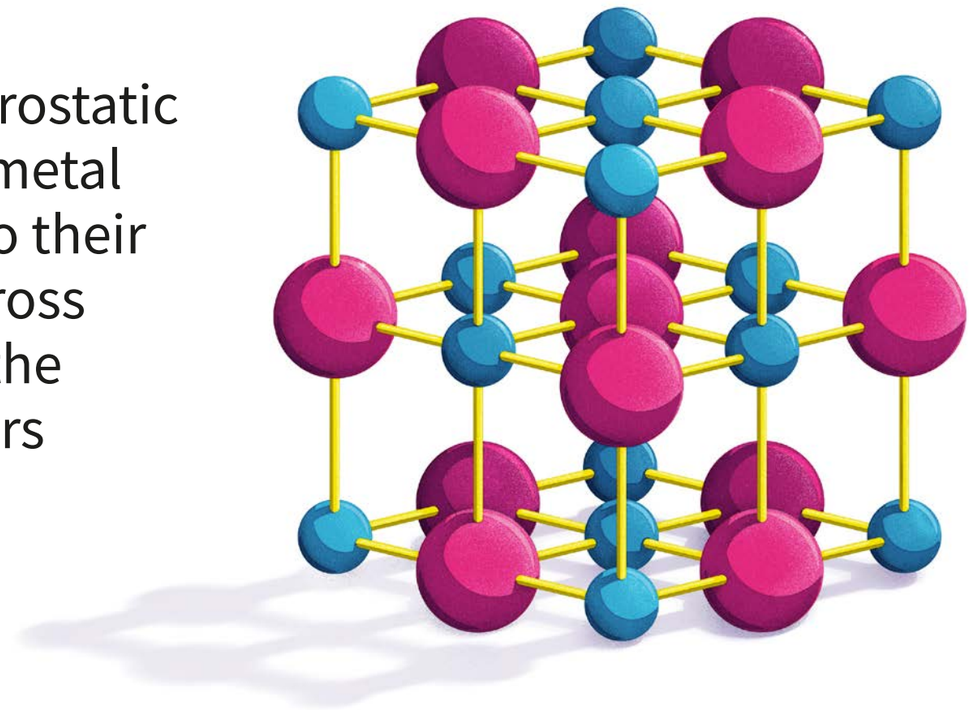
Ionic bonding dot and cross diagrams

An ionic bond is a strong electrostatic force of attraction between a metal ion and a non-metal ion due to their opposite charges. A dot and cross diagram is one way to model the transfer of electrons that occurs during this process.



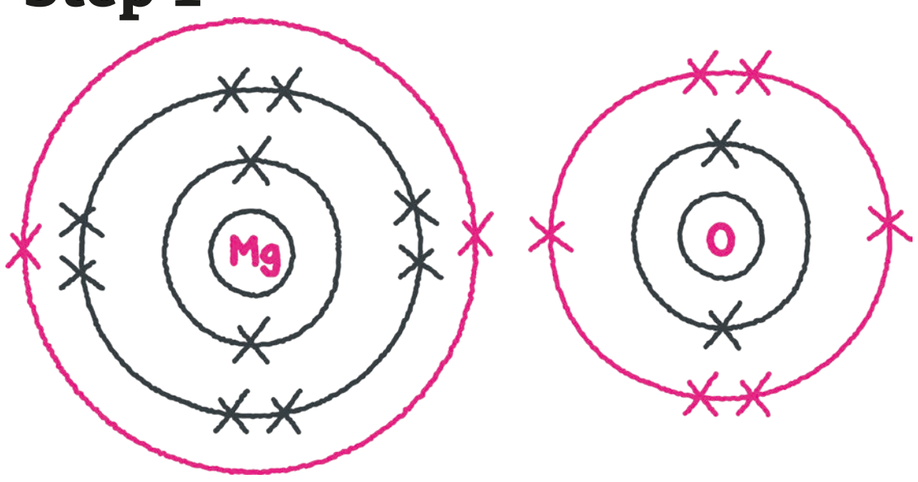
Did you know …?

In an ionic compound the metal ion doesn't form a bond with the ion it donated electrons to. It forms strong ionic bonds with any ions of opposite charge that are close enough to fit in the ionic lattice.

How to draw a dot and cross diagram for magnesium oxide

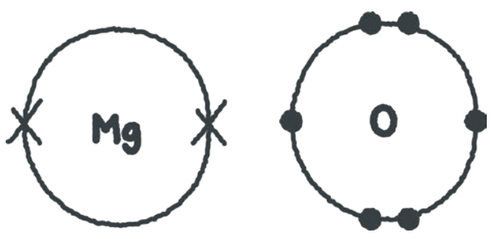
Magnesium is a metal in group two of the periodic table, so will form a 2^+ ion. **Oxygen is a non-metal** in group six of the periodic table, so will form a 2^- ion.

Step 1



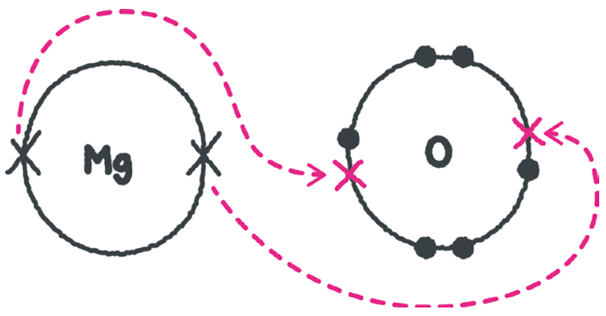
Draw the electron configuration diagram for each atom.

Step 2



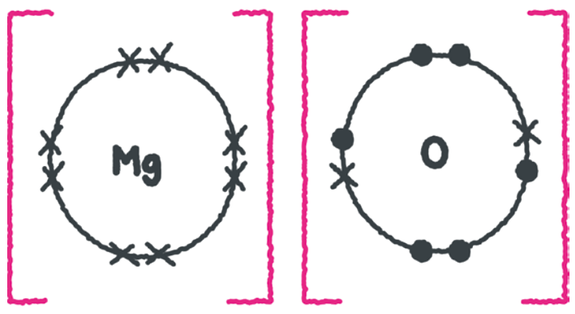
Draw the **outer shell** of each atom. Magnesium has two electrons in its outer shell, oxygen has six. Swap the crosses for dots in one of your diagrams.

Step 3



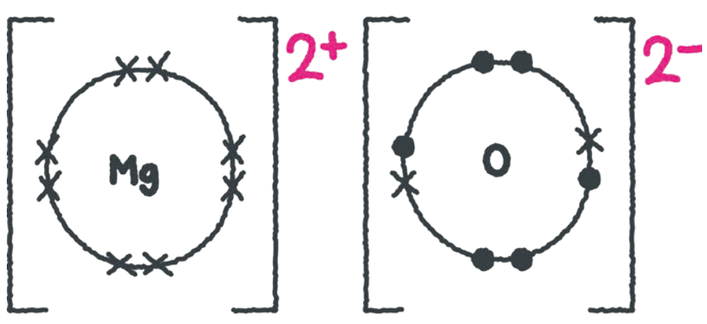
During **ionic bonding** the atoms form ions by **gaining or losing electrons** to obtain a full outer shell. Magnesium loses two electrons and oxygen gains two electrons, leaving Mg^{2+} and O^{2-}.

Step 4



Draw a square bracket around each ion. Magnesium now has an empty third shell so draw the second shell instead.

Step 5

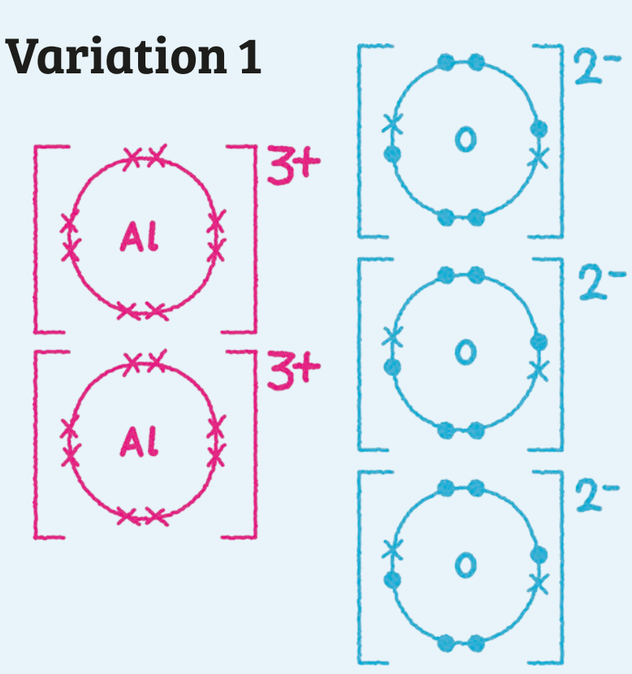


Add the charge outside the brackets at the top right corner. Write the size of the charge first, followed by the plus or minus.

Drawing more complex ionic compounds

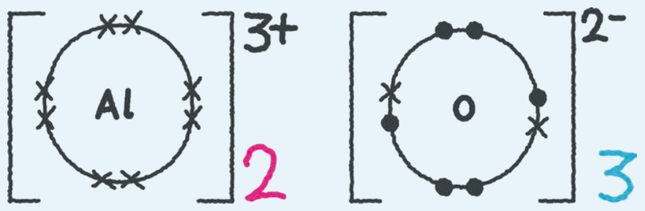
In magnesium oxide, the charges on the metal and non-metal ions are **equal and opposite**. What happens when the charges on the ions are not equal in magnitude? In **aluminium oxide** the charge on the positive metal ions is 3^+ while the charge on the negative oxide ions is 2^-. Here are some different ways to draw aluminium oxide (Al_2O_3).

Variation 1



The number of ions indicates the ratio of aluminium to oxygen.

Variation 2



This diagram looks more like the chemical symbol for the compound Al_2O_3.

Variation 3

The large numbers in this diagram are multipliers. They mean that there are two aluminium ions for every three oxygen ions.