Formulae of ionic compounds

Background information and help

Many compounds, such as sodium chloride, magnesium oxide and copper(II) sulphate, are **ionic compounds**. These contain electrically charged particles called **ions**. Ions can be positive or negative, and they attract each other strongly because of their opposite charges. The number of positive charges must equal the number of negative charges in a compound, so that it has no charge overall.

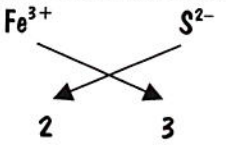
When the positive ion has the same number of charges as the negative ion, it is easy to work out the formula of the compound formed. Sodium chloride contains sodium ions, Na^+, and chloride ions, Cl^-. As both ions have single charges, the formula is simply written as NaCl (i.e. the positive ion followed by the negative ion with no charges written). In the same way, ammonium chloride is NH_4Cl; magnesium oxide is MgO, and so on. The fun starts when the number of charges is different, as in iron(III) sulphide. The "cross-over" method may help:

Step 1 Write the ions side by side:

Fe^{3+} S^{2-}

Step 2 Draw arrows that cross each other:

Step 3 Put the **number** of charges at the ends:



Step 4 Write the formula as follows:

a) write the positive ion without its charge:

Fe

b) write the number as a subscript (don't write a 1):

Fe_2

c) write the negative ion without its charge:

Fe_2S

d) write the number as a subscript (don't write a 1):

Fe_2S_3 … all done!

Watch out for **compound ions** (which contain more than one element), e.g. ammonium, 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 $Mg(OH)_2$; and copper(II) sulphate is $CuSO_4$, but ammonium sulphate is $(NH_4)_2SO_4$.

Watch out for ones that need to reduce

Your task

Use Table 7 from the *Data Book* (or your copy of it) to help you answer these questions.
Make sure you write down the **name** of each compound, then its **formula**.
Until you get the hang of it all, it helps to show your working out (like the example above).

$Mg^2\ O^2$
$\rightarrow Mg_2O_2$
$\rightarrow MgO$

Work out the formulae for the following compounds:

1. sodium chloride
2. calcium oxide
3. potassium hydroxide
4. magnesium sulphide
5. copper(II) carbonate
6. aluminium oxide
7. iron(III) oxide
8. sodium carbonate
9. aluminium hydroxide
10. ammonium nitrate
11. zinc nitrate
12. magnesium carbonate