
Welcome!

This is a chemistry lesson covering *how to name covalent and ionic compounds*.

I will guide you step-by-step.

I will be asking you many questions along the way.

Each time I ask a question, **you should attempt to answer the question on your own** before you scroll down to view my answer.

This is a lesson in the chapter “Atoms, Molecules, and Compounds”, which is part of the series “Chemistry, Explained Step by Step”.

This lesson builds on the material covered in the previous lessons:

Ions,
Ionic Compounds and Covalent Compounds, and
Distinguishing Ionic and Covalent Compounds

You should complete those lessons before attempting this lesson.

This lesson was written by Freelance-Teacher.

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To succeed with naming compounds, you must first be familiar with the names and chemical symbols for the elements that commonly appear.

In an earlier lesson, we learned the following names and chemical symbols:

lithium = Li
nitrogen = N
oxygen = O
fluorine = F
sodium = Na
magnesium = Mg
aluminum = Al
phosphorus = P
sulfur = S
chlorine = Cl
potassium = K
calcium = Ca
bromine = Br
iodine = I

Here is a quiz covering those names.

What is the name of the element whose atomic symbol is Mg?

Mg represents the element *magnesium*.

What is the name of the element whose atomic symbol is Na?

Na represents the element *sodium*.

What is the name of the element whose atomic symbol is N?

N represents the element *nitrogen*.

What is the name of the element whose atomic symbol is O?

O represents the element *oxygen*.

What is the name of the element whose atomic symbol is Ca?

Ca represents the element *calcium*.

What is the name of the element whose atomic symbol is S?

S represents the element *sulfur*.

What is the name of the element whose atomic symbol is Cl?

Cl represents the element *chlorine*.

What is the name of the element whose atomic symbol is Li?

Li represents the element *lithium*.

What is the name of the element whose atomic symbol is P?

P represents the element *phosphorus*.

What is the name of the element whose atomic symbol is K?

K represents the element *potassium*.

What is the name of the element whose atomic symbol is F?

F represents the element *fluorine*.

What is the name of the element whose atomic symbol is Al?

Al represents the element *aluminum*.

What is the name of the element whose atomic symbol is Br?

Br represents the element *bromine*.

What is the name of the element whose atomic symbol is I?

I represents the element *iodine*.

Now I will quiz you on the symbols for these elements.

What is the atomic symbol for the element bromine?

The symbol for bromine is Br.

What is the atomic symbol for the element oxygen?

The symbol for oxygen is O.

What is the atomic symbol for the element fluorine?

The symbol for fluorine is F.

What is the atomic symbol for the element aluminum?

The symbol for aluminum is Al.

What is the atomic symbol for the element chlorine?

The symbol for chlorine is Cl.

What is the atomic symbol for the element potassium?

The symbol for potassium is K.

What is the atomic symbol for the element iodine?

The symbol for iodine is I.

What is the atomic symbol for the element lithium?

The symbol for lithium is Li.

What is the atomic symbol for the element nitrogen?

The symbol for nitrogen is N.

What is the atomic symbol for the element phosphorus?

The symbol for phosphorus is P.

What is the atomic symbol for the element sulfur?

The symbol for sulfur is S.

What is the atomic symbol for the element calcium?

The symbol for calcium is Ca.

What is the atomic symbol for the element sodium?

The symbol for sodium is Na.

What is the atomic symbol for the element magnesium?

The symbol for magnesium is Mg.

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1. Is $MgCl_2$ an ionic compound or a covalent compound?

As we learned in the lesson on Distinguishing Ionic and Covalent Compounds, the rule is:

If the formula contains a metal and a nonmetal, it usually represents an ionic compound.

If the formula contains only nonmetals, it usually represents a covalent compound.

$MgCl_2$ contains
a metal (magnesium)
and a nonmetal (chlorine).

Based on the rule above, we conclude that
$MgCl_2$ is an ionic compound.

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2. Is OCl_2 an ionic compound or a covalent compound?

OCl_2 contains
two nonmetals (oxygen and chlorine).

Based on the rule above, we conclude that
OCl_2 is a covalent compound.

A covalent compound is typically composed of two or more nonmetals.

For example: H_2O, NH_3, CO_2, OCl_2, $C_6H_{12}O_6$, H_2SO_4, HNO_3

A *binary compound* is a compound formed by *exactly two* elements.

A *binary covalent compound* is a covalent compound formed by *exactly two* nonmetallic elements.

For example:

H_2O, NH_3, CO_2, and OCl_2 are all binary covalent compounds,
because they are each composed of exactly two different nonmetallic elements.

$C_6H_{12}O_6$, H_2SO_4, HNO_3 are covalent compounds,
but they are not *binary* covalent compounds,
because they are each composed of three different nonmetallic elements.

In this lesson, we will learn how to name binary covalent compounds;
and then we will learn how to name binary ionic compounds.

Here are six rules for naming binary *covalent* compounds.

1. The elements appear *in the same order* in the name as in the chemical formula.

2. The element that appears first in the name
is referred to by the same name in the compound as the name of the element.

3. The element that appears second in the name
is referred to in the compound by a name that ends with the suffix -ide.

4. Covalent compounds use Greek prefixes to represent the number of atoms of each element in the chemical formula.

5. The second element in the name *always* takes a Greek prefix.

6. If the formula contains two or more atoms of the first element, then the first element in the name takes a Greek prefix.

If the formula contains one atom of the first element, then the first element in the name omits the Greek prefix.

Another way to express Rules 5 and 6 is:

The prefix mono- should be used (when appropriate) for the second element in the name, but never for the first element;
all the other Greek prefixes can be used for *either* the first or second element in the name.

Here are the Greek prefixes used in naming covalent compounds:

Number of atoms of the element	**Prefix**	**Usage**
1 atom	mono-	used for the second element in the name only
2 atoms	di-	used for either the first or second element in the name
3 atoms	tri-	used for either the first or second element
4 atoms	tetra-	used for either the first or second element
5 atoms	penta-	used for either the first or second element
6 atoms	hexa-	used for either the first or second element

For example:

3. What is the name of the compound represented by the chemical formula P_4S_3?

Answer: the name of P_4S_3 is *tetraphosphorus trisulfide*

Analysis:

First, we must check whether P_4S_3 is an ionic compound or a covalent compound.

P_4S_3 contains
two nonmetals (phosphorus and sulfur)
so P_4S_3 is a covalent compound.

Therefore, in order to name P_4S_3 properly,
we must follow the rules we just learned on this page for naming *covalent* compounds.

The name of P_4S_3 is *tetraphosphorus trisulfide*.

Notice that:

The elements appear in the same order in the name as in the chemical formula.
Phosphorus appears first in both the name and the formula.
Sulfur appears second in the name, with the suffix -ide.

As stated in Rules 2 and 3 above,

the element that appears first in the name is referred to by the same name in the compound as the name of the element
(the element phosphorus is referred to as “phosphorus”);

while the element that appears second in the name is referred to in the compound by a name that ends with the suffix -ide
(the element sulfur is referred to as “sulfide”).

Furthermore, notice that:

The formula contains four phosphorus atoms and three sulfur atoms,
so we use the prefixes tetra- and tri- to indicate the numbers of each.

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4. What is the name of CO_2?

Answer: the name of CO_2 is *carbon dioxide*

Analysis:

First, we must check whether CO_2 is an ionic compound or a covalent compound.

CO_2 contains
two nonmetals (carbon and oxygen)
so CO_2 is a covalent compound.

The name of CO_2 is *carbon dioxide*.

Notice that:

The elements appear in the same order in the name as in the chemical formula.
Carbon appears first in the name and formula.
Oxygen appears second in the name, with the suffix -ide.

The formula contains one carbon and two oxygens,
but the prefix mono- is omitted for the *first* element in the name,
so we use only the prefix di-.

No doubt you have heard of carbon dioxide.

It is the gas exhaled by animals, and absorbed by plants.

For the prefixes that end with the letter “o” or “a” (i.e., mono-, tetra-, penta-, and hexa-)
if the name of the element begins with a vowel,
then the last letter of the prefix is omitted, for ease of pronunciation.

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5. What is the name of the compound represented by the chemical formula CO?

Answer: the name of CO is *carbon monoxide*

Analysis:

First, we must check whether CO is an ionic compound or a covalent compound.

CO contains
two nonmetals (carbon and oxygen)
so CO is a covalent compound.

The name of CO is *carbon monoxide*.

Notice that:

The elements appear in the same order in the name as in the chemical formula.
Carbon appears first in both the name and the formula.
Oxygen appears second in the name, with the suffix -ide.

The formula contains one carbon and one oxygen,
but the prefix mono- is omitted for the *first* element in the name,
so we use the prefix mono- only for the oxygen, not for the carbon.

The prefix mono- ends with the letter "o",
and the name "oxygen" begins with a vowel,
so, in this case, the last letter of the prefix is omitted, for ease of pronunciation.

(I think you can see that "carbon monoxide" sounds better than "carbon monooxide".)

The moral of this problem is that

the prefix mono- *should* be used (when appropriate) for the second element in the name, but never for the first element;
all the other Greek prefixes can be used for *either* the first or second element in the name.

You have probably heard of carbon monoxide.

It is a poisonous gas present in car exhaust fumes.

Notice that a small change in the chemical formula, CO_2 versus CO,
can mean the difference between a harmless gas and a poisonous one.

That's why it's important to report the names and chemical formulas for compounds accurately!

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6. What is the name of the compound represented by the chemical formula NF_3?

Answer: the name of NF_3 is *nitrogen trifluoride*

Analysis:

First, we must check whether NF_3 is an ionic compound or a covalent compound.

NF_3 contains
two nonmetals (nitrogen and fluorine)
so NF_3 is a covalent compound.

The name of NF_3 is *nitrogen trifluoride*.

Notice that:

The elements appear in the same order in the name as in the chemical formula.
Nitrogen appears first in both the name and the formula.
Fluorine appears second in the name, with the suffix -ide.

The formula contains one nitrogen and three fluorines,
but the prefix mono- is omitted for the *first* element in the name,
so we use only the prefix tri-.

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7. What is the name of the compound represented by the chemical formula N_2O_4?

Answer: the name of N_2O_4 is *dinitrogen tetroxide*

Analysis:

First, we must check whether N_2O_4 is an ionic compound or a covalent compound.

N_2O_4 contains
two nonmetals (nitrogen and oxygen)
so N_2O_4 is a covalent compound.

The name of N_2O_4 is *dinitrogen tetroxide*.

Notice that:

The elements appear in the same order in the name as in the chemical formula.
Nitrogen appears first in both the name and the formula.
Oxygen appears second in the name, with the suffix -ide.

The formula contains two nitrogens and four oxygens, so we use the prefixes di- and tetra-.

The prefix tetra- ends with the letter "a",
and the name "oxygen" begins with a vowel,
so, in this case, the last letter of the prefix is omitted, for ease of pronunciation.

(Chemists think that "dinitrogen tetroxide" sounds better than "dinitrogen tetraoxide".)

Remember, **the prefix is omitted for the first element in the name *only when the prefix would be mono-*;**

otherwise, *both* elements in the name of a covalent compound should have a Greek prefix.

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8. From memory, write down all the numerical Greek prefixes, from one to six.

Number of atoms of the element	Prefix	Usage
1 atom	mono-	used for the second element in the name only
2 atoms	di-	used for either the first or second element in the name
3 atoms	tri-	used for either the first or second element
4 atoms	tetra-	used for either the first or second element
5 atoms	penta-	used for either the first or second element
6 atoms	hexa-	used for either the first or second element

You need to memorize these prefixes!

It's possible that your professor may also require you to memorize additional Greek prefixes for seven through ten:

Number of atoms of the element	Prefix	Usage
7 atoms	hepta-	used for either the first or second element
8 atoms	octa-	used for either the first or second element
9 atoms	nona-	used for either the first or second element
10 atoms	deca-	used for either the first or second element

We have learned the rules for naming *covalent* compounds.

Our next job is to learn how to name *ionic* compounds.

For purposes of naming ionic compounds, there are a few more element names and atomic symbols that you will need to know:

strontium = Sr
cesium = Cs
barium = Ba

Please memorize the names and symbols in this list.

Then take the following quiz.

What is the name of the element whose symbol is Sr?

Sr represents the element *strontium*.

What is the symbol for the element cesium?

The symbol for cesium is Cs.

What is the name of the element whose symbol is Ba?

Ba represents the element *barium*.

What is the symbol for the element strontium?

The symbol for strontium is Sr.

What is the name of the element whose symbol is Cs?

Cs represents the element *cesium*.

What is the symbol for the element barium?

The symbol for barium is Ba.

Let's review some material you should be familiar with from the lesson on Ions.

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9. What is an ion?

An ion is defined as
an atom or group of atoms
with a net electric charge.

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10. What is the name of a positively charged ion?
What is the name of a negatively charged ion?

A positively charged ion is called a *cation*.

A negatively charged ion is called an *anion*.

Here are some memory aids to help you remember these definitions.

In the word "anion", we can suppose that the letter "n" stands for "negative".

So we can imagine that the letters of the word "A-N-ION" spell "A Negative ION".

In the word "cation", the letter "t" looks a little like a + symbol

So we can imagine that the last five letters of the word "c a-t-ion" spell "a + ion";
i.e., "a positive ion".

A *single* atom with an electric charge is called a *monatomic* ion.

A *group* of atoms with an electric charge is called a *polyatomic* ion.

("Mono-" is from the Greek word for "one"; "poly-" is from the Greek word for "many".)

Some examples of monatomic cations:

Na^{+}, Mg^{2+}, Al^{3+}

Some examples of monatomic anions:

N^{3-}, O^{2-}, F^{-}

Some examples of polyatomic anions:

ClO^{-}, ClO_2^{-}, ClO_3^{-}, ClO_4^{-},

NO_3^{-}, CO_3^{2-}, SO_4^{2-}, PO_4^{3-}

CN^{-}, OH^{-}

The only example of a polyatomic cation which we will discuss in this chapter is:

NH_4^{+}

In this lesson, we will focus on examples involving *monatomic* ions.

We will deal with examples involving polyatomic ions in a later lesson.

Rule for Directly Naming *Monatomic Cations*:

The name of a cation is the *same* as the name of the element;
plus the word “ion” (or, “cation”).

Rule for Directly Naming *Monatomic Anions*:

The name of a monatomic anion is *adapted* from the name of the element, but with the suffix -ide;
plus the word “ion” (or, “anion”).

Here are the names for some *monatomic anions*:

F^-, fluoride ion
Cl^-, chloride ion
Br^-, bromide ion
I^-, iodide ion
O^{2-}, oxide ion
S^{2-}, sulfide ion
N^{3-}, nitride ion

Notice that, in each case,

the name of the monatomic anion is adapted from the name of the element, but with the suffix -ide;
plus the word “ion”.

It would also be acceptable to say that

F^- is a fluoride anion (or just, F^- is fluoride),
O^{2-} is an oxide anion (or just, O^{2-} is oxide),
etc.

Pay particular attention to the ion N^{3-}.

I find that students tend to have extra trouble remembering the name for this ion.

Remember: the name for N^{3-} is “nitride ion”.

Here are the names for some *monatomic cations*:

Li^+, lithium ion
Na^+, sodium ion
K^+, potassium ion
Cs^+, cesium ion
Mg^{2+}, magnesium ion
Ca^{2+}, calcium ion
Sr^{2+}, strontium ion
Ba^{2+}, barium ion
Al^{3+}, aluminum ion

Notice that, in each case, the cation is given the *same name* as the uncharged element, plus the word "ion".

It would also be acceptable to say that

Li^+ is a lithium cation,
Mg^{2+} is a magnesium cation,
etc.

To summarize:

Rule for Directly Naming *Monatomic Cations*:

The name of a cation is the *same* as the name of the element;
plus the word "ion" (or, "cation").

Rule for Directly Naming *Monatomic Anions*:

The name of a monatomic anion is *adapted* from the name of the element, but with the suffix -ide;
plus the word "ion" (or, "anion").

Rule for Directly Naming Monatomic *Cations*:

The name of a cation is the *same* as the name of the element;
plus the word “ion” (or, “cation”).

Rule for Directly Naming *Monatomic Anions*:

The name of a monatomic anion is *adapted* from the name of the element, but with the suffix -ide;
plus the word “ion” (or, “anion”).

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11. What is the name of the ion formed by oxygen?

Oxygen forms a monatomic anion: O^{2-}

(If you don’t know how we figured out the charge on the ion,
you should review the lesson on Ions.)

Rule for Directly Naming Monatomic *Anions*:

The name of a monatomic anion is *adapted* from the name of the element, but with the suffix -ide;
plus the word “ion” (or, “anion”).

So the name of O^{2-} is *oxide ion*.

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12. What is the name of the ion formed by iodine?

Iodine forms a monatomic anion: I^{-}

Rule for Directly Naming *Monatomic Anions*:

The name of a monatomic anion is *adapted* from the name of the element, but with the suffix -ide;
plus the word “ion” (or, “anion”).

So the name of I^{-} is *iodide ion*.

---

13. What is the name of the ion formed by sodium?

Sodium forms a monatomic cation: Na^+

(If you don't know how we figured out the charge on the ion,
review the lesson on Ions.)

Rule for Directly Naming Monatomic *Cations*:

The name of a cation is the *same* as the name of the element;
plus the word "ion" (or, "cation").

So the name of Na^+ is *sodium ion*.

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14. What is the name of the ion formed by magnesium?

Magnesium forms a monatomic cation: Mg^{2+}

Rule for Directly Naming Monatomic *Cations*:

The name of a cation is the *same* as the name of the element;
plus the word "ion" (or, "cation").

So the name of Mg^{2+} is *magnesium ion*.

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15. What is the structure of water (H_2O)?

H_2O consists of two nonmetals (hydrogen and oxygen),
so water is a *covalent* compound.

We studied the structure of covalent compounds in the lesson on Ionic and Covalent Compounds.

As a covalent compound,
water consists of many, many, many *separate* H_2O molecules.

As is indicated by the chemical formula (H_2O),
each water molecule consists of two hydrogen atoms and one oxygen atom.

Each molecule is held together by covalent bonds between the atoms.

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16. What is the structure of the compound K_2O?

K_2O contains a metal (K) and a nonmetal (O),
so K_2O is an *ionic* compound.

We studied the structure of ionic compounds in the lesson on Ionic and Covalent Compounds.

As an ionic compound,
K_2O consists of a *continuous*, solid, three-dimensional array
of many, many, many K^+ cations and O^{2-} anions.

As is indicated by the chemical formula (K_2O),
the cations and anions appear in the array in a 2:1 ratio
(i.e., twice as many K^+ cations as O^{2-} anions).

The array is held together by the attractions between the cations and the anions.

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17. What is the structure of the compound AlF_3?

AlF_3 contains a metal (Al) and a nonmetal (F),
so AlF_3 is an *ionic* compound.

As an ionic compound,
AlF_3 consists of a *continuous*, solid, three-dimensional array
of many, many, many Al^{3+} cations and F^- anions.

As is indicated by the chemical formula (AlF_3),
the cations and anions appear in the array in a 1:3 ratio
(i.e., three times as many F^- anions as Al^{3+} cations).

The array is held together by the attractions between the cations and the anions.

If you don't know how we determined the charges on the ions,
you should review the lesson on Ions.

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18. What is the structure of the compound Al_2O_3?

Al_2O_3 contains a metal (Al) and a nonmetal (O),
so Al_2O_3 is an *ionic* compound.

As an ionic compound,
Al_2O_3 consists of a *continuous*, solid, three-dimensional array
of many, many, many Al^{3+} cations and O^{2-} anions.

As is indicated by the chemical formula (Al_2O_3),
the cations and anions appear in the array in a 2:3 ratio
(i.e., two Al^{3+} cations for every three O^{2-} anions).

The array is held together by the attractions between the cations and the anions.

We're finally ready to learn how to name an *ionic* compound.

In the name for the ionic compound,
the cation is named first, and
the anion is named second.

Earlier we learned these rules for naming monatomic cations and monatomic anions:

Rule for *Directly* Naming Monatomic *Cations*:

The name of a cation is the *same* as the name of the element;
plus the word "ion" (or, "cation").

Rule for *Directly* Naming Monatomic *Anions*:

The name of a monatomic anion is *adapted* from the name of the element, but with the suffix -ide;
plus the word "ion" (or, "anion").

These are the rules that we apply when *directly* naming a cation or directly naming an anion.

The rules for naming a cation and an anion *as part of an ionic compound* are similar, but simpler:

Rule for Naming a Monatomic Cation as part of an ionic compound:

The name of a cation is the *same* as the name of the element.

Rule for Naming a Monatomic Anion as part of an ionic compound:

The name of a monatomic anion is *adapted* from the name of the element, but with the suffix -ide.

The moral is:

When *directly* naming a cation or an anion,
the name ends with the word "ion";

but when naming a cation or an anion *as part of an ionic compound*,
the name does *not* include the word "ion".

And here's one more rule:

The subscripts in the formula for an *ionic* compound
are *not* referred to in the name of the compound.

(Earlier, we saw that the subscripts in the formula for a *covalent* compound
are referred to in the name of the compound.)

Let's summarize all these rules:

In the name for the ionic compound,
the cation is named first, and
the anion is named second.

Rule for Naming a Monatomic Cation as part of an ionic compound:

The name of a monatomic cation is the *same* as the name of the element.

Rule for Naming a Monatomic Anion as part of an ionic compound:

The name of a monatomic anion is *adapted* from the name of the element, but with the suffix -ide.

The subscripts in the formula for an ionic compound are not referred to in the name of the compound.

(In contrast, the subscripts in the formula for a *covalent* compound *are* referred to in the name of the compound.)

We'd better clarify all these rules with some examples!

We'll do that on the next page.

Here are the rules for naming an ionic compound:

In the name for the ionic compound,
the cation is named first, and
the anion is named second.

Rule for Naming a Monatomic Cation as part of an ionic compound:

The name of the monatomic cation is the *same* as the name of the element.

Rule for Naming a Monatomic Anion as part of an ionic compound:

The name of the monatomic anion is *adapted* from the name of the element, but with the suffix -ide.

The subscripts in the formula for an ionic compound do *not* affect the name of the ionic compound.

(This rule does *not* apply to covalent compounds.)

For example:

19. What is the name of the compound represented by the formula $AlBr_3$?

Answer:

The name of $AlBr_3$ is *aluminum bromide*.

Analysis:

The first step is to identify whether $AlBr_3$ is an ionic compound or a covalent compound.

$AlBr_3$ consists of both a metal (Al) and a nonmetal (Br), so $AlBr_3$ is an ionic compound.

The ionic compound $AlBr_3$ consists of:

Al^{3+} cations, and
Br^- anions

So we apply the rules we have just learned for naming *ionic* compounds.

The name of the compound is *aluminum bromide*.

Notice that:

The name of the cation (aluminum ion) appears first, but without the word “ion”.

The name of the anion (bromide ion) appears second, but without the word “ion”.

The name of the monatomic cation (aluminum) is the same as the name of the neutral element.

The name of the monatomic anion (bromide) ends with the suffix -ide.

The implied subscript $_1$ and the written subscript $_3$ from the formula do not affect the name of the ionic compound.

---

20. What is the name of Li_2O?

Answer:

The name of Li_2O is *lithium oxide*.

Analysis:

The first step is to identify whether Li_2O is an ionic compound or a covalent compound.

Li_2O consists of both a metal (Li) and a nonmetal (O), so Li_2O is an ionic compound.

The ionic compound Li_2O consists of:

lithium cations (Li^+), and
oxide anions (O^{2-}).

So we apply the rules we have learned for naming ionic compounds.

The name of the compound is *lithium oxide*.

Notice that:

The name of the cation (lithium ion) appears first, but without the word “ion”.

The name of the anion (oxide ion) appears second, but without the word “ion”.

The name of the monatomic cation (lithium) is the same as the name of the neutral element.

The name of the monatomic anion (oxide) ends with the suffix -ide.

The written subscript $_2$ and the implied subscript $_1$ from the formula do not affect the name of the ionic compound.

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21. What is the name of Al_2S_3?

Answer:

The name of Al_2S_3 is *aluminum sulfide*.

Analysis:

The first step is to identify whether Al_2S_3 is an ionic compound or a covalent compound.

Al_2S_3 consists of both a metal (Al) and a nonmetal (S), so Al_2S_3 is an ionic compound.

The ionic compound Al_2S_3 consists of:

aluminum cations (Al^{3+}), and
sulfide anions (S^{2-}).

So we apply the rules we have learned for naming ionic compounds.

The name of the compound is *aluminum sulfide*.

Notice that:

The name of the cation (aluminum) appears first.

The name of the anion (sulfide) appears second.

The name of the monatomic cation (aluminum) is the same as the name of the neutral element.

The name of the monatomic anion (sulfide) ends with the suffix -ide.

The subscripts $_2$ and $_3$ from the formula do not affect the name of the ionic compound.

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22. What is the name of KCl?

Answer:

The name of KCl is *potassium chloride*.

Analysis:

The first step is to identify whether KCl is an ionic compound or a covalent compound.

KCl consists of both a metal (K) and a nonmetal (Cl), so KCl is an ionic compound.

The ionic compound KCl consists of:

potassium cations (K^+), and
chloride anions (Cl^-).

So we apply the rules we have learned for naming ionic compounds.

The name of the compound is *potassium chloride*.

Notice that:

The name of the cation (potassium) appears first.

The name of the anion (chloride) appears second.

The name of the monatomic cation (potassium) is the same as the name of the neutral element.

The name of the monatomic anion (chloride) ends with the suffix -ide.

The implied subscripts $_1$ and $_1$ from the formula do not affect the name of the ionic compound.

---

23. What is the name of SCl_2?

The first step is to identify whether SCl_2 is an ionic compound or a covalent compound.

SCl_2 consists of two nonmetals (sulfur and chlorine), so SCl_2 is a *covalent* compound.

The main purpose of this page is to practice naming ionic compounds,
but I threw in this *covalent* compound to keep you on your toes.

Remember that, unlike ionic compounds,
the names of covalent compounds use *Greek prefixes* to indicate how many atoms of each element are present in the chemical formula.

Therefore, the name of SCl_2 is *sulfur dichloride*.

Notice that:

The elements appear in the same order in the name as in the chemical formula.

Sulfur appears first in the name and formula.

Chlorine appears second in the name, with the suffix -ide.

The formula contains one sulfur and two chlorines,
but the prefix mono- is omitted for the *first* element in the name,
so we use only the prefix di-.

Remember:

Unlike ionic compounds,
the names of covalent compounds use *Greek prefixes* to indicate how many atoms of each element are present in the chemical formula.

All of the examples of ionic compounds on this page involved monatomic ions only.

We will work on examples involving polyatomic ions in a later lesson.

Let’s do one more round of integrated practice.

---

24. What is the name of the compound represented by the chemical formula NO?

Answer: the name of NO is *nitrogen monoxide*

Analysis:

First, we must check whether NO is an ionic compound or a covalent compound.

NO contains
two nonmetals (nitrogen and oxygen)
so NO is a covalent compound.

So we apply the rules we have learned for naming covalent compounds.

The name of NO is *nitrogen monoxide*.

Notice that:

The elements appear in the same order in the name as in the chemical formula.

Nitrogen appears first in both the name and the formula.

Oxygen appears second in the name, with the suffix -ide.

The formula contains one nitrogen and one oxygen,
but the prefix mono- is omitted for the first element in the name,
so we use the prefix mono- only for the second element.

---

25. What is the name of $BaCl_2$?

Answer:

The name of $BaCl_2$ is *barium chloride*.

Analysis:

The first step is to identify whether $BaCl_2$ is an ionic compound or a covalent compound.

$BaCl_2$ consists of both a metal (Ba) and a nonmetal (Cl), so $BaCl_2$ is an ionic compound.

The ionic compound $BaCl_2$ consists of:

barium cations (Ba^{2+}), and
chloride anions (Cl^-).

So we apply the rules we have learned for naming ionic compounds.

The name of the compound is *barium chloride*.

Notice that:

The name of the cation (barium ion) appears first, but without the word “ion”.

The name of the anion (chloride ion) appears second, but without the word “ion”.

The name of the monatomic cation (barium) is the same as the name of the neutral element.

The name of the monatomic anion (chloride) ends with the suffix -ide.

The implied subscript $_1$ and the written subscript $_2$ from the formula do not affect the name of the ionic compound.

---

26. What is the name of the compound represented by the chemical formula Cl_2O_6?

Answer: the name of Cl_2O_6 is *dichlorine hexoxide*

Analysis:

First, we must check whether Cl_2O_6 is an ionic compound or a covalent compound.

Cl_2O_6 contains
two nonmetals (chlorine and oxygen)
so Cl_2O_6 is a covalent compound.

So we apply the rules we have learned for naming covalent compounds.

The name of Cl_2O_6 is *dichlorine hexoxide*.

Notice that:

The elements appear in the same order in the name as in the chemical formula.

Chlorine appears first in both the name and the formula.

Oxygen appears second in the name, with the suffix -ide.

The formula contains two chlorines and six oxygens,
so we use the prefix di- for the first element
and the prefix hexa- for the second element (omitting the "a").

Hexa- ends with an "a", and "oxide" begins with a vowel,
so we omit the letter "a" from the prefix hexa-, for ease of pronunciation.

---

27. What is the name of LiCl?

Answer:

The name of LiCl is *lithium chloride*.

Analysis:

The first step is to identify whether LiCl is an ionic compound or a covalent compound.

LiCl consists of both a metal (Li) and a nonmetal (Cl), so LiCl is an ionic compound.

The ionic compound LiCl consists of:

lithium cations (Li^+), and
chloride anions (Cl^-).

So we apply the rules we have learned for naming ionic compounds.

The name of the compound is *lithium chloride*.

Notice that:

The name of the cation (lithium ion) appears first, but without the word “ion”.

The name of the anion (chloride ion) appears second, but without the word “ion”.

The name of the monatomic cation (lithium) is the same as the name of the neutral element.

The name of the monatomic anion (chloride) ends with the suffix -ide.

The implied subscripts $_1$ and $_1$ from the formula do not affect the name of the ionic compound.

---

28. What is the name of the compound represented by the chemical formula IBr_3?

Answer: the name of IBr_3 is *iodine tribromide*

Analysis:

First, we must check whether IBr_3 is an ionic compound or a covalent compound.

IBr_3 contains
two nonmetals (iodine and bromine)
so IBr_3 is a covalent compound.

So we apply the rules we have learned for naming covalent compounds.

The name of IBr_3 is *iodine tribromide*.

Notice that:

The elements appear in the same order in the name as in the chemical formula.

Iodine appears first in both the name and the formula.

Bromine appears second in the name, with the suffix -ide.

The formula contains one iodine and three bromines,
but the prefix mono- is omitted for the first element in the name,
so we use only the prefix tri-.

Note:

Be aware that in some typefaces it can be difficult to recognize the letter “capital I” (pronounced “eye”).

This is because, in some typefaces, a “capital I” might look like the letter “lowercase l” (pronounced “ell”).

In the formula IBr_3, the “I” represents the letter “capital I” (pronounced “eye”), and represents the element iodine.

Let's review the material that we've learned in this lesson.

---

29. What are the rules for *directly* naming monatomic cations and monatomic anions?
Give a few *examples* of names for monatomic cations and monatomic anions.

Rule for *Directly* Naming Monatomic *Cations*:

The name of a cation is the *same* as the name of the element;
plus the word "ion" (or, "cation").

For example:

Na^{+} is sodium ion (or, sodium cation);
Mg^{2+} is magnesium ion (or, magnesium cation);
Al^{3+} is aluminum ion (or, aluminum cation);
etc.

Rule for *Directly* Naming Monatomic *Anions*:

The name of a monatomic anion is *adapted* from the name of the element, but with the suffix -ide;
plus the word "ion" (or, "anion").

For example,

N^{3-} is nitride ion (or, nitride anion; or simply "nitride");
O^{2-} is oxide ion (or, oxide anion; or simply "oxide");
F^{-} is fluoride ion (or, fluoride anion; or simply "fluoride");
etc.

---

30. What are the rules for naming ionic compounds?

In the name for the ionic compound,
the cation is named first, and
the anion is named second.

Rule for Naming a Monatomic Cation as part of an ionic compound:

The name of a monatomic cation is the *same* as the name of the element.

Rule for Naming a Monatomic Anion as part of an ionic compound:

The name of a monatomic anion is *adapted* from the name of the element, but with the suffix -ide.

The subscripts in the formula for an *ionic* compound are *not* referred to in the name of the compound.

(In contrast, remember that the subscripts in the formula for a *covalent* compound *are* referred to in the name of the compound.)

---

31. What are the rules for naming covalent compounds?

Rules for naming *covalent* compounds:

1. The elements appear *in the same order* in the name as in the chemical formula.

2. The element that appears first in the name
is referred to by the same name in the compound as the name of the element.

3. The element that appears second in the name
is referred to in the compound by a name that ends with the suffix -ide.

4. Unlike ionic compounds,
covalent compounds use Greek prefixes to represent the number of atoms of each element in the chemical formula.

5. The second element in the name *always* takes a Greek prefix.

6. If the formula contains two or more atoms of the first element, then the first element in the name takes a Greek prefix.

If the formula contains one atom of the first element, then the first element in the name omits the Greek prefix.

Another way to express Rules 5 and 6 is:

The prefix mono- should be used (when appropriate) for the second element in the name, but never for the first element;
all the other Greek prefixes can be used for *either* the first or second element in the name.

---

32. From memory, write down all the numerical Greek prefixes, from one to six.

Number of atoms of the element	Prefix	Usage
1 atom	mono-	used for the second element in the name only
2 atoms	di-	used for either the first or second element in the name
3 atoms	tri-	used for either the first or second element
4 atoms	tetra-	used for either the first or second element
5 atoms	penta-	used for either the first or second element
6 atoms	hexa-	used for either the first or second element

For the prefixes that end with the letter “o” or “a” (i.e., mono-, tetra-, penta-, and hexa-)
if the name of the element begins with a vowel,
then the last letter of the prefix is omitted, for ease of pronunciation.

---

33. True or false? If false, how would you rewrite the statement so that it is true?
Names for ionic compounds use Greek prefixes to represent the number of atoms of each element in the chemical formula.

False.

Names for ionic compounds do *not* use Greek prefixes to represent the number of atoms of each element in the chemical formula;
rather, names for *covalent* compounds use Greek prefixes to represent the number of atoms of each element in the chemical formula.

---

34. True or false? If false, how would you rewrite the statement so that it is true?
When naming a binary covalent compound, the first element in the name never takes a Greek numerical prefix.

False.

If the formula contains two or more atoms of the first element, then the first element in the name *does* take a Greek prefix;
if the formula contains one atom of the first element, then the first element in the name omits the Greek prefix.

---

35. True or false? If false, how would you rewrite the statement so that it is true?
When naming a binary covalent compound, the second element in the name always takes a Greek numerical prefix.

True.

When naming a binary covalent compound, the second element in the name *always* takes a Greek numerical prefix.

Any Greek prefix can be used with the second element in the name,
including the prefix mono-.

---

36. True or false? If false, how would you rewrite the statement so that it is true?
The name of Al_2S_3 is dialuminum trisulfide.

False.

Al_2S_3 is an ionic compound, so the name of the compound should not include Greek prefixes.

The correct name of Al_2S_3 is aluminum sulfide.

---

37. True or false? If false, how would you rewrite the statement so that it is true?
The name of NCl_3 is nitrogen chloride.

False.

NCl_3 is a covalent compound, so the name must use Greek prefixes.

The correct name for NCl_3 is nitrogen trichloride.

(The prefix mono- is omitted for the first element in the name.)

You have reached the end of the lesson.

You're ready now to proceed to the next lesson:
Writing formulas for covalent and ionic compounds