

Working out formulae of ionic compounds

Positive ion (cation)		
hydrogen	H ⁺	
lithium	Li ⁺	Group 1
sodium	Na ⁺	
potassium	K ⁺	
magnesium	Mg ²⁺	
calcium	Ca ²⁺	
barium	Ba ²⁺	
silver	Ag ⁺	Transition metals
iron(II)	Fe ²⁺	
iron(III)	Fe ³⁺	
copper(II)	Cu ²⁺	
zinc	Zn ²⁺	
aluminium	Al ³⁺	
lead(II)	Pb ²⁺	Group 4
ammonium	NH ₄ ⁺	Polyatomic ion

Negative ion (anion)		
oxide	O ²⁻	Group 16 (6)
sulfide	S ²⁻	
fluoride	F ⁻	Group 17 (7)
chloride	Cl ⁻	
bromide	Br ⁻	
iodide	I ⁻	
nitrate	NO ₃ ⁻	Polyatomic ion
carbonate	CO ₃ ²⁻	
sulfate	SO ₄ ²⁻	

These tables show the names and formulae of some common ions.

You need to be able to write the formulae of compounds containing these ions or others that may be given to you.

Equal numbers of charges

Ionic compounds are neutral because they contain the same number of positive charges and negative charges. It is easy to work out formulae when ions carry the same number of charges. For example:

Name of compound	Positive ion	Negative ion	Formula
sodium chloride	Na ⁺	Cl ⁻	NaCl
magnesium oxide	Mg ²⁺	O ²⁻	MgO
potassium hydroxide	K ⁺	OH ⁻	KOH
copper(II) sulfate	Cu ²⁺	SO ₄ ²⁻	CuSO ₄
zinc nitrate	Zn ²⁺	NO ₃ ⁻	Zn(NO ₃) ₂

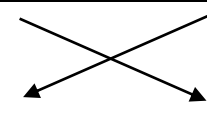
Notice that you do not write charges or ones in a formula.

Polyatomic ions contain more than one element. If you need more than one of these ions, write them inside brackets.

You might find the crossover method helpful, particularly if things seem to be getting complicated.

Worked example

Write the formula of iron(III) carbonate.

What you do		What you get
Step 1	Write the ions side by side	Fe ³⁺ CO ₃ ²⁻
Step 2	Draw two arrows that cross over each other	
Step 3	Write the number of charges at the end of each arrow	2 3
Step 4	Write each ion with its number, but without its charge	Fe CO ₃
Step 5	Add the numbers as subscripts, remembering to put any polyatomic ion in brackets if you need more than one of it	Fe ₂ (CO ₃) ₃