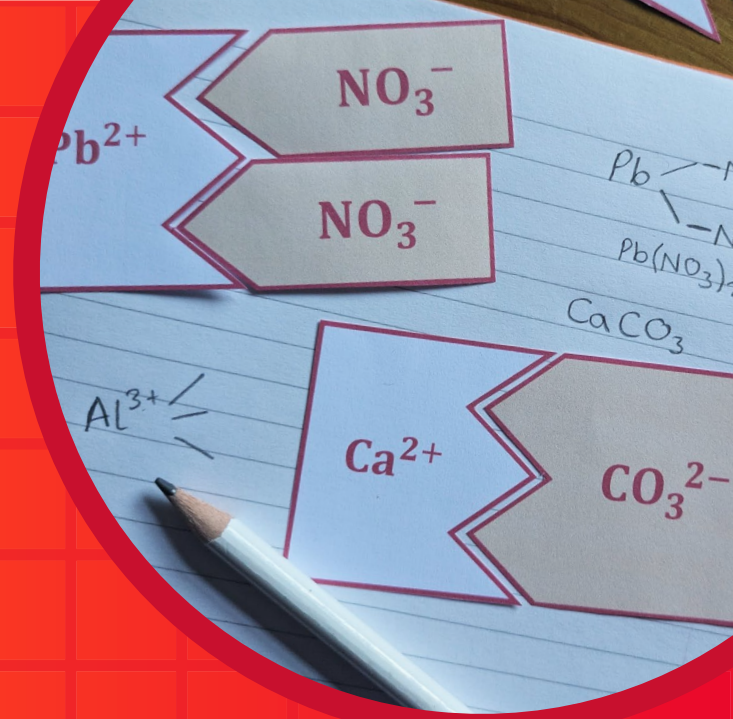
14–16 years

Writing formulas for ionic compounds



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Nitride or nitrate?

The pictures show magnesium nitride (top) and magnesium nitrate (bottom).

1. What are the differences between magnesium nitride and magnesium nitrate?
2. How do you know which elements they contain?
3. Give some other examples of formulas that end in ‘-ide’ vs ‘-ate’.

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Nitride or nitrate?

Magnesium nitride, Mg_3N_2, is an ionic compound containing magnesium ions and **nitride ions**. It is a greenish yellow powder which is sometimes used as a catalyst.

Source: © Trunnano

Magnesium nitrate, $Mg(NO_3)_2$, is an ionic compound containing magnesium ions and **nitrate ions**. It is a white powder which is used in fertilisers and as a dehydrating agent.

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Nitride or nitrate?

What is different about the two ionic formulas, $\mathbf{Mg_3N_2}$ and $\mathbf{Mg(NO_3)_2}$?

- Both contain Mg^{2+} ions, but what is different about their negative ions?
- How does this impact the overall ionic formula of the compound?

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Learning objectives

By the end of today's lesson, you will be able to:

- Recall the names and formulas of common positive and negative ions.
- Write formulas of ionic compounds.

Activity 1

On your worksheet, there are some important ionic formulas which you will need.

- Complete the table to show the correct formulas and names of each ion.
- Once you have finished, raise your hand to have your work checked.
- You will then become an ‘expert group’ and will go and check other learners’ formulas

Answers

Formula	Name of ion
Na^+	Sodium ion
K^+	Potassium ion
Ag^+	Silver(I) ion
NH_4^+	Ammonium ion
Ca^{2+}	Calcium ion
Mg^{2+}	Magnesium ion
Pb^{2+}	Lead(II) ion
Zn^{2+}	Zinc ion
Cu^{2+}	Copper(II) ion
Fe^{2+}	Iron(II) ion
Fe^{3+}	Iron(III) ion
Al^{3+}	Aluminium ion

Formula	Name of ion
Cl^-	Chloride ion
Br^-	Bromide ion
I^-	Iodide ion
NO_3^-	Nitrate ion
N^{3-}	Nitride ion
OH^-	Hydroxide ion
CO_3^{2-}	Carbonate ion
S^{2-}	Sulfide ion
SO_4^{2-}	Sulfate ion

Combining formulas

When combining ions to make ionic formulas, the positive and negative charges must balance. This is because ionic compounds are overall **neutral**.

On your mini-whiteboard, write the formulas of:

- A sodium ion
- A bromide ion
- The formula of sodium bromide

Combining formulas

When combining ions to make ionic formulas, the positive and negative charges must balance. This is because ionic compounds are overall **neutral**.

e.g. sodium bromide

The formula is NaBr

Combining formulas

When combining ions to make ionic formulas, the positive and negative charges must balance. This is because ionic compounds are overall **neutral**.

On your mini-whiteboard, write the formulas of:

- A sodium ion
- A carbonate ion
- The formula of sodium carbonate

Combining formulas

When combining ions to make ionic formulas, the positive and negative charges must balance. This is because ionic compounds are overall **neutral**.

e.g. sodium carbonate

The formula is Na_2CO_3

Combining formulas

When combining ions to make ionic formulas, the positive and negative charges must balance. This is because ionic compounds are overall **neutral**.

On your mini-whiteboard, write the formulas of:

- A magnesium ion
- A hydroxide ion
- The formula of magnesium hydroxide

Combining formulas

When combining ions to make ionic formulas, the positive and negative charges must balance. This is because ionic compounds are overall **neutral**.

e.g. magnesium hydroxide

The formula is $Mg(OH)_2$

Activity 2

Using the cards and the worked examples we have discussed:

- Complete the table to give the formulas of the ionic compounds.
- Once you have finished, raise your hand to have your work checked.
- You will then become an ‘expert group’ and will go and check other learners’ formulas.

Extension opportunity: which other ionic formulas can you make from your cards?

Answers

Activity 2

Compound	Formula
Magnesium carbonate	$MgCO_3$
Silver(I) nitrate	$AgNO_3$
Calcium bromide	$CaBr_2$
Copper(II) hydroxide	$Cu(OH)_2$
Iron(II) nitrate	$Fe(NO)_3$
Iron(III) iodide	FeI_3
Lead sulfate	$PbSO_4$

Compound	Formula
Zinc nitrate	$Zn(NO_3)_2$
Potassium sulfate	K_2SO_4
Magnesium sulfide	MgS
Aluminium hydroxide	$Al(OH)_3$
Ammonium chloride	NH_4Cl
Sodium hydrogen carbonate	$NaHCO_3$
Iron(III) carbonate	$Fe_2(CO_3)_3$

Nitride or nitrate?

What do we now know about the differences between magnesium nitride, Mg_3N_2 and magnesium nitrate, $Mg(NO_3)_2$?

- Write a short explanation of the different ions these compounds contain.
- You may wish to use diagrams like those used in Activity 2.
- If you came up with other examples of 'ides' and 'ates', do the same for these compounds!

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Review