

Common ions and formulae of ionic compounds

Symbols of common ions

In A Level Chemistry you are expected to know the names and symbols of common ions, and to be able to work out the formulae of ionic compounds. The names and symbols of some ions are shown below.

| Positive ions (cations) | | Negative ions (anions) | |
|-------------------------|------------------------------|------------------------|-------------------------------|
| Name | Symbol | Name | Symbol |
| hydrogen | H ⁺ | chloride | Cl ⁻ |
| sodium | Na ⁺ | bromide | Br ⁻ |
| silver | Ag ⁺ | fluoride | F ⁻ |
| potassium | K ⁺ | iodide | I ⁻ |
| lithium | Li ⁺ | hydrogencarbonate | HCO ₃ ⁻ |
| ammonium | NH ₄ ⁺ | hydroxide | OH ⁻ |
| barium | Ba ²⁺ | nitrate | NO ₃ ⁻ |
| calcium | Ca ²⁺ | oxide | O ²⁻ |
| copper(II) | Cu ²⁺ | sulphide | S ²⁻ |
| magnesium | Mg ²⁺ | sulphate | SO ₄ ²⁻ |
| zinc | Zn ²⁺ | carbonate | CO ₃ ²⁻ |
| lead | Pb ²⁺ | | |
| iron(II) | Fe ²⁺ | | |
| iron(III) | Fe ³⁺ | | |
| aluminium | Al ³⁺ | | |

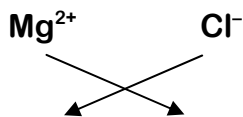
Formulae of ionic compounds

Ionic compounds contain positive and negative ions. The number of positive charges must equal the number of negative charges so that the compound has no charge overall. When the positive ion has the same number of charges as the negative ion, it is easy to work out the formula of the compound formed. Sodium chloride contains sodium ions, Na⁺, and chloride ions, Cl⁻. As both ions have single charges, the formula is simply written as NaCl, i.e. the positive ion followed by the negative ion with no charges written. Similarly, ammonium chloride is NH₄Cl; magnesium oxide is MgO, and so on. The fun starts when the number of charges is different, as in magnesium chloride. The “cross-over” method may help:

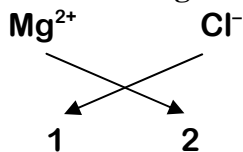
Step 1 Write the ions side by side:



Step 2 Draw arrows that cross each other:



Step 3 Write the **charges** at the arrow ends:



Step 4 Write the formula as follows:

a) write the positive ion without its charge:



b) write the number as a subscript unless it is 1:



c) write the negative ion without its charge:



d) write the number as a subscript unless it is 1:



Watch out for **compound ions**, e.g. ammonium, hydrogencarbonate, hydroxide, nitrate, sulphate and carbonate. If you need more than one of them to balance the charges, put brackets around their symbol at step (a) or (c). For example, sodium hydroxide is NaOH, but magnesium hydroxide is Mg(OH)₂; copper(II) sulphate is CuSO₄, but ammonium sulphate is (NH₄)₂SO₄.