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Welcome!

This is a chemistry lesson, covering *how to name ionic compounds involving monatomic ions*.

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.

The script for this lesson was written by Freelance-Teacher.

My website is:

<http://www.freelance-teacher.com>

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I offer **tutoring** in chemistry, and a variety of other subjects.

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

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

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 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 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.

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](#).

1. What is an ion?

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

2. 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^- , HO^-

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.

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”).

3. 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*.

4. 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*.

5. 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*.

6. 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*.

In this chapter, we are discussing two types of compounds:
ionic compounds, and
covalent compounds

7. Is SO_2 an ionic compound or a covalent compound?

Answer:

SO_2 is a covalent compound

Analysis:

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.

Sulfur (S) is a nonmetal,
and oxygen (O) is a nonmetal,
so SO_2 is a covalent compound.

If you don't know how to distinguish metals from nonmetals,
you should review the lesson on [Distinguishing Ionic and Covalent Compounds](#).

8. Is K_2O an ionic compound or a covalent compound?

Answer:

K_2O is an ionic compound

Analysis:

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.

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

9. What is the structure of water (H₂O)?

H₂O 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* H₂O molecules.
As is indicated by the chemical formula (H₂O),
each water molecule consists of two hydrogen atoms and one oxygen atom.
Each molecule is held together by covalent bonds between the atoms.

10. What is the structure of table salt (NaCl)?

NaCl contains a metal (Na) and a nonmetal (Cl),
so NaCl is an *ionic* compound.

We studied the structure of ionic compounds in the lesson on [Ionic and Covalent Compounds](#).

As an ionic compound,
NaCl consists of a *continuous*, solid, three-dimensional array
of many, many, many Na⁺ cations and Cl⁻ anions.
As is indicated by the chemical formula (NaCl),
the cations and anions appear in the array in a 1:1 ratio
(i.e., the same number of Na⁺ cations and of Cl⁻ anions).
The array is held together by attractions between the anions and the cations.

11. What is the structure of the compound CaF_2 ?

CaF_2 contains a metal (Ca) and a nonmetal (F),
so CaF_2 is an *ionic* compound.

As an ionic compound,
 CaF_2 consists of a *continuous*, solid, three-dimensional array
of many, many, many Ca^{2+} cations and F^- anions.
As is indicated by the chemical formula (CaF_2),
the cations and anions appear in the array in a 1:2 ratio
(i.e., twice as many F^- anions as Ca^{2+} 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](#).

12. 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.

Let's discuss 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 do *not* affect the *name* of the ionic compound.
(Later, we will see that this rule does *not* apply to covalent compounds.)

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.
(Later, we will see that this rule does *not* apply to covalent compounds.)

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.
(Later, we will see that this rule does *not* apply to covalent compounds.)

For example:

13. 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 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 subscripts ₁ and ₃ from the formula do not affect the name of the ionic compound.

14. What is the name of Na_2O ?

Answer:

The name of Na_2O is *sodium oxide*.

Analysis:

The first step is to identify whether Na_2O is an ionic compound or a covalent compound.

Na_2O consists of both a metal (Na) and a nonmetal (O), so Na_2O is an ionic compound.

The ionic compound Na_2O consists of:

sodium cations (Na^+), and

oxide anions (O^{2-}).

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

The name of the compound is *sodium oxide*.

Notice that:

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

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

The subscripts ₂ and ₁ from the formula do not affect the name of the ionic compound.

15. 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.

16. 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 subscripts ₁ and ₁ from the formula do not affect the name of the ionic compound.

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

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

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

17. 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.

18. 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 a later lesson, we will see that, for *covalent* compounds, the subscripts *are* referred to in the name of the compound.)

You have reached the end of the lesson.

You're ready now to proceed to the next lesson:

[Writing Formulas for Ionic Compounds](#)