

Writing the chemical formulas of ionic compounds.

Monoatomic ions Both sodium and chlorine ions are **monoatomic ions**, that is, ions that consist of a single atom. It's easy to write the chemical formula for compounds made of monoatomic ions, if you follow these rules:

- 1 Write the symbol for the monoatomic ion that has a **positive** charge first.
- 2 Write the symbol for the monoatomic ion that has a **negative** charge second.
- 3 Add **subscripts** below each element symbol so that the sum of the positive and negative oxidation numbers is equal to zero—a neutral compound, remember? Subscripts tell you how many atoms of each element are in the compound.

Some elements have more than one oxidation number. In this case, roman numerals are used to distinguish the oxidation number. Figure 19.17 shows a few of these elements.

element	oxidation number
copper (I)	Cu^+
copper (II)	Cu^{2+}
iron (II)	Fe^{2+}
iron (III)	Fe^{3+}
chromium (II)	Cr^{2+}
chromium (III)	Cr^{3+}
lead (II)	Pb^{2+}
lead (IV)	Pb^{4+}

Figure 19.17: Elements with variable oxidation numbers.

Example: Writing a chemical formula

Write the formula for a compound that is made of iron (III) and oxygen.

1. Find the oxidation numbers of each element in the compound.

Iron (III) is a transition metal. The roman numbers indicate that it has an oxidation number of 3+. Its formula is Fe^{3+} .

Oxygen is in group 16 of the periodic table and has an oxidation number of 2-. Its formula is O^{2-} .

2. Determine the ratios of each element and write the chemical formula.

If one iron (III) ion bonds with one oxygen ion, will the compound be neutral? No, since 3+ added to 2- equals 1+. If you have two iron (III) ions for every three oxygen ions, what happens? $2(3+)$ added to $3(2-)$ is equal to 0. This means that three iron (III) ions bond with two oxygen ions to get a neutral compound.

The formula for a compound of iron (III) and oxygen is Fe_2O_3 .

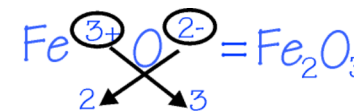


Figure 19.18: The criss-cross method is a simple way to determine the chemical formula of a compound.