Cohesion of ionic compounds

What is an ionic compound?

An ionic compound is a solid made up of anions and cations regularly arranged in space, but the whole remains electrically neutral.

Note: Usually, an ionic compound is made of only one type of cations and only one type of anions.
Both in the formula and in the name of the compound, the cation is given first, then the anion.
Often, the cation is a monoatomic metal.
Ex: Copper sulfate, $CuSO_4$, is made of copper ions (Cu^{2+}) and sulfate ions (SO_4^{2-})
Counter examples: Ammonium chloride, NH_4Cl, is made of ammonium ions (NH_4^+) and chloride ions (Cl^-)
Ferrous ammonium sulfate (AKA Mohr salt), $Fe(NH_4)_2(SO_4)_2$, is made of iron II ions (Fe^{2+}), ammonium ions (NH_4^+) and sulfate ions (SO_4^{2-})

The empiric formula of the solid indicates the nature and proportion of the ions present, without mentioning their charges.

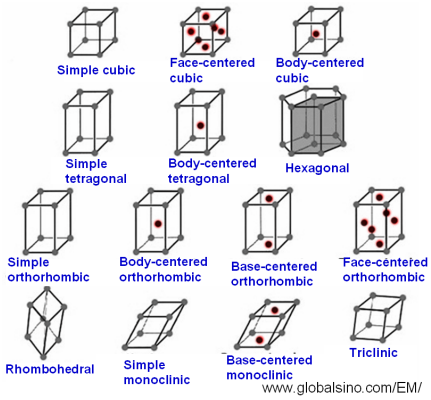
Ex: $Al_2(SO_4)_3$ is an ionic compound made of aluminum ions (Al^{3+}) and sulfate ions (SO_4^{2-}).
The empiric formula shows that in the solid, 40% (2 out of 5) are aluminum ions and 60% (3 out 5) are sulfate ions.

Cohesion of an ionic compound

Each individual ion is interacting with the surrounding ions. This interaction is electrostatic, attractive with ions of opposite sign and repulsive with ions of the same sign. The ions form a structure that maximizes attractions and minimizes repulsions.

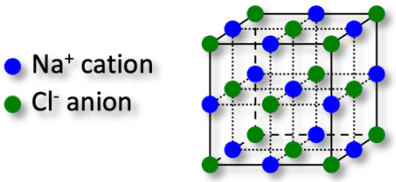
Note: An ionic "bond" is not a bond. No matter is shared between the ions – they interact at a distance.
Ionic interaction should be used instead.

Several parameters influence the spatial arrangement of ions in the crystal lattice, such as the stoichiometry of the ionic compound, of course, but also the radii of the ions involved or external factors such as temperature or pressure.
This leads to a list of 14 different structures, known as Bravais lattices



Note: The macroscopic shape of a cristal is directly related to the microscopic Bravais lattice formed by their ions.

Ex : Sodium chlorine (AKA kitchen salt) is an arrangement of 2 face-centered cubic lattices.



Chemical formula of the solid: $NaCl_{(s)}$