Ionic Bonding Map

AQA A-level Chemistry · 3.1.3 Bonding · Ionic bonding

1 Forming ions

3.1.3.1

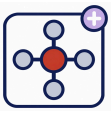
- Metals **lose** electrons: positive ions
- Non-metals **gain** electrons: negative ions
- Charge from the **group**
- Groups 1, 2, 3: 1+, 2+, 3+
- Groups 5, 6, 7: 3−, 2−, 1−



2 Compound ions

3.1.3.1

- A group of atoms with one overall charge
- **Sulfate** SO_4^{2-}, **hydroxide** OH^-
- **Nitrate** NO_3^-, **carbonate** CO_3^{2-}
- **Ammonium** NH_4^+: the common positive one
- Covalent bonds inside; ionic bonds outside

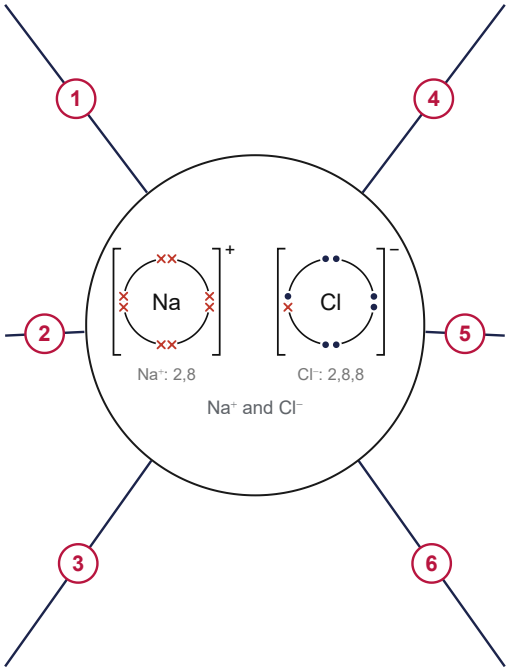


3 Ionic formulae

3.1.3.1

- Total charge on the compound: **zero**
- Cross over the charge numbers, then simplify
- **Brackets** round a compound ion used twice or more
- $Ca(OH)_2$, $Mg(NO_3)_2$, $(NH_4)_2SO_4$
- $Al_2(SO_4)_3$: 2 × 3+ balances 3 × 2−





4 The ionic lattice

3.1.3.1, 3.1.3.4

- **Electrostatic attraction** between oppositely charged ions
- A **giant lattice**, attraction in all directions
- NaCl: each ion has **six** opposite neighbours
- No molecules: the formula is the **ratio** of ions
- Higher charges: stronger attraction (MgO > NaCl)

5 Properties

3.1.3.4

- **High** melting points: strong attraction to overcome
- Conduct only **molten or dissolved**: the ions move
- Solid: ions fixed, no conduction
- Hard but **brittle**: like charges meet and repel
- Many dissolve in water

6 Changes of state

3.1.3.4

- Melting and boiling: **endothermic**
- Energy overcomes the attraction between particles
- Freezing and condensing: **exothermic**
- Temperature **constant** during a change of state
- Stronger attraction: more energy, higher m.p.

Compound ions and their formulae

balance the charges to zero; brackets when a compound ion is used more than once

Ion	Formula	Charge	Compound	Formula of compound
sulfate	SO_4^{2-}	2−	sodium sulfate	Na_2SO_4
hydroxide	OH^-	1−	calcium hydroxide	$Ca(OH)_2$
nitrate	NO_3^-	1−	magnesium nitrate	$Mg(NO_3)_2$
carbonate	CO_3^{2-}	2−	potassium carbonate	K_2CO_3
ammonium	NH_4^+	1+	ammonium sulfate	$(NH_4)_2SO_4$
sulfate	SO_4^{2-}	2−	aluminium sulfate	$Al_2(SO_4)_3$

Writing a formula (3.1.3.1)

Find the charges

- Simple ions: from the group
- Compound ions: learn the five
- Transition metals: from the name, e.g. iron(III)

Balance them

- Lowest numbers that give zero
- Mg^{2+} and Cl^-: $MgCl_2$
- Al^{3+} and O^{2-}: Al_2O_3

Write it

- Positive ion first
- Subscripts after each ion
- Brackets round repeated compound ions

Ionic and covalent bonding are the two ends of a continuum: the electronegativity difference decides (Covalent bonding).

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