Ionic Bonding Map

Cambridge International AS & A Level Chemistry · Topic 3 Chemical bonding · Ionic bonding

1 Forming ions

3.2, 3.7

- Metals **lose** electrons: positive ions (cations)
- Non-metals **gain** electrons: negative ions (anions)
- Charge = electrons lost or gained
- Often a noble-gas configuration: Na^+ 2,8; Cl^- 2,8,8
- Groups 1–3: 1+, 2+, 3+; Groups 5–7: 3−, 2−, 1−

2 Dot-and-cross diagrams

3.2, 3.7

- Outer shells only; dots for one atom, crosses for the other
- Cation: its new outer shell (8) or drawn empty
- Anion: its own electrons + those gained
- **Square brackets** and the **charge** on every ion
- Ratio from electron transfer: CaF_2, Na_2O, Al_2O_3

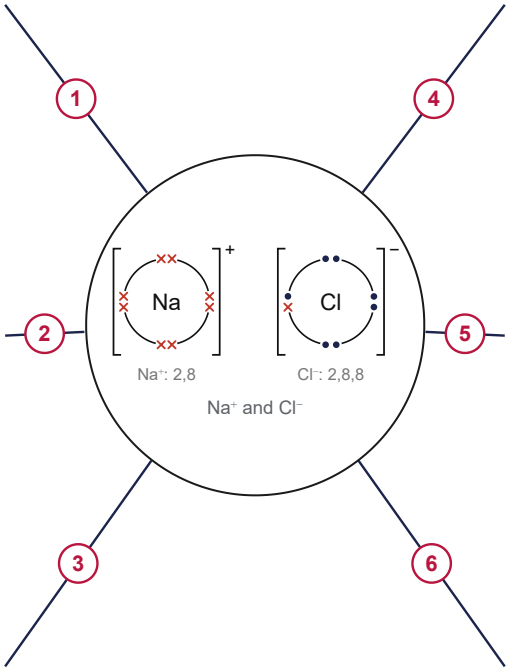


3 The giant lattice

3.2, 4.2.1(a)

- A **giant lattice**: regular 3D array of ions
- NaCl: each ion has **six** opposite neighbours
- Ionic bonding: strong **net electrostatic attraction**
- Acts in all directions: no molecules
- The formula is only the ratio of ions

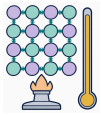




4 Melting and boiling points

4.2.2

- Giant lattice: attraction in **all directions**
- Much energy to overcome: **high** m.p. and b.p.
- **Higher charges**: stronger attraction
- MgO 2852 °C against NaCl 801 °C
- Boiling separates the ions completely



5 Solubility

4.2.2

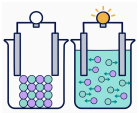
- Water is **polar**: δ− O and δ+ H
- Its ends attract the ions out of the lattice
- The ions are **hydrated**: many compounds dissolve
- **Non-polar** solvents (hexane) cannot
- Very strong lattices (MgO) barely dissolve



6 Conductivity

4.2.2

- Charge carried only by **mobile** ions
- **Solid**: ions fixed in the lattice: no
- **Liquid** (molten): ions free to move: yes
- **Aqueous**: hydrated ions move: yes
- Electrons do not carry the current



Ionic compounds and their properties

melting points in °C; all conduct when molten, and in solution if they dissolve

Compound	Ion charges	Melting point	Soluble in water?	Conducts as a solid?
NaCl	1+, 1−	801	yes	no
KBr	1+, 1−	734	yes	no
$MgCl_2$	2+, 1−	714	yes	no
CaF_2	2+, 1−	1418	no	no
Al_2O_3	3+, 2−	2072	no	no
MgO	2+, 2−	2852	no	no

Conductivity in three states (4.2.2)

Solid

- Ions held in fixed positions
- Nothing free to carry charge
- Does not conduct

Liquid (molten)

- The lattice has broken down
- Ions free to move
- Conducts

Aqueous solution

- Ions separated by water
- Hydrated ions free to move
- Conducts

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

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