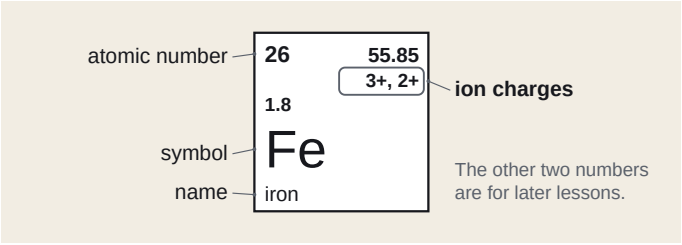
A1 · Recall: ions, and names and formulas · Completed notes

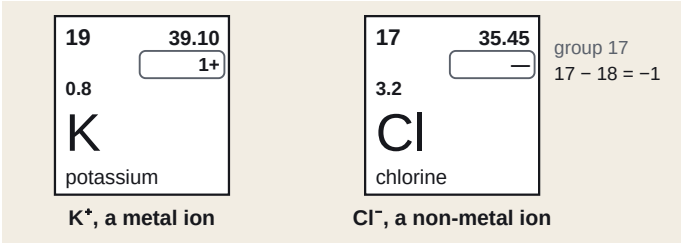
Goals: Find an ion's charge using the Data Booklet and the group number. Write formulas and names for ionic compounds, including metals with more than one charge and polyatomic ions. Write formulas and names for molecular compounds, and tell the two kinds of compound apart.

These are the completed notes. The blanks are filled in and each question is worked.

Slide 1 of 7 · Ion charges in the Data Booklet

In Science 10 you met ions. Today you find their charges in the Data Booklet. Every formula in this lesson starts from those charges.





Key ideas

An **ion** is an atom with a charge. It has lost or gained **electrons**.

In an element box, the ion charges are under the number at the **top right**.

A metal atom **loses** electrons, so its ion is **positive**.

A non-metal atom gains electrons, so its ion is **negative**. Its charge is the group number minus **18**.

Example

Sulfur is in group 16. What is the charge of a sulfide ion?

1. Sulfur is a non-metal, so use the group number.
2. 16 − 18 = −2.
3. The ion is S^{2-}.

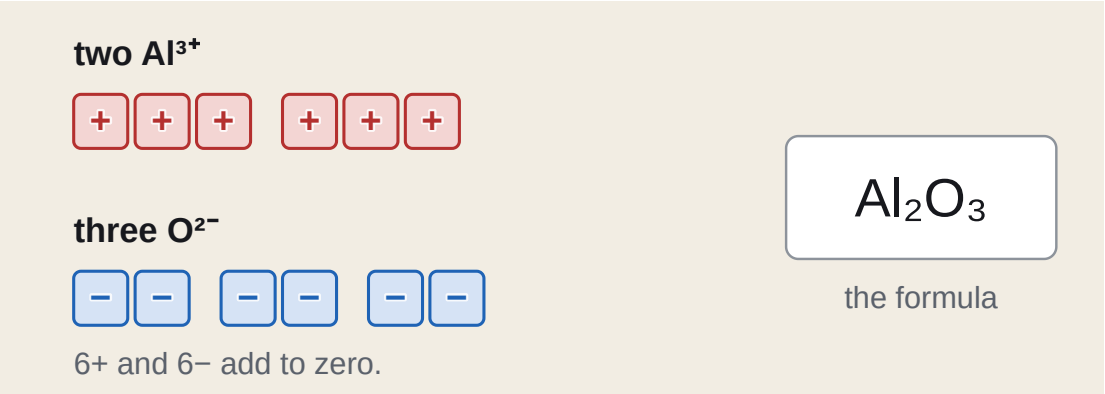
Try it

Nitrogen is in group 15. What is the charge of a nitride ion? Write its symbol.

1. Nitrogen is a non-metal, so use the group number.
2. 15 − 18 = −3.
3. The ion is N^{3-}.

Slide 2 of 7 · An ionic formula adds to zero

On the last slide you found ion charges. Now you use them to write a formula. The plus and minus charges in a formula must add to zero.



Key ideas

An **ionic compound** is made of positive ions and negative ions.

The plus and minus charges must add to **zero**.

A small number after a symbol is a **subscript**. It says how many of that ion there are.

A formula uses the **simplest** whole-number ratio of ions.

Example

Strontium is Sr^{2+} and chloride is Cl^{-}. Write the formula of strontium chloride.

1. One Sr^{2+} has two plus.
2. Each Cl^{-} has one minus, so two are needed.
3. The formula is $SrCl_2$.

Try it

Potassium is K^{+} and sulfide is S^{2-}. Write the formula of potassium sulfide.

1. One S^{2-} has two minus.
2. Each K^{+} has one plus, so two are needed.
3. The formula is K_2S.

Slide 3 of 7 · Method: how to write an ionic formula

You just wrote three formulas with charge blocks. You did the same four things each time. Here they are as steps.

1. **Find** each ion's charge.
2. **Balance** the charges to zero.
3. **Write** the positive ion first, with subscripts.
4. **Reduce** to the simplest ratio.



Check: positive total and negative total add to zero.

Used again in: lessons A3 and A4, and Unit D

Key ideas

Step 1: **find** the charge of each ion.

Step 2: **balance** the charges so they add to zero.

Step 3: write the **positive** ion first, with subscripts.

Step 4: **reduce** to the simplest ratio.

Example

Use the four steps to write the formula of aluminium sulfide.

1. Step 1: aluminium is Al^{3+}. Sulfur is in group 16, so sulfide is S^{2-}.
2. Step 2: two Al^{3+} give 6+. Three S^{2-} give 6−.
3. Step 3: Al goes first.
4. Step 4: the ratio 2 to 3 cannot be reduced. The formula is Al_2S_3.

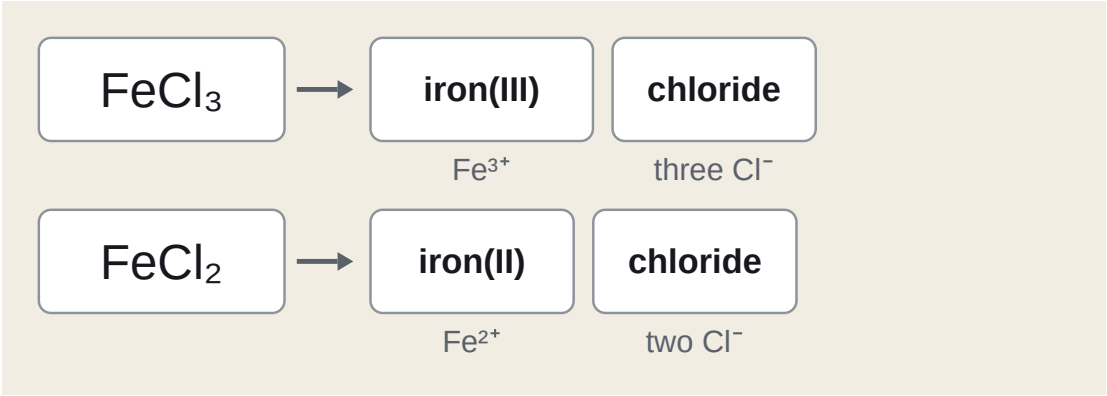
Try it

Use the four steps to write the formula of magnesium nitride.

1. Step 1: magnesium is Mg^{2+}. Nitrogen is in group 15, so nitride is N^{3-}.
2. Step 2: three Mg^{2+} give 6+. Two N^{3-} give 6−.
3. Step 3: Mg goes first.
4. Step 4: the ratio 3 to 2 cannot be reduced. The formula is Mg_3N_2.

Slide 4 of 7 · Naming ionic compounds

You can now write an ionic formula. Next you give the compound a name. The name has two parts, in the same order as the formula.



Key ideas

Name the **positive** ion first. A metal ion keeps the name of the metal.

Name the negative ion second. Change its ending to **-ide**.

A **Roman numeral** gives the charge of a metal that has more than one charge.

A **polyatomic ion** is a group of atoms that shares one charge.

Example

The ions of copper are Cu^{2+} and Cu^{+}. What is the name of Cu_2O?

1. Oxide is O^{2-}.
2. Two copper ions share 2+, so each is 1+.
3. The name is copper(I) oxide.

Try it

The ions of iron are Fe^{3+} and Fe^{2+}. What is the name of FeS?

1. Sulfide is S^{2-}.
2. The one iron ion must be 2+.
3. The name is iron(II) sulfide.

Slide 5 of 7 · Molecular formulas and names

Every compound so far had a metal in it. Now look at compounds made of two non-metals. They are built and named in a different way.

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

CCl_4 → **carbon tetrachloride**

NF_3 → **nitrogen trifluoride**

Key ideas

Two non-metals join into a **molecule**, a group of atoms joined together.

A **molecular formula** counts the atoms in one molecule. Its numbers are never **reduced**.

A molecular name counts the atoms with **prefixes**.

Seven elements exist as **two-atom** molecules, such as H_2 and O_2.

Example

What is the name of CS_2?

1. Carbon is first. One atom takes no prefix.
2. Two sulfur atoms are "di" plus sulfide.
3. The name is carbon disulfide.

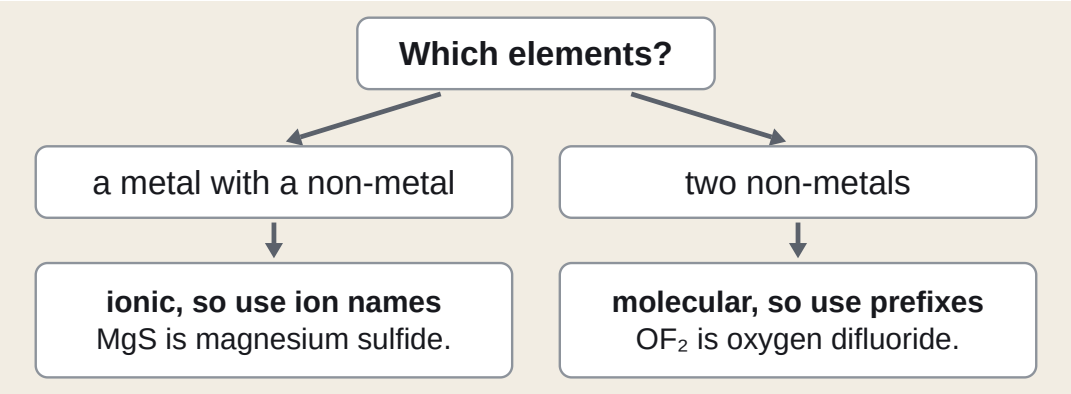
Try it

What is the name of SF_2?

1. Sulfur is first. One atom takes no prefix.
2. Two fluorine atoms are "di" plus fluoride.
3. The name is sulfur difluoride.

Slide 6 of 7 · Ionic or molecular?

You now have two ways to name a compound. Slide 3 used ion names and slide 4 used prefixes. Before you name a compound, decide which way fits.



Key ideas

Look at the **elements** in the formula first.

A metal with a non-metal makes an **ionic** compound. Use ion names.

Two non-metals make a **molecular** compound. Use prefixes.

Example

Is PCl_3 ionic or molecular? What is its name?

1. Phosphorus and chlorine are both non-metals.
2. So it is molecular.
3. The name is phosphorus trichloride.

Try it

Is $CaBr_2$ ionic or molecular? What is its name?

1. Calcium is a metal and bromine is a non-metal.
2. So it is ionic.
3. The name is calcium bromide.

Slide 7 of 7 · Method: how to name a compound

On the last slide you sorted a compound, then named it. These four steps put the sorting and the naming in order.

1. **Sort** the compound. Does it have a metal?
2. **Use** ion names if it has a metal.
3. **Add** a Roman numeral if the metal has two charges.
4. **Use** prefixes if it has two non-metals.



Check: the name leads back to one formula only.

Used again in: lesson A3 and Units C and D

Key ideas

Step 1: **sort** the compound. Does it have a metal?

Step 2: use **ion names** if it has a metal.

Step 3: add a **Roman numeral** if the metal has two charges.

Step 4: use **prefixes** if it has two non-metals.

Example

Use the four steps to name Fe_2O_3.

1. Step 1: iron is a metal and oxygen is a non-metal, so it is ionic.
2. Step 2: the ion names are iron, then oxide.
3. Step 3: three O^{2-} give 6−, so each of the two iron ions is 3+.
4. Step 4 is not used. The name is iron(III) oxide.

Try it

Use the four steps to name $SiCl_4$.

1. Step 1: silicon and chlorine are both non-metals, so it is molecular.
2. Steps 2 and 3 are not used.
3. Step 4: one silicon atom takes no prefix. Four chlorine atoms are "tetra" plus chloride.
4. The name is silicon tetrachloride.