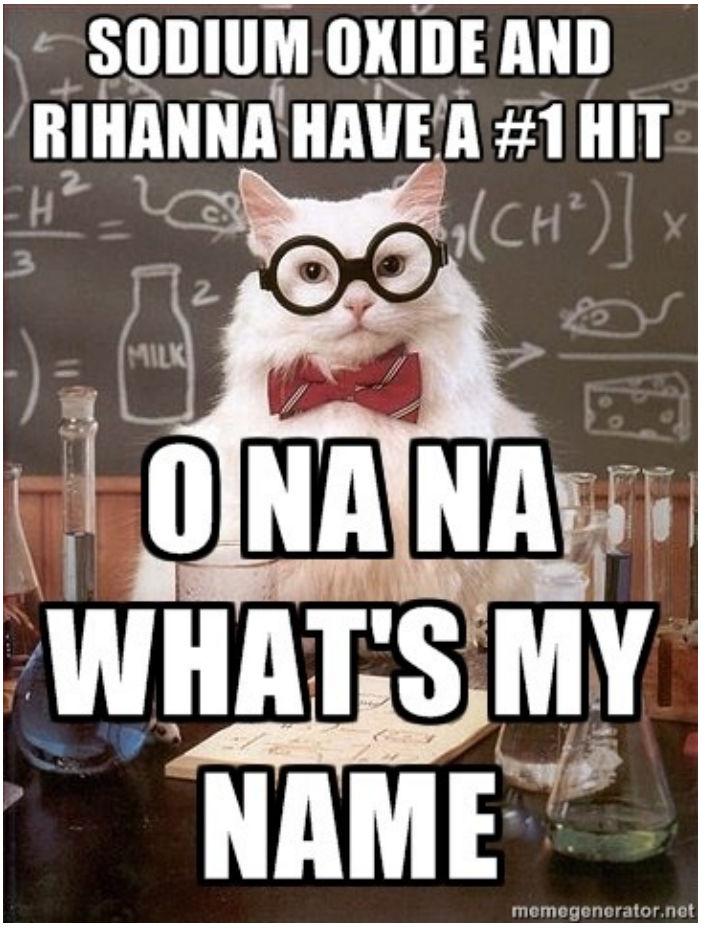
CHEMISTRY 11

UNIT 2: MATTER & INORGANIC NAMING



BOOK 2: INORGANIC NAMING

Name: Key **Block:**_____

Test yourself....ionic & covalent

	Formula	Ionic or Covalent?	Name of Compound
(a)	Cl_2O	C	dichlorine oxide
(b)	CO_2	C	carbon dioxide
(c)	CoO	I	cobalt (II) oxide
(d)	CO	C	carbon monoxide
(e)	PbO_2	I	lead (IV) oxide
(f)	$MgCl_2$	I	magnesium chloride
(g)	$PtCl_2$	I	platinum (II) chloride
(h)	SCl_2	C	sulphur dichloride
(i)	$NaCH_3COO$	I	sodium acetate
(j)	NH_4CH_3COO	I	ammonium acetate

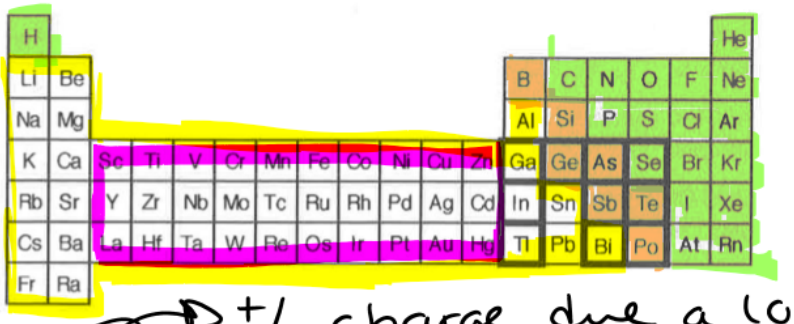
*CH_3COO (ethanoate or acetate)

This unit deals with the naming of compounds made from metals and non-metals.

Indicate the sections on the periodic table below that contain:

- METALS
- NON-METALS
- METALLOIDS
- TRANSITION METALS

The compounds used in the examples and exercises which follow are selected from the metals in white boxes (below) and the nonmetals in shaded boxes. The elements in outlined boxes are not used in any of the examples or exercises which follow (although you should know the names and symbols for later purposes).

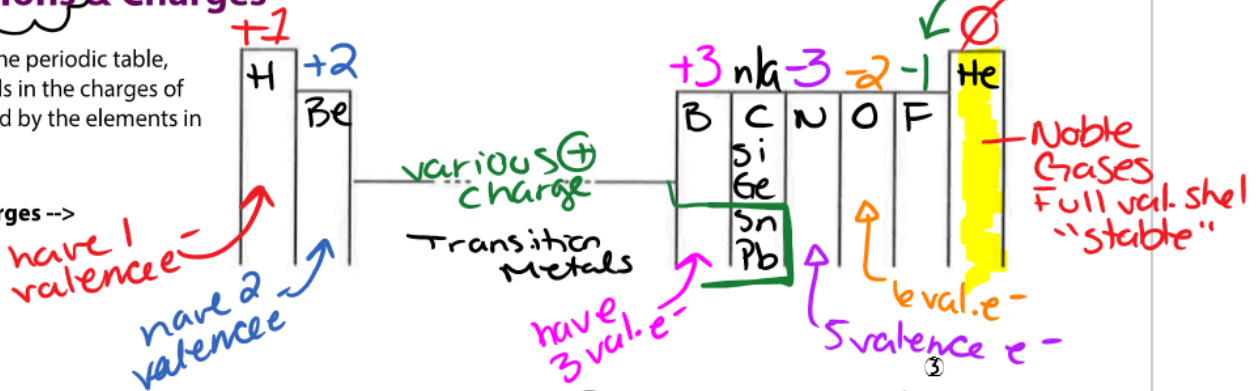


+/- charge due a loss or gain of electrons.

Review: Ions & Charges

Going across the periodic table, there are trends in the charges of the ions formed by the elements in the columns.

Label the charges -->



Lose e^- = $p^+ > e^-$ ⊕ ion Cation

Gain e^- = $p^+ < e^-$ ⊖ ion Anion

You should become **VERY** familiar with the following ion charges, as they are the most common...and you will use them often

+ charge increase

H^+							
Li^+	Be^{2+}				O^{2-}	F^-	
Na^+	Mg^{2+}		Al^{3+}		S^{2-}	Cl^-	
K^+	Ca^{2+}					Br^-	
Rb^+	Sr^{2+}					I^-	
Cs^+	Ba^{2+}						

(ignore these middle ones)

- charge increase

IMPORTANT: Metals form ⊕ cations
Nonmetals form ⊖ anions.

Key Terms:

An Anion is an ion with a ⊖ charge.
Example: Cl^-, NO_3^-

A Cation is an ion with a ⊕ charge.
Example: Al^{3+}, NH_4^+

MEMORY AID: Cats are PAWsitive

A **MONATOMIC** species is made up of only one atom.
Example: Ne, He, Li^+, Cl^-

A **DIATOMIC** species is made up of 2 atoms (which may be the same or different types).
Example: O_2, IBr, NO, Br_2, ClO^-, Hg_2^{2+} mercury.

A Triatomic species is made up of three atoms.
Example: O_3, NO_2, NOCl, H_2O, I_3^-

A Polyatomic species is made up of many atoms ("poly" means "more than ONE").
Note: This is a general term and applies to any species having more than one atom.
Example: $H_3PO_4^-$, NO_3^-, NH_4^+

PRACTICE

1. In the space after each of the following species, indicate which of the terms below apply to each species. There is more than one term which applies to each species.

N (neutral), C (a cation), A (an anion)
M (monatomic), D (diatomic), T (triatomic), P (polyatomic)

(a) SO_4^{2-} A, P (c) Sr^{2+} C, M (e) NH_4^+ C, P
(b) H_2O N, T, P (d) OH^- A, D, P (f) Ar N, M

Technically... anything 4 than 1 is "poly"

Part A Ionic Compounds: *Naming Monatomic Metal & Non-Metal Ions*

Naming monatomic metal ions: Use the name of the metal and add the word "ion"

Example: Sodium metal (Na) forms the Na^+ = sodium ion
Aluminum metal (Al) forms the Al^{3+} = Aluminium ion.

The Stock System of naming metal ions: If a metal ion has more than one possible charge, the charge is indicated by a Roman Numeral, immediately following the name.

Example: Fe^{3+} = iron (III) ion Fe^{2+} = iron (II) ion U^{6+} = uranium (VI) ion U^{3+} = uranium (III) ion

Multivalent Ions: most transition metals are multivalent, meaning they have more than 1 stable state.

PRACTICE *(Complete the following questions in the space provided below)*

2. Write the names of the following ions using the Stock system of notation.
   (a) Cu^+ (b) Cr^{3+} (c) W^{6+}

3. Write the formula of the following ions to show their charges.
   (a) cobalt(III) ion (b) nickel(II) ion (c) vanadium(V) ion

Naming monatomic non–metal ions: Take off the original ending of the element's name and put on an "-ide"

(The ending **ide** means the ion has a negative charge and has no attached atoms such as oxygen included with the ion.)

Element name	Element symbol	Ion name	Ion symbol
fluorine	F	fluoride	F^-
chlorine	Cl	chloride	Cl^-
bromine	Br	bromide	Br^-
iodine	I	iodide	I^-
oxygen	O	oxide	O^{2-}
sulphur	S	sulphide	S^{2-}
nitrogen	N	nitride	N^{3-}
phosphorus	P	phosphide	P^{3-}

Group 17 -1 Group 16 -2 Group 15 -3

Names and Formulae of Inorganic Compounds

PRACTICE Challenge *(how much do you remember?)*

ANSWERS ZA

	Br^-	O^{2-}	N^{3-}	OH^-	SO_4^{2-}	PO_4^{3-}
Na^+	NaBr	Na_2O	Na_3N	NaOH	Na_2SO_4	Na_3PO_4
Ca^{2+}	$CaBr_2$	CaO	Ca_3N_2	$Ca(OH)_2$	$CaSO_4$	$Ca_3(PO_4)_2$
Al^{3+}	$AlBr_3$	Al_2O_3	AlN	$Al(OH)_3$	$Al_2(SO_4)_3$	$AlPO_4$
NH_4^+	NH_4Br	$(NH_4)_2O$	$(NH_4)_3N$	NH_4OH	$(NH_4)_2SO_4$	$(NH_4)_3PO_4$
Sn^{4+}	$SnBr_4$	Sn_2O_4	Sn_3N_4	$Sn(OH)_4$	$Sn(SO_4)_2$	$Sn_3(PO_4)_4$

* don't forget brackets for polyatomic ions.

Binary Ionic Compounds

Recall that non-metals form molecular (covalent) compounds with other non-metals but they form ionic compounds with metals. The names and formulas of these two types of compounds are handled differently.

A binary compound contains the atoms of only two elements, and binary ionic compounds contain only two types of monatomic ions (charged individual atoms).

The name of any ionic compound is ... name of the metal (1) + name of non-metal ion (2)

eg. NaCl "sodium chloride"

For example, a compound containing sodium ions and chloride ions is called sodium chloride.

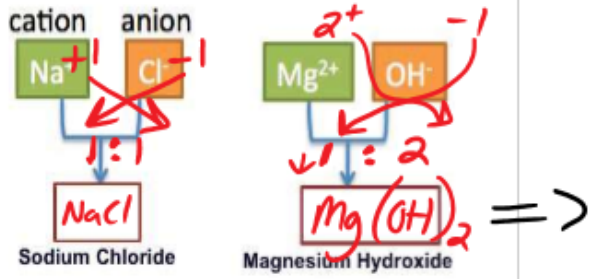
The ratio of ions formed when a particular metal and non-metal react can be predicted through the charge of their common ions, which can be found in the table of common ions in your DATA BOOKLET.

Positively charged ions are called cations *(think of the letter "t" as a + sign)*

Negatively charged ions are called anions.

Note that the sign of the ion charge (+ or –) is written *after the numeral*.

For example, the aluminum ion is denoted as Al^{3+} rather than as Al^{+3}.



The different types of electrical charge are called opposite charges because they have opposing effects.

When particles with opposite charges (+/-) charges bond together, the charges cancel to yield a product with a net charge of zero. = ∅

Ions always associate together in a ratio that results in their charges cancelling to form neutral compounds

separate → combined

$2Al^{3+}(aq) + 3S^{2-}(aq) \rightarrow Al_2S_3(s)$

6+ + 6– = 0

* all compounds are neutral ions that have charges.

ion (+) + ion (-) = neutral (ionic) compound.

The formula Al_2S_3 means that there are $2Al^{3+}$ ions for every $3S^{2-}$ ions.

Chemists know the charges but DO NOT show charges in the formulas of ionic compounds.

The formula of an ionic compound shows that the compound as a whole is neutral even though it contains both positively and negatively charged ions.

Look at the formula of **aluminum sulphide** shown below on the left. The number of aluminum ions equals the numerical value of the sulphide ion's charge and vice versa.

This simple shortcut for determining the formula ← ratio of ions of ionic compounds is sometimes called the "cross-over" *(or 'swap and drop')*.

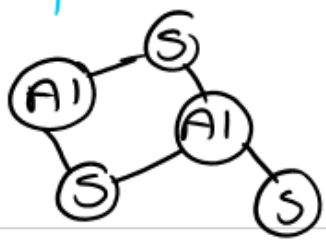
This method matches up the opposite charges so that they cancel and ***will always work if you reduce the formula*** to its simplest ratio.

EXAMPLES:

$Al^{3+} S^{2-}$

2 : 3

Al_2S_3



$Pb^{4+} S^{2-}$

2 : 4 → simplify

1 : 2

PbS_2

Constructing an IONIC COMPOUND from the NAME of the compound

Definition: An **IONIC COMPOUND** is a compound made up of ions.

IMPORTANT: Compounds are **NEUTRAL MOLECULES.** Therefore
(the sum of the "+" ion charges in the molecule) = (the sum of the "–" ion charges in the molecule)

The translation of a chemical name into a chemical formula is a simple process with three rules.

1. **Write the formula for the positive ion first and write the formula for the negative ion second.** (In a chemical name, the **POSITIVE** ion is ***always*** written **FIRST** and the **NEGATIVE** ion is ***always*** **SECOND.** All you do is translate the words in the chemical name into ions in the order they are given.)

   For example: Tin(IV) oxide is translated as Sn^{4+} O^{2-}

2. **"Criss–cross" the numbers in front of the charges on the ions.**

   For example: Sn^{4+} O^{2-} → 2 : 4 → Sn_2O_4

3. **Tidy up the formula in a three–part process.**
   - **If both subscripts can be evenly divided by "2" (or "3", occasionally), do so.**
   - **Omit the superscripted charges.**
   - **Omit any subscript which is a "1".**

   For example: simplify the ratio → SnO_2

PRACTICE

ions

EXAMPLES:

a) **sodium chloride :** Na^+ Cl^- → $NaCl$

b) **potassium oxide :** K^+ O^{2-} → K_2O

c) **calcium phosphide :** Ca^{2+} P^{3-} → Ca_3P_2

ionic compounds neutral

d) **tin(IV) sulphate :** tin(IV) ion = Sn^{4+} sulphate ion = (SO_4^{2-})

$Sn_2(SO_4)_4$ → simplify ÷ 2 → $Sn(SO_4)_2$

Sample Problem — Determining the Name of a Binary Ionic Compound from Its Formula

What is the name of Fe_2S_3?

Fe! transition metal

What to Think about	How to Do It
1. Write the names of the two constituent ions. 2. Write the formulas of the possible compounds to see which one has the correct formula.	Fe^{3+} S^{2-} → Fe_2S_3 "reverse swap + drop" Iron(III) sulfide

need to know charge on ion

chemistry homework

Determining the Names and Formulas of Binary Ionic Compounds

1. Write the formula of each of the following binary ionic com
   (a) lithium sulphide
   (b) chromium(III) oxide
   (c) aluminum ch
   (d) lead(II) sulph

2. Name each of the following binary ionic compounds:
   (a) ZnO _____
   (b) $PbCl_4$ _____
   (c) $CuCl_2$ _____

ANSWERS:

1. a. Li_2S
   b. CrO
   c. $AlCl_3$
   d. PbS
   e. SnI_2
   f. $ZnBr_2$
2. a. zinc oxide
   b. lead(IV) chloride
   c. copper(II) chloride
   d. sodium iodide
   e. potassium sulphide
   f. chromium(II) oxide

• non-metals
• no charge
→ eg. H_2O, CO_2

Polyatomic Ions

nitrite	NO_2^-
sulphite	SO_3^{2-}
nitrate	NO_3^-
sulphate	SO_4^{2-}

Recall that a molecule is a *neutral* group of covalently bonded atoms.

A **polyatomic ion** is a CHARGED group of covalently bonded atoms so it's like a molecule except that it has a charge. -+ / -

They are relatively stable species that often remain intact in chemical reactions.

Many polyatomic ions are oxyanions, consisting of an atom of a given element and some number of oxygen atoms.

Typically the element forms polyatomic ions with different numbers of oxygen atoms.

The prefix "bi-" before the name of a polyatomic ion adds an +1+ to it.

For example: 2- → +1 → -1

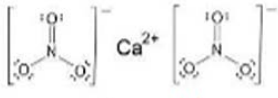
carbonate CO_3^{2-} (hydrogen carbonate) or bicarbonate HCO_3^- ($H^+ + CO_3^{2-}$)

sulphate SO_4^{2-} hydrogen sulphate or bisulphate HSO_4^- ($H^+ + SO_4^{2-}$)

Because they are charged, polyatomic ions associate with oppositely charged ions to form neutral ionic compound

Polyatomic ions are in bracket in formulas. (if multiple)

For example, the formula of calcium nitrate is $Ca(NO_3)_2$

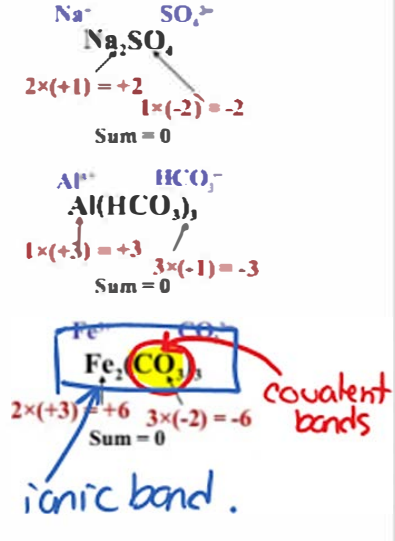


This means that the atoms within the brackets are bonded covalently to each other and as a group they are bonded ionically to the atom or atoms outside the brackets.

The brackets are necessary to show that the formula ratio applies to the entire polyatomic ion, not just to its last atom.

For example, the formula of calcium hydroxide is $Ca(OH)_2$ meaning that there are 2 hydroxide (OH^-) ions for each calcium ion.

By convention, chemists ***omit the brackets if no subscript is required.***
For example, Na(OH) is written as just NaOH.
only 1



Sample Problem — Determining the Formula of any Ionic Compound from Its Name

What is the formula of potassium sulphite?

What to Think about

1. Write the symbols of the ions named.
2. Combine the ions in the simplest ratio that results in their charges cancelling.

How to Do It

Potassium Sulphite

K^+ SO_3^{2-}

2 : 1

$K_2(SO_3)_1$ omit brackets

K_2SO_3

PRACTICE

PRACTICE

polyatomic ion

e) iron(II) phosphate : Fe^{2+} PO_4^{3-} => $Fe_3(PO_4)_2$ (3 : 2)

f) ammonium sulphate : NH_4^+ SO_4^{2-} => $(NH_4)_2SO_4$ (2 : 1)

Sample Problem — Determining the Name of any Ionic Compound from Its Formula

What is the name of $Cr(HSO_4)_2$?

reverse swap + drop

What to Think about

1. Write the names of the two constituent ions.
2. Write the formulas of the possible compounds to see which one has the correct formula.

How to Do It

+2 : -1

multivalent ion

Cr^{2+} Cr^{3+}

$Cr_1(HSO_4)_2$

Chromium (II) bisulphate (or ✓ hydrogen sulphate)

Practice Problems — Determining the Names and Formulas of Ionic Compounds

1. Write the formula of each of the following ionic compounds:
   - (a) barium sulphate
   - (b) silver nitrate
   - (c) mercury(II) bromide
   - (d) tin(IV) oxalate
   - (e) aluminum dichromate
   - (f) potassium fluoride
2. Name each of the following ionic compounds:
   - (a) $Zn(OH)_2$ _____
   - (b) SnO _____
   - (c) $Cu(ClO)_2$ _____
   - (d) $NaCH_3COO$ _____
   - (e) MgI_2 _____
   - (f) $FeCr_2O_7$ _____

ANSWERS:

1. a. $BaSO_4$ d. $Sn(C_2O_4)_2$
   b. AgNO3 e. Al2(Cr2O7)3
   c. HgBr2 f. KF
2. a. zinc hydroxide
   b. tin(II) oxide
   c. copper(II) hypochlorite
   d. sodium ethanoate or sodium acetate
   e. magnesium iodide
   f. iron(II) dichromate

chemistry homework

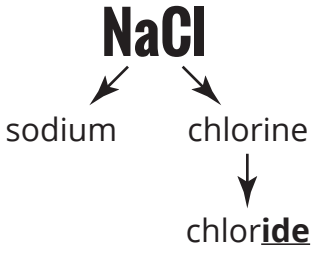
Assignment #8- Hebden pg 71-72 Questions #4-5(odd)

All assignments are to be completed on a separate page with the assignment number & heading. Be sure to show FULL WORKING OUT for all homework.

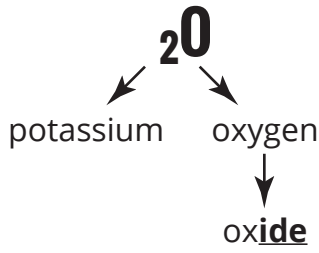
Writing Compound Names

Ionic Bonds
(a bond between a metal and a nonmetal)

Naming a Binary Ionic Compound
(two elements with no transition metals)

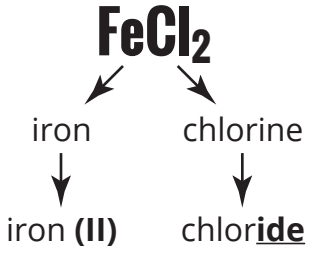


sodium chloride

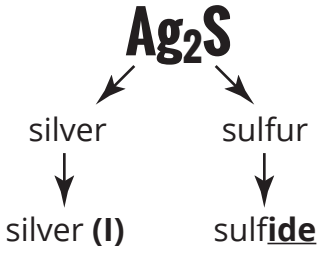


potassium oxide

Naming a Compound with a Transition Metal



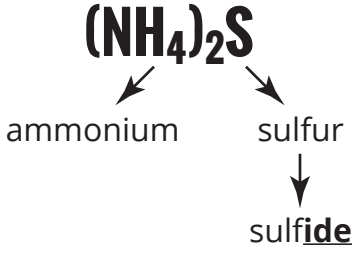
iron (II) chloride



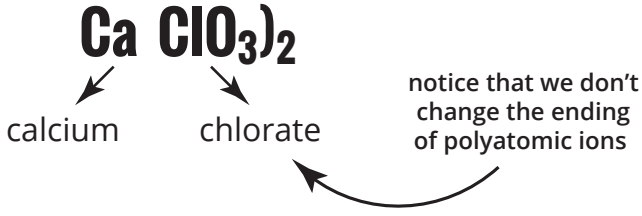
silver (I) sulfide

you can figure out this number based on the number of atoms of the second element

Naming a Compound with a Polyatomic Ion



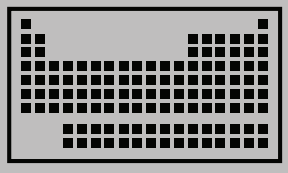
ammonium sulfide



calcium chlorate

Element or Polyatomic Ion?

Elements are found on the **periodic table.**



Elements look like this:

H K O Cu Ag

one capital letter

OR

one capital letter and one lowercase letter

Polyatomic ions are groups of two or more elements.

ClO_3 NH_4 OH

They stick together.

(molecular)

Part B Covalent Compounds: *Names and Formulas of Binary Molecular Compounds*

(Covalent Compounds)

Any cation and anion combine in a single ratio that is easily predictable from their charges. This is why ionic compounds' names do not need to explicitly contain their formulas.

On the other hand, two non-metals atoms may share electrons and combine in several ratios. Therefore, the name of the molecular compound must reveal its formula to distinguish it from the other compounds of the same two elements. The name of a molecular compound uses a prefix code to provide its formula. **The prefixes used are shown in Table 2.4.1.**

Table 4.13 Prefixes Used in Naming Binary Covalent Compounds

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

The names of all binary compounds have an -ide suffix. (ending)

N_2O_4 is therefore di nitrogen tetra oxide. (or tetroxide)

Note that the number of atoms comes ***before the name*** of the element but after the symbol of the element.

* The prefix **mono-** is understood for the first element named if no prefix is stated.

For example, carbon di oxide is CO_2, NOT *mono*carbon dioxide

assumed.

Determining the FORMULA of a Molecular Compound from Its Name

What is the formula of xenon tetrafluoride?

no prefix Xe = 1 F = 4

What to Think about	How to Do It
1. Write the symbols of each element and the number of atoms of each. 2. Rewrite this information as a formula.	XeF_4

tetra

Determining the NAME of a Molecular Compound from Its Formula

What is the name of P_4S_{10}?

P = phosphorus S = Sulphur (f)

deca

What to Think about	How to Do It
1. Write the names of each element and the number of atoms of each. 2. Rewrite this information using the prefix code.	tetraphosphorus decasulphur

-ide

only on the last element.

PRACTICE

Determining the Names and Formulas of Molecular Compound

1. Write the formula of each of the following:
   (a)) nitrogen monoxide
   (b)) nitrogen dioxide
2. Name each of the following molecular compounds:
   (a) PCl_5 _____
   (b) SO_2 _____

ANSWERS:

1. a. NO c. N_2O_4
   b. NO_2 d. N_2O_3
2. a. phosphorus pentachloride
   b. sulphur dioxide
   c. carbon monoxide
   d. Diphosphorus pentoxide

chemistry homework

Assignment #9- Hebden pg 74 Questions #8-9

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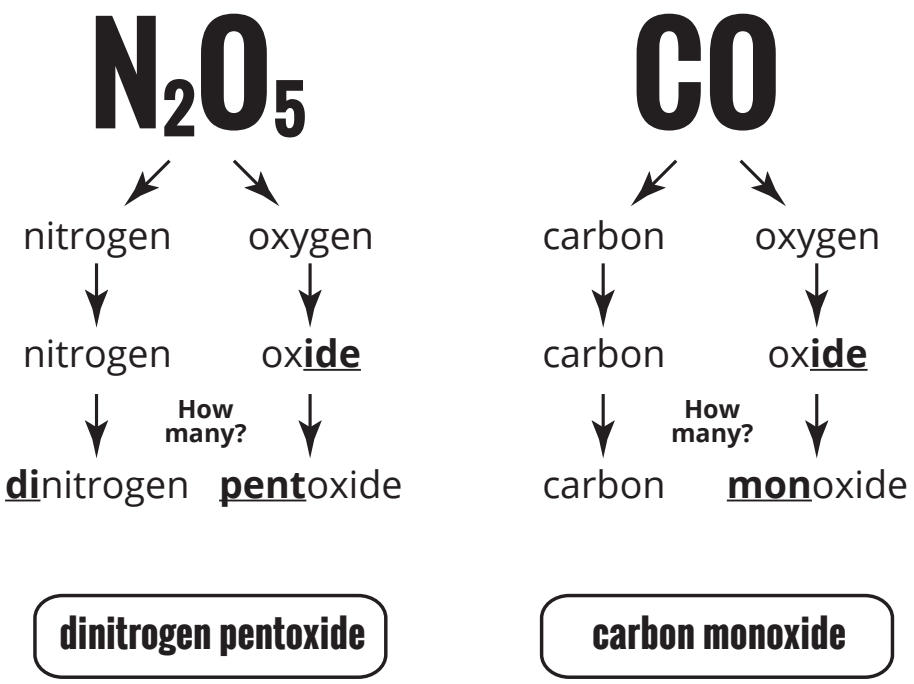
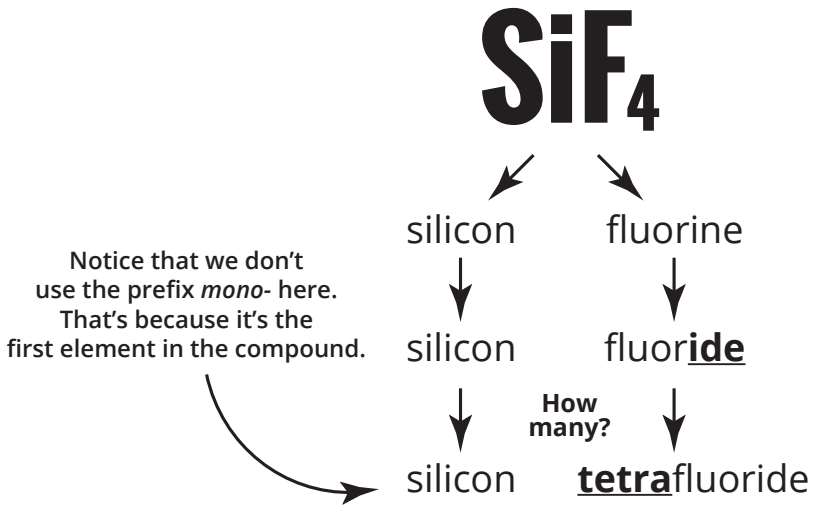
Writing Compound Names

Covalent Bonds
(a bond between two nonmetals)



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



If the element starts with a vowel, you may need to drop the *o-* or *a-* at the end of your prefix.

penta- → pentoxide
di- → dioxide
tetra- → tetroxide
hexa- → hexoxide

"salt" = ionic compound

Part C Naming Hydrates:

When many salts crystallize out of aqueous solution they incorporate water molecules ("trap") in a fixed ratio and pattern into their ionic crystal lattice. (same every time)

These salts are called hydrates. Many salts are supplied as hydrates. and are destined for aqueous solutions *(dissolved in water)* anyway.

* Water is an integral part of hydrates and thus must be accounted for in both their names and their formulas.

The same prefixes used for naming covalent compounds go before the term –hydrate to denote the number of water molecules in the formula. This tells you the Ratio of water molecules to ions. (a "salt")

When a crystal of an ionic compound is grown by evaporation from aqueous solution, frequently it is found that the crystalline structure will include water molecules.

Cu^{2+} SO_4^{2-}

EXAMPLE: When copper(II) sulphate is crystallized from water, the resulting crystals have the formula $CuSO_4 \cdot 5H_2O$ (hydrate ratio)

This formula shows that 5 water molecules are included with (or attached to) every $CuSO_4$.
In other words, $CuSO_4 \cdot 5H_2O$ can be thought of as "$CuSO_4 + 5H_2O$".

The naming:
is straightforward and relies on using a prefix to tell how many water molecules are attached.
Memorize the following prefixes and the numbers they represent.

only for "hydrate" part ratio of H_2O

Prefix used	# of water molecules	Prefix used	# of water molecules
mono	1	hexa	6
di	2	hepta	7
tri	3	octa	8
tetra	4	nona	9
penta	5	deca	10

Determining the Formula of a Hydrate from Its Name

What is the formula of copper(II) sulphate heptahydrate? (H_2O) (hepta = 7)

What to Think about
1. Write the symbols of the ions named.
2. Combine the ions in the simplest ratio that results in their charges cancelling.
3. Tack on the appropriate number of water molecules to complete the formula.

How to Do It

Cu^{2+} SO_4^{2-}

$CuSO_4 + 7\ H_2O$

$CuSO_4 \cdot 7H_2O$

Determining the Name of a Hydrate from its Formula What is the name of $NaCH_3COO \cdot 3H_2O$? (hydrate = H_2O)

ionic (salt) compound.

What to Think about
1. Write the names of the two constituent ions.
2. Tack on the appropriate number of water molecules using the prefix code (–hydrate). (3 = tri)

How to Do It

Sodium acetate trihydrate (H_2O)

Na^{+1} CH_3COO^{-1}

Sodium acetate

name of ionic compound

prefix

EXAMPLE: $CuSO_4 \cdot 5H_2O$ = copper (II) sulphate pentahydrate

$Zn(CH_3COO)_2 \cdot 2H_2O$ = zinc acetate dihydrate

$Ca(NO_3)_2 \cdot 4H_2O$ = calcium nitrate tetrahydrate

ionic salt.

Ca^{2+} NO_3^-

1 : 2

$Ca(NO_3)_2$ $4H_2O$

PRACTICE **Determining the Names and Formulas of Hydrates**

1. Write the formula of each of the following hydrates:
   (a) barium chloride dihydrate
   (b) sodium carbonate monohydrate
   (c) iron(III) nitrate nonahydrate
   (d) barium hydroxide octahydrate

2. Name each of the following hydrates:
   (a) $CoCl_2 \cdot 6H_2O$ _____
   b) $FeCl_3 \cdot 4H_2O$ _____
   (c) $Na_2Cr_2O_7 \cdot 2H_2O$ _____
   (d) $MgSO_4 \cdot 7H_2O$ _____

ANSWERS

1. a. $BaCl_2, 2H_2O$ c. $Fe(NO_3)_3, 9H_2O$
   b. Na_2CO_3, H_2O d. $Ba(OH)_2, 8H_2O$
2. a. cobalt chloride hexahydrate
   b. iron(III) chloride tetrahydrate
   c. sodium dichromate dihydrate
   d. magnesium sulphate heptahydrate

chemistry homework

Assignment #10- Hebden pg 73 Questions #6-7
All assignments are to be completed on a separate page with the assignment number & heading. Be sure to show FULL WORKING OUT for all homework.

Part D Naming Acids:

Acids

$HCl_{(aq)}$ Hydrochloric acid	$HC_2H_3O_2$ Acetic acid
H_2SO_4 Sulfuric acid	$H_3C_6H_5O_7$ Citric acid
HNO_3 Nitric acid	H_3PO_4 Phosphoric acid
H_2CO_3 Carbonic acid	$H_2C_2O_4$ Oxalic acid

An acid can be thought of as one or more ___H^+ ions___ bonded to an anion. Remember that in ionic compounds the ___charges cancel___ (negate each other) without being cancelled (eliminated). In acids however, these ion charges are actually cancelled as the ions convert into ___neutral compounds___ and the group of atoms into a ___molecule___

___Acids___ are a special type of ___molecular___ compound that can be induced to form ions. (in aq solutions)

The names of acids are based on the name of the ___Anion___ formed.

The rules for naming acids depend on whether the anion contains ___oxygen___.
If the anion doesn't contain oxygen, the prefix ___hydro –___ precedes the name of the anion and the suffix ___–ic___ replaces the *–ide in the anion's name.*

Hydrogen fluoride (HF) is ___ide ⇒ ic hydrofluoric acid___
hydrogen chloride (HCl) is ___ide ⇒ ic hydrochloric acid___
hydrogen cyanide (HCN) ___ide ⇒ ic hydrocyanic acid___

There are of course some exceptions. S^{2-} is the sulphide ion, not the sulphuride ion yet hydrogen sulphide (H_2S) is hydrosulphuric acid.

Determining the Formula of an Acid from Its Name

What is the formula of hydrobromic acid?

What to Think about

1. Decode the suffix to determine possible anions: bromic denotes bromide or bromate.
2. Decode the prefix (if any) to select the anion: *hydro-* indicates that the anion doesn't contain oxygen.
3. Determine the formula from the ion charges.

How to Do It

HBr

If the anion **does contain oxygen** then the suffix ___"-ic"___ replaces ___"-ate"___ in the anion's name or the suffix ___"-ous"___ replaces ___"-ite"___ in the anion's name.

1. Hydrogen sulphate (H_2SO_4) is ___sulphuric acid___
2. Hydrogen sulphite (H_2SO_3) is ___sulphurous acid___

If an acid contains a polyatomic ion that ends in "-ate", the acid name will end in "-ic".

"I **ATE** an acid and it was **IC**ky!"
H_2SO_4 = sulf**ATE** ion = sulfur**IC** acid

If an acid contains a polyatomic ion that ends in "-ite", the acid name will end in "-ous".

"I only b**ITE** into things that are delici**OUS**."
H_2SO_3 = sulf**ITE** ion = sulfur**OUS** acid

H^+ NO_2^- = nitrite "ous"

Determining the Name of an Acid from Its Formula

What acid has the formula HNO_2?

What to Think about

1. Write the names of the two constituent ions.
2. Use the code for naming acids. The anion contains oxygen so the suffix *–ous* replaces *–ite* in the anion's name.

How to Do It

Nitrous acid

PRACTICE **Determining the Names and Formulas of Acids**

1. Write the formula

   (a) hydrofluoric a

   (b) hypochlorous

2. Name each of the

   (a) HCH_3COO ___

   (b) H_2SO_3 ___

ANSWERS

1. a. HF
   b. HClO ✓
   c. H_3PO_4
   d. H_2S
2. a. ethanoic or acetic acid
   b. sulphurous acid
   c. carbonic acid
   d. hydriodic acid

SOME COMMON ACIDS

A compound is called an "acid" if the compound has a chemical formula starting with "H". All of the following acids are assumed to be dissolved in water; that is, they are "aqueous solutions".

HF = hydrofluoric acid	H_2SO_4 = sulphuric acid	HNO_3 = nitric acid
HCl = hydrochloric acid	H_2SO_3 = sulphurous acid	HNO_2 = nitrous acid
HBr = hydrobromic acid	H_3PO_4 = phosphoric acid	$HC_2H_3O_2$ or CH_3COOH = acetic acid
HI = hydroiodic acid		

Some additional facts about these acids:

HF is used to "etch" or "frost" glass ,
HCl is present in "stomach acid" and is also called "muriatic acid",
HNO_3 is a very corrosive acid which reacts with most metals,
H_2SO_4 is the acid used in automobile batteries,
H_2SO_3 is one of the principle components of acid rain ,
H_3PO_4 is present in most Cola beverages,
A 5% solution of CH_3COOH is called "vinegar".

SUMMARY : HOW TO PICK THE CORRECT METHOD FOR NAMING A COMPOUND

The first element or ion in a formula is used to decide on the method.

If the first element or ion in the formula is:	Then:
hydrogen	write the name of the acid if the substance is listed under "SOME COMMON ACIDS". use "hydrogen" as the first name and add the name of the anion which follows the "H" if the acid is NOT in the list.
a non–metal (and the formula doesn't contain NH_4)	use the prefix–naming system
a species listed in the table ***Names, Formulae, and Charges of Some Common Ions***	use the name of the cation listed, followed by the name of the anion.
a metal not listed in the table ***Names, Formulae, and Charges of Some Common Ions***	use the Stock system (Roman numerals) for the cation, followed by the name of the anion.

chemistry homework

Assignment #11- Inorganic Naming REVIEW pg 17-18
(page19 is optional extra naming practice)
Review Questions can be completed in the space provided below.

Review Questions

1. In each case below, write out the chemical equation for the a… binary ic… Example… 3 Mg^{2+} +…
(a) sodiu…
(b) iron(…
(c) tin(IV…
(d) chro…

2. Write th… compou…
(a) chro…
(b) alum…
(c) magn…
(d) tin(IV…

3. Write th… compou…
(a) K_2O
(b) ZnBr…
(c) PbO_2
(d) HgCl…

4. Write th… compou…
(a) potas…
(b) man…
(c) iron(III) and sulphur
(d) copper(II) and iodine

5. In each case below, write out the chemical equation … form the given …te)
…onic compounds:
…nic compounds:
…of ions. In BC, we …luding two forms …$CO_3)(OH)_2$ …$_3(CO_3)_2(OH)_2$ …0 …he ions results …ere is more than …n combinations.

Write a possible formula for:
(a) iron(III) sodium chromate
(b) zinc sulphate nitrate

ANSWERS:

1. a. $Na^+ + F^- \rightarrow NaF$
   b. $Fe^{2+} + 2Br^- \rightarrow FeBr_2$
   c. $Sn^{4+} + 4Cl^- \rightarrow SnCl_4$
   d. $2Cr^{3+} + 3S^{2-} \rightarrow Cr_2S_3$
2. a. $CrCl_2$ c. MgI_2
   b. AlF_3 d. SnO_2
3. a. potassium oxide c. lead(IV) oxide
   b. zinc bromide d. mercury(I) chloride
4. a. potassium chloride KCl
   b. manganese(IV) oxide MnO_2
   c. iron(III) sulphide Fe_2S_3
   d. copper(II) iodide CuI_2
5. a. Na+ + NO2 → NaNO2
   b. 3Ag+ + PO43 → Ag3PO4
   c. Li+ + CH3COO → LiCH3COO
   d. 2Cr3+ + 3C2O42→ Cr2(C2O4)3
6. a. $CuClO_4$ c. $Al_2(HPO_4)_3$
   b. $Ca(HS)_2$ d. $Mg(OH)_2$
7. a. barium phosphate
   b. iron(II) bisulphite
   c. lead(IV) binoxalate
   d. copper(I) dihydrogen phosphate
8. a. for e.g. $FeNa(CrO_4)_2$ or $FeNa_3(CrO_4)_3$
   b. for e.g. $Zn_2(SO_4)(NO_3)_2$ or $Zn_3(SO_4)_2(NO_3)_2$

9. Write the formulas of the following molecular compounds:

(a) chlo

(b) tetr

(c) arse

(d) nitr

10. Write t
compc
(a) P_3B

(b) B_2H

(c) SO_3

(d) CF_4

11. Write t
(a) sod

(b) calc

(c) cop

(d) chr

12. Write t
(a) Cd(

(b) Na

(c) CuS

(d) Fe(I

13. Why is

14. Sugge
manne
of wate
rather

15. Write the formulas of the following acids:

(a) hydrobromic acid

(j) magnesium hydroxide

ANSWERS:

9. a. ClO c. AsF_5
b. P_4O_6 d. NI_3

10. a. Triphosphorus pentabromide
b. Diboron hexahydride
c. sulphur tri-oxide
d. carbon tetrafluoride

11. a. Na_2SO_4, $10H_2O$
b. $CaCl_2$, $2H_2O$
c. $Cu(CH_3COO)_2$, H_2O
d. $CrCl_3$, $6H_2O$

12. a. cadmium nitrate, tetrahydrate
b. sodium monohydrogen phosphate, heptahydrate
c. copper(II) sulphate, pentahydrate
d. iron(III) nitrate, nonahydrate

13. because water is combined in a fixed ratio with the salt ions.

14. bracketing the H_2O might suggest that it is a polyatomic ion

15. a. HBr c. $HClO_3$
b. H_2CrO_4 d. HClO

16. a. hydrosulphuric acid c. nitrous acid
b. perchloric acid d. thiocyanic acid

17. a. K_2O f. HCN
b. $HMnO_4$ g. SF_6
c. SO_2 h. $Ca(CH_3COO)_2$, H_2O
d. $(NH_4)_2CO_3$ i. $Cr(HSO_3)_2$
e. $FeSO_4$, $7H_2O$ j. $Mg(OH)_2$

OPTIONAL EXTRA NAMING PRACTICE

You most certainly DO NOT have to complete all of these....I would recommend that you use this as test practice.

COMBINED EXERCISES FOR INORGANIC NAMING

Write the correct name for each of the following.

14. MgO
15. $CuSO_4$
16. $NaCH_3COO$
17. NH_4NO_2
18. $MoCl_5$
19. $LiOH \cdot H_2O$
20. $PtCl_4$
21. NH_4ClO_4
22. AlN
23. $KMnO_4$
24. Cu_2SO_4
25. H_2SO_4
26. $Na_2CO_3 \cdot 10H_2O$
27. Na_2SO_3
28. $Pb(HSO_4)_4$
29. WF_6
30. NaH_2PO_4
31. BaS
32. NH_4ClO_2
33. $Fe(ClO)_2$
34. $Sn(CN)_2$
35. KrF_2
36. Na_3PO_4
37. CaS
38. $Mn(SCN)_2$
39. $AgMnO_4$
40. $Pt_2O_3 \cdot 3H_2O$
41. PBr_5
42. $Cu(CH_3COO)_2$
43. $Al(ClO_4)_3$
44. NH_3
45. Al_2S_3
46. $NaOH$
47. $Ba(HS)_2 \cdot 4H_2O$
48. N_2O
49. HNO_3
50. $CsHCO_3$
51. Cu_2S
52. C_3S_2
53. $Cu(NO_3)_2 \cdot 6H_2O$
54. $Co(ClO_3)_2$
55. Mn_2O_3
56. $Zn(CH_3COO)_2$
57. CH_3COOH
58. $MnPO_4$
59. $Cr(NO_3)_3 \cdot 9H_2O$
60. $Sr(ClO)_2$
61. VN
62. $Pb(C_2O_4)_2$
63. CoF_3
64. $BaSO_3$
65. $CuCr_2O_7$
66. NI_3
67. $CrBr_2$
68. Mg_3P_2
69. $FeSO_4 \cdot 5H_2O$
70. $Ca(OH)_2$
71. H_3PO_4
72. $RaSO_4$
73. KHC_2O_4
74. Cl_2O
75. TiO_2
76. $NiSO_4 \cdot 7H_2O$
77. $Mg(ClO_2)_2$
78. $PbCl_4$
79. $Fe(HC_2O_4)_3$
80. I_2O_5
81. $Hg(NO_3)_2$
82. $Zn(OH)_2$
83. H_2S
84. XeO_3
85. $TiCl_2$
86. HF
87. $Sn(CrO_4)_2$
88. $Co_3(PO_4)_2 \cdot 8H_2O$
89. PtS_2

Write the chemical formula for each of the following.

90. silver chloride
91. sulphur dioxide
92. iron(III) oxalate
93. beryllium oxide
94. lead(II) acetate decahydrate
95. potassium chromate
96. mercury(I) acetate
97. molybdenum(III) chloride
98. ammonia
99. gold(III) sulphide
100. silver dichromate
101 calcium acetate
102. chromium(III) oxalate
103 calcium nitrite
104. difluorine dioxide
105. molybdenum(V) oxide
106. silicon tetrafluoride
107. cadmium(II) acetate
108. mercury(II) chloride
109. lithium hydrogen sulphite
110. acetic acid
111. magnesium chlorate hexahydrate
112. phosphorus trifluoride
113. copper(II) iodide
114. calcium nitride
115. magnesium hydroxide
116. molybdenum(V) sulphide trihydrate
117. iron(II) dihydrogen phosphate
118. carbon tetraiodide
119. zinc sulphate
120. mercury(I) sulphide
121. sulphurous acid
122. iron(II) fluoride octahydrate
123. magnesium hydrogen sulphate
124. aluminum sulphide
125. radium carbonate
126. xenon tetrafluoride
127. sodium oxide
128. barium phosphate
129. mercury(I) nitrate dihydrate
130. sodium hypochlorite
131. gold(I) cyanide
132. tin(IV) bromide
133. hydroiodic acid
134. tetrasulphur tetranitride
135. iron(II) hydroxide
136. copper(I) fluoride
137. tin(II) hydrogen carbonate
138. dinitrogen pentoxide
139. zinc hydrogen sulphite
140. zinc perchlorate hexahydrate
141. gold(III) nitrate
142. manganese(III) sulphate
143. hydrochloric acid
144. chromium(II) oxide
145. zinc hydrogen sulphide
146. molybdenum(VI) sulphide
147. iron(III) carbonate
148. iodine pentafluoride
149. manganese(IV) oxide
150. hydrogen cyanide
151. iron(III) sulphate nonahydrate
152. potassium nitrite
153. chromium(III) phosphide
154. nickel(II) hydroxide
155. chlorine tetroxide
156. mercury(II) thiocyanate
157. nitrous acid
158. lead(II) carbonate
159. sodium hydrogen oxalate
160. aluminum bromide hexahydrate
161. lead(II) iodide
162. silver oxide
163. manganese(IV) monohydrogen phosphate