl^-
   5. The charge is based on the number of electrons that it can gain from another element.
4. Oxoanions contain an element bonded to one or more oxygen atoms , e.g., NO_3^-, SO_4^{2-}, CrO_4^{2-}

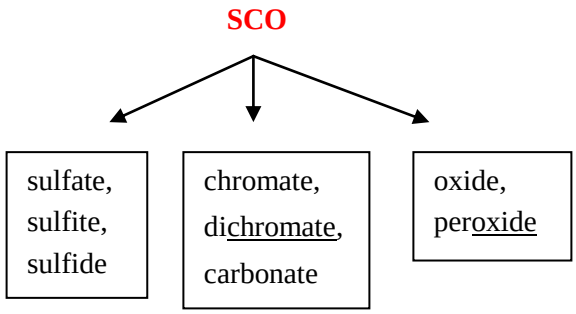
Table I Table of Ions (most ions from Silberberg, p. 68, Table 2.5)

(A) Cations

Formula	Name
1^+	
NH_4^+	ammonium

(B) Anions (**SCO**); Anions with a 2^- charge can be remembered using the acronym **SCO**, {sulfate/sulfite/sulfide//chromate/dichromate/carbonate//oxide/peroxide}

		Formula	Name
2^-	**S**	SO_4^{2-}	sulfate
		SO_3^{2-}	sulfite
		S^{2-}	sulfide
	C	CrO_4^{2-}	chromate
		$Cr_2O_7^{2-}$	dichromate
		CO_3^{2-}	carbonate
	O	O^{2-}	oxide
		O_2^{2-}	peroxide



(C) Anions

	Formula	Name	Formula	Name
1^-	MnO_4^-	permanganate	perchlorate	ClO_4^-
	CH_3COO^-	acetate	chlorate	ClO_3^-
	OH^-	hydroxide	chlorite	ClO_2^-
	HSO_4^-	bisulfate	hypochlorite	ClO^-
	HSO_3^-	bisulfite	nitrate	NO_3^-
	HCO_3^-	bicarbonate	nitrite	NO_2^-

(D) Ions ending in "-ate" & "-ite", indicating 1 less oxygen atom

SO_4^{2-}	sulfate
SO_3^{2-}	sulfite
NO_3^-	nitrate
NO_2^-	nitrite
ClO_3^-	chlorate
ClO_2^-	chlorite

Table II Table of Cations and Anions, Set #1

Cations	Formula	Name
1^+	Li^+	Lithium
	Na^+	Sodium
	K^+	Potassium
	Cs^+	Cesium
2^+	Be^{2+}	Beryllium
	Mg^{2+}	Magnesium
	Ca^{2+}	Calcium
	Sr^{2+}	Strontium
	Ba^{2+}	Barium
Anions		
4^-	C^{4-}	carbide (methanide)
3^-	N^{3-}	nitride
	P^{3-}	phosphide
2^-	O^{2-}	oxide
	S^{2-}	sulfide
1^-	F^-	fluoride
	Cl^-	chloride
	Br^-	bromide
	I^-	iodide

Table III Table of Cations and Anions, Set #2

Cations	Formula	Name
1^+	NH_4^+	ammonium
Anions		
2^- SCO	SO_4^{2-}	sulfate
	SO_3^{2-}	sulfite
	CrO_4^{2-}	chromate
	$Cr_2O_7^{2-}$	dichromate
	CO_3^{2-}	carbonate
	C_2^{2-}	carbide (acetylide)
	O^{2-}	oxide
	O_2^{2-}	peroxide
1^-	MnO_4^-	permanganate
	CH_3COO^-	acetate
	HSO_4^-	bisulfate
	OH^-	hydroxide

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Table IV Basic Rules for Naming Compounds

Substance	Name	Formula
(1) Element	Name of element, e.g. silver (Ag), copper (Cu) molecular elements (ref: Silberberg, 5th Ed, p92)	Symbol, e.g., Ag, Cu; Molecular elements: H_2, N_2, O_2, F_2, Cl_2, Br_2, I_2 as diatomic molecules
(2) Monatomic* cations (*ref: Silberberg, p. 60)	Name of the element followed by the term "ion", e.g. sodium ion. If element has more than 1 charge, element name is followed by ion charge in Roman numerals	Symbol of element followed by superscript to indicate charge, Na^+ ion. Chromium (II) or Chromium (III).
(3) Polyatomic cations	Ammonium ion	NH_4^+
(4) Monatomic anions	Name of element changed to end in "-ide", bromine → bromide oxygen → oxide nitrogen → nitride; carbon → carbide	Symbol of element followed by a superscript to indicate charge: Br^-, O^{2-}, N^{3-}, C^{4-}
(5) Polyatomic anions, (*2* oxoanions in family)	Oxoanions with ***more*** oxygen atoms - "-ate". Oxoanions with ***fewer*** oxygen atoms - "-ite".	SO_4^{2-} = sulfate; NO_3^- = nitrate SO_3^{2-} = sulfite; NO_2^- = nitrite
(6) Polyatomic anions, (*4* oxoanions in family, Silberberg, p. 68) O.N. - Mortimer, p. 361	perchlorate – ion with the *most* oxygen atoms chlorate – *one fewer* oxygen atoms chlorite – *two fewer* oxygen atoms hypochlorite – ion with the *least* oxygen atoms	ClO_4^-, [O.N. = +7] ClO_3^-, [O.N. = +5] ClO_2^-, [O.N. = +3] ClO^-, [O.N. = +1]
(7) Polyatomic anions	hydroxide & cyanide	OH^- & CN^-
(8) Ionic compounds	Name comes from the metal element and the non-metal element.	NaCl – Sodium chloride
(9) Binary & ternary ionic compounds	Binary – compounds containing 2 elements, Ternary – compounds containing 3 elements, at least 1 metal and non-metal. Name comes from metal & non-metal or polyatomic anion.	KCl KNO_3
(10) Aqueous acids (binary acids)	Prefix "hydro-" followed by the name of the second element and ends in "-ic".	Hydrochloric – HCl Hydrofluoric – HF Hydroiodic – HI
(12) Aqueous acids (Oxoacid) (ternary acids) higher charge ends in "ic" lower charge ends in "ous"	Composed of hydrogen, a non-metal and oxygen. The name comes from the middle element and is changed to end in "-ic", e.g., chlorine → chloric, nitrogen → nitric	Chloric – $HClO_3$ Nitric – HNO_3, [O.N. = +5] Nitrous – HNO_2, [O.N. = +3] Sulfuric – H_2SO_4, [O.N. = +6] Sulfurous – H_2SO_3, [O.N. = +4] Carbonic – H_2CO_3 Phosphoric – H_3PO_4
(13) Other anions [oxidation state of Mn] [O.N.]	(i) SO_4^{2-}, sulfate → HSO_4^-, hydrogen sulfate or bisulfate (ii) SO_3^{2-}, sulfite → HSO_3^-, hydrogen sulfite or bisulfite (iii) CO_3^{2-}, carbonate → HCO_3^-, hydrogen carbonate or bicarbonate (iv) MnO_4^-, permanganate, [Mn = +7]; MnO_4^{-2}, manganate, [Mn = +6], Silberberg, p.1028.	

NOTES FOR NAMING IONIC COMPOUNDS

[B] CROSSOVER RULE

1. Magnesium nitride

   Mg^{2+}, N^{3-} → Mg__N___ → Mg_3N_2

2. Potassium chromate

   K^{+}, CrO_4^{2-} → K__CrO_4 ___ → K_2CrO_4

3. Calcium bromide

   Ca^{2+}, Br^{-} → Ca__Br___ → $CaBr_2$

4. Cesium sulfide

   Cs^{+}, S^{2-} → Cs__S___ → Cs_2S

5. Zinc oxide

   Zn^{2+}, O^{2-} → Zn__O___ → Zn_2O_2 → ZnO {simplest form}

   {note: when reduced to simplest form, this represents the *empirical* formula}

NOTE: If the subscript is 1, do not include it in the formula.

[C1] NAMING COMPOUNDS WITH POLYATOMIC ANIONS

Examples with only one polyatomic anion; thus, no brackets needed.

1. Sodium nitrate

   Na^{+}, NO_3^{-} → $NaNO_3$

2. Sodium nitrite

   Na^{+}, NO_2^{-} → $NaNO_2$

3. Sodium sulfate

   Na^{+}, SO_4^{2-} → Na_2SO_4

Examples where there is more than one polyatomic anion; thus, need brackets surrounding the anion.

4. Calcium acetate

   Ca^{2+} , CH_3COO^{-} → $Ca(CH_3COO)_2$

5. Nickel (II) nitrate

   Ni^{2+}, NO_3^{-} → $Ni(NO_3)_2$

NOTES FOR NAMING IONIC COMPOUNDS

[C2] NAMING COMPOUNDS WITH POLYATOMIC ANIONS - practise questions

1. Sodium carbonate

   Na^+, CO_3^{2-} → _____ Na_2CO_3

2. Potassium permanganate

   K^+, MnO_4^- → _____ $KMnO_4$

3. Sodium sulfite

   Na^+, SO_3^{2-} → _____ Na_2SO_3

4. Potassium dichromate

   K^+, $Cr_2O_7^{2-}$ → _____ $K_2Cr_2O_7$

5. Nickel (II) nitrite

   Ni^{2+}, NO_2^- → _____ $Ni(NO_2)_2$

6. Nickel (III) nitrite

   Ni^{3+}, NO_2^- → _____ $Ni(NO_2)_3$

[D] NAMING COMPOUNDS WITH MULTIPLE OXIDATION STATES

1. Iron (III) chloride

   $\underline{Fe^{3+,\,2+}}$, Cl^- → Fe^{3+} , Cl^- , Fe__Cl__ → Fe_1Cl_3 → $FeCl_3$

2. Chromium (III) sulfide

   $\underline{Cr^{3+,\,2+}}$, S^{2-} → Cr^{3+}, S^{2-} → Cr__S___ → Cr_2S_3

3. Tin (II) flouride, (stannous flouride)

   $\underline{Sn^{4+,\,2+}}$, F^- → Sn^{2+}, F^- → Sn__F___ → Sn_1F_2 → SnF_2

4. Iron (III) oxide, (ferrous oxide)

   $\underline{Fe^{3+,\,2+}}$, O^{2-} → Fe^{3+} , O^{2-} → Fe__O___ → Fe_2O_3

5. Chromium (II) sulfide

   $\underline{Cr^{3+,\,2+}}$, S^{2-} → Cr^{2+}, S^{2-} → Cr__S__ → Cr_2S_2 → CrS {note: reduce to simplest form}

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NOTES FOR NAMING IONIC COMPOUNDS

[E1] DETERMING CHARGE FOR AN ION

1. Cr_2S_3 - what is the charge on the Cr ion?
   - S (sulfide) has a charge of 2^-,
   - since there are 3 sulfide ions = 3 x (-2) = -6
   - formula charge = 0; thus, cation = 6
   - $Cr^{x+} + Cr^{x+}$: x + x = 6, 2x = 6, thus x = 3
   - Cr has a charge of 3^+

     {Cr can be either 3^+ or 2^+}

2. $FeCl_3$ - what is the charge on the Fe ion?
   - Cl (chloride) has a charge of 1^-,
   - since there are 3 chloride ions = 3 x (-1) = -3
   - formula charge = 0; thus, cation = 3
   - Fe^{x+} : x = 3,
   - Fe has a charge of +3.

     {Fe can be either 3^+ or 2^+}

3. Ni_2O_3 - what is the charge on the Ni ion?
   - O (oxide) has a charge of 2^-,
   - since there are 3 oxide ions = 3 x (-2) = -6
   - formula charge = 0; thus, cation = 6
   - $Ni^{x+} + Ni^{x+}$: x + x = 6, 2x = 6, thus x = 3
   - Ni has a charge of 3^+

     {Ni can be either 3^+ or 2^+}

4. $Ni(NO_3)_3$ - what is the charge on the Ni ion?

   - NO_3 (nitrate) has a charge of 1^-,
   - since there are 3 nitrate ions = 3 x (-1) = -3
   - formula charge = 0; thus, cation = 3
   - Ni^{x+}: x = 3
   - Ni has a charge of 3^+

     {Ni can be either 3^+ or 2^+}

[E2] COMMON NAME FOR IONS WITH MORE THAN ONE OXIDATION STATE

Cations	Formula	Name
iron (III)	Fe^{3+}	ferric
iron (II)	Fe^{2+}	ferrous
chromium (III)	Cr^{3+}	chromic
chromium (II)	Cr^{2+}	chromous
copper (II)	Cu^{2+}	cupric
copper (I)	Cu^+	cuprous

As a guide to remember the charges, the charges for each ion are listed in decreasing order.

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[F1] TERNARY ACIDS, (OXOANIONS, OXOACIDS)

Current terminology refers to **oxoanions** & **oxoacids** (ref: Silberberg, p. 68-70).
Older terminology used the terms oxyanions & oxyacids (ref: Mortimer, p. 294).

Anion prefix / suffix	**Acid** prefix / suffix	**Acid** formula/name
per – ate perchlorate (ClO_4^-)	per – ic perchloric	$HClO_4$ Perchloric acid
– ate chlorate (ClO_3^-)	- ic chloric	$HClO_3$ Chloric acid
– ite chlorite (ClO_2^-)	- ous chlorous	$HClO_2$ Chlorous acid
hypo – ite hypochlorite (ClO^-)	hypo - ous hypochlorous	HClO Hypochlorous acid
– ate nitrate (NO_3^-)	- ic nitric	HNO_3 Nitric acid
– ite nitrite (NO_2^-)	- ous nitrous	HNO_2 Nitrous acid
– ate sulfate (SO_4^{2-})	- ic - sulfuric	H_2SO_4 Sulfuric acid
– ite sulfite (SO_3^{2-})	- ous - sulfurous	H_2SO_3 Sulfurous acid
– ate phosphate (PO_4^{3-})	- ic - phosphoric	H_3PO_4 Phosphoric acid
– ite phosphite (HPO_3^{2-})	- ous - phosphorous	H_3PO_3 Phosphorous acid[(1)]
hypo – ite hypophosphite ($H_2PO_2^-$)	hypo - ous - hypophosphorous	H_3PO_2 Hypophosphorous acid[(2)]

[(1)] Reference: Silberberg, p. 602, phosphite ion (HPO_3^{2-})
[(2)] Reference: Mortimer, p. 559.

[F2] ACIDS OF SULFUR: The oxoanions of sulfur.

Sulfuric acid (O.N. of sulfur = +6, Mortimer, p. 531)

$H_2SO_4 \rightarrow H^+ + HSO_4^- \rightarrow H^+ + SO_4^{2-}$

sulfuric acid $\rightarrow H^+$ + hydrogen sulfate $\rightarrow H^+$ + sulfate (Mortimer, p.533)

Sulfurous acid (O.N. of sulfur = +4; Mortimer p. 529)

$H_2SO_3 \rightarrow H^+ + HSO_3^- \rightarrow H^+ + SO_3^{2-}$

sulfurous acid $\rightarrow H^+$ + hydrogen sulfite $\rightarrow H^+$ + sulfite (Mortimer, p.529)

Peroxy acids: Sulfur.

An acid that contains a peroxide group (–O–O–) is termed a peroxy acid (Mortimer, p. 534).

(i) $H_2S_2O_8$ (peroxydisulfuric acid), which contains the peroxydisulfate ion ($S_2O_8^{2-}$) (Mortimer, p. 535).
$S_2O_8^{2-}$ may also be termed *persulfate* (Harris, p. 335).

(ii) Hydrolysis of peroxydisulfuric acid yields H_2SO_5 (peroxymonosulfuric acid) (Mortimer, p. 535).

Thiosulfate $S_2O_3^{2-}$, which is oxidized to tetrathionate $S_4O_6^{2-}$ (Mortimer, p. 535-536).

NOTES FOR NAMING IONIC COMPOUNDS

[F3] ACIDS OF PHOSPHORUS: The oxoanions of phosphorous.

Phosphoric acid (O.N. of phosphorus = +5, Mortimer, p. 556)

$H_3PO_4 \rightarrow H^+ + H_2PO_4^- \rightarrow H^+ + HPO_4^{-2} \rightarrow H^+ + PO_4^{3-}$

phosphoric acid $\rightarrow H^+$ + dihydrogen phosphate $\rightarrow H^+$ + hydrogen phosphate $\rightarrow H^+$ + phosphate (Silberberg, p.602)

Phosphorous acid (O.N. of phosphorus = +3, Mortimer, p.559)

$H_3PO_3 \rightarrow 2H^+ + \mathbf{H}PO_3^{-2}$ (Mortimer, p. 559; **H** does not dissociate)

phosphorous $\rightarrow 2H^+$ + phosphite

Hypohosphorous acid (O.N. of phosphorus = +1, Mortimer, p.559)

$H_3PO_2 \rightarrow H^+ + \mathbf{H}_2PO_2^-$ (Mortimer, p. 559; two **H** do not dissociate)

hypophosphorous $\rightarrow H^+$ + hypophosphite

Note: (i) The naming of the phosphorus oxoanions are based on the scheme reported in Silberberg, p. 602, i.e., phosphite ion (HPO_3^{2-}), as well as Mortimer, p. 548, hypophosphite ($H_2PO_2^-$). *Current naming conventions may be different.*

(ii) For phosphorus acid, only two of the hydrogens are dissociable and the 3rd hydrogen is bonded to the phosphorous atom; thus, is not dissociable (not acidic).

(iii) For hypophosphorus acid, only one of the hydrogens is dissociable and the other two hydrogen atoms are bonded to the phosphorous atom; thus, is not dissociable (not acidic).

(iv) O.N. based on Mortimer, p. 362.

[F4] OXIDATION NUMBER (O.N.)

The O.N. and oxidation state are equivalent terms and refers to the charge that an atom would have if the electrons are ***completely transfered*** to another atom(s).

For a monatomic ion, the O.N. is equal to the ion charge, e.g., Na^+, O.N. = +1; Mg^{2+}, O.N. = +2.

For polyatomic ions, the sum of the O.N. for all atoms must equal the charge for the ion, e.g., NO_3^- : since oxygen is -2, then -2 x 3 = -6. Therefore -6 + N = -1, thus, N = -1 + 6 = +5. Therefore, the O.N. for nitrogen is +5.

[G1] PRACTISE PROBLEMS

(1) Provide the formula or name for the following:

(i) Cadmium sulfide (cadmium is a transition element - most stable oxidation state +2)

(ii) Magnesium flouride

(iii) Zinc oxide (zinc is a transition element - most stable oxidation state +2)

(iv) $BaSO_4$

(v) KCl

(vi) Na_3N

(vii) Sodium peroxide

(viii) Calcium nitride

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[G1] PRACTISE PROBLEMS, continued,

(ix) Barium hydroxide

(x) Sodium hypochlorite {main component in bleach}

(xi) LiOH

(2) Provide the formula or name for the following (crossover rule):

(i) Ammonium carbonate

(ii) Sodium hydrogen phosphate

(iii) $Fe_2(CrO_4)_3$

(iv) Sodium manganate

(v) Calcium sulfate (commercial product - Drierite, a drying agent, Harris, p. 31)

(vi) Magnesium oxide

(3) Provide the formula or name for the following (cations with multiple charges - multivalent):

(i) Iron (II) sulfide , (ferrous sulfide)

(ii) Iron (II) carbonate

(iii) Lead (IV) oxide

(iv) Cu_2O

(v) Chromous chloride

(4) Provide the formula or name for the following (polyatomic anions):

(i) Calcium hydroxide

(ii) Barium chromate

(iii) $BaSO_4$

(iv) $CaCO_3$

(v) Cupric sulfate

(vi) K_2HPO_4

(vii) Magnesium perchlorate (a drying agent, Harris, p. 31)

(viii) Ammonium nitrate

[G2] Answers to problems in G1

(1) Provide the formula or name for the following:

(i)	Cadmium sulfide	CdS
(ii)	Magnesium fluoride	MgF_2
(iii)	Zinc oxide	ZnO
(iv)	$BaSO_4$	Barium sulfate
(v)	KCl	Potassium chloride
(vi)	Na_3N	sodium nitride

[G2] Answers to problems in G1

(vii)	Sodium peroxide	Na_2O_2
(viii)	Calcium nitride	Ca_3N_2
(ix)	Barium hydroxide	$Ba(OH)_2$
(x)	Sodium hypochlorite {bleach}	NaClO
(xi)	LiOH	Lithium hydroxide

(2) Provide the formula or name for the following (crossover rule):

(i)	Ammonium carbonate	$(NH_4)_2CO_3$
(ii)	Sodium hydrogen phosphate	Na_2HPO_4
(iii)	$Fe_2(CrO_4)_3$	Iron (III) chromate, (ferric chromate)
(iv)	Sodium manganate	Na_2MnO_4 (forms a green coloured ion, Harris, p.336)
(v)	Calcium sulfate	$CaSO_4$
(vi)	Magnesium oxide	MgO

(3) Provide the formula or name for the following (cations with multiple charges - multivalent):

(i)	Iron (II) sulfide	FeS
(ii)	Iron (II) carbonate	$FeCO_3$
(iii)	Lead (IV) oxide	PbO_2
(iv)	Cu_2O	Copper (I) oxide, (cuprous oxide)
(v)	Chromous chloride	$CrCl_2$

(4) Provide the formula or name for the following (polyatomic anions):

(i)	Calcium hydroxide	$Ca(OH)_2$
(ii)	Barium chromate	$BaCrO_4$
(iii)	$BaSO_4$	Barium sulfate
(iv)	$CaCO_3$	Calcium carbonate
(v)	Cupric sulfate	$CuSO_4$
(vi)	K_2HPO_4	Potassiun hydrogen phosphate
(vii)	Magnesium perchlorate (drying agent)	$Mg(ClO_4)_2$
(viii)	Ammonium nitrate	NH_4NO_3

[H1] PRACTISE PROBLEMS, part 2

(1) Provide the formula or name for the following:

(i) Sodium chloride

(ii) Magnesium sulfide

(iii) Sodium oxide

(iv) CaF_2

[H1] PRACTISE PROBLEMS, part 2

(v) CuBr

(vi) ZnO

(vii) Na_3P

(viii) Sodium nitrite

(ix) Sodium thiosulfate

(x) Potassium permanganate

(xi) Calcium carbonate

(xii) Sodium bisulfate

(xiii) Sodium perchlorate

(xiv) Calcium hydroxide

(2) Provide the formula or name for the following (crossover rule):

(ii) Magnesium nitride

(iv) Ba_3N_2

(v) MgO

(vi) Be_3P_2

(vii) CaO

(viii) FeO

(3) Provide the formula or name for the following (cations with multiple charges - multivalent):

(i) Iron (II) hydroxide

(ii) Copper (II) carbonate

(iii) CuS

(iv) Fe_2O_3

(v) Colbalt (II) sulfide

(vi) Cu_2S

(4) Provide the formula or name for the following (polyatomic anions):

(i) Sodium nitrate

(ii) Sodium sulfate

(iii) Magnesium acetate

(iv) $Ni(NO_3)_2$

(v) Na_2CO_3

(vi) $K_2Cr_2O_7$

(vii) Sodium bicarbonate

(viii) Sodium hydrogen phosphate

[H1] PRACTISE PROBLEMS, part 2

(ix) Magnesium nitrate

[H2] **Answers to H1** , part 2

(1) Provide the formula or name for the following:

(i)	Sodium chloride	NaCl
(ii)	Magnesium sulfide	MgS
(iii)	Sodium oxide	Na_2O
(iv)	CaF_2	Calcium fluoride
(v)	CuBr	Copper (I) bromide
(vi)	ZnO	Zinc oxide
(vii)	Na_3P	Sodium phosphide
(viii)	Sodium nitrite	$NaNO_2$
(ix)	Sodium thiosulfate	$Na_2S_2O_3$
(x)	Potassium permanganate	$KMNO_4$
(xi)	Calcium carbonate	$CaCO_3$
(xii)	Sodium bisulfate	$NaHSO_4$
(xiii)	Sodium perchlorate	$NaClO_4$
(xiv)	Calcium hydroxide	$Ca(OH)_2$

(2) Provide the formula or name for the following (crossover rule):

(ii)	Magnesium nitride	Mg_3N_2
(iv)	Ba_3N_2	Barium nitride
(v)	MgO	Magnesium oxide
(vi)	Be_3P_2	Beryllium phosphide
(vii)	CaO	Calcium oxide
(viii)	FeO	Iron (II) oxide, Ferrous oxide

(3) Provide the formula or name for the following (cations with multiple charges - multivalent):

(i)	Iron (II) hydroxide	$Fe(OH)_2$
(ii)	Copper (II) carbonate	$CuCO_3$
(iii)	CuS	Copper (II) sulfide
(iv)	Fe_2O_3	Iron (III) oxide
(v)	Colbalt (II) sulfide	CoS
(vi)	Cu_2S	Copper (I) sulfide

[H2] **Answers to H1** , part 2

(4) Provide the formula or name for the following (cations with multiple charges - multivalent):

(i) Sodium nitrate $NaNO_3$

(ii) Sodium sulfate Na_2SO_4

(iii) Magnesium acetate $Mg(CH_3COO)_2$

(iv) $Ni(NO_3)_2$ Nickel (II) nitrate

(v) Na_2CO_3 Sodium carbonate

(vi) $K_2Cr_2O_7$ Potassium dichromate

(vii) Sodium bicarbonate $NaHCO_3$

(viii) Sodium hydrogen phosphate Na_2HPO_4

(ix) Magnesium nitrate $Mg(NO_3)_2$

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