

Exercise walk-through

Ionic bonding ■ 3.2

eXercise

You must be able to

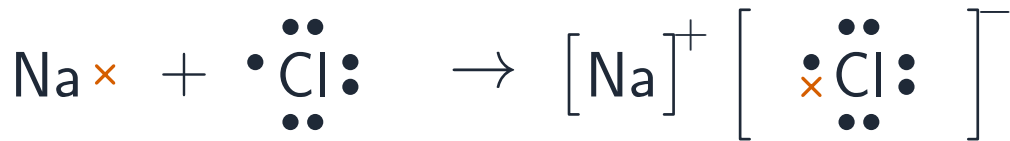
- define ionic bonding as the electrostatic attraction between oppositely charged ions
- describe ionic bonding using NaCl, MgO and CaF

Method — Ionic bonding

Ionic bonding is the **electrostatic attraction** 静电引力 between oppositely charged **ions** — positive **cations** 阳离子 and negative **anions** 阴离子. It forms when a metal gives electrons to a non-metal; the ions pack into a giant **lattice** 晶格.

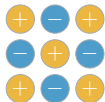
In **MgO**, Mg gives two electrons to O $\rightarrow$ Mg^{2+} and O^{2-} . In **CaF**, Ca gives one electron to each of two F atoms $\rightarrow$ Ca^{2+} and two F^- .

Method — Ionic bonding



sodium gives its outer electron ($\times$) to chlorine

Method — Ionic bonding



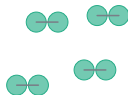
giant ionic

NaCl: high m.p.,
conducts when molten



giant covalent

diamond, SiO₂: very
high m.p., insulating



simple molecular

I₂, ice: low m.p.,
weak forces between



giant metallic

copper: high m.p.,
conducts (solid + molten)

ionic bonding builds a giant lattice

Practice 2.1 ■ 2 marks

Define **ionic bonding**.

Solution 2.1

Method: Ionic bonding

Worked steps

the electrostatic attraction **B1** between oppositely charged ions (cations and anions) **B1**.

Practice 2.2 ■ 1 mark

State the charges on the ions in magnesium oxide.

Solution 2.2

Worked steps

Mg^{2+} and O^{2-} **B1**.

Exam-style 3.1 ■ 1 mark

Ionic bonding is best described as:

- A** a shared pair of electrons
- B** the electrostatic attraction between oppositely charged ions
- C** positive ions in a sea of electrons
- D** weak forces between molecules

Solution 3.1

Method: Ionic bonding

- A a shared pair of electrons
- B the electrostatic attraction between oppositely charged ions 
- C positive ions in a sea of electrons
- D weak forces between molecules

Worked steps

B. Ionic bonding is the electrostatic attraction between oppositely charged ions.

Exam-style 3.2 ■ 1 mark

Which compound contains ions with charges $2+$ and $2-$?

A NaCl

B MgO

C CaF

D HCl

Solution 3.2

A NaCl

B MgO



C CaF

D HCl

Worked steps

B. MgO has Mg^{2+} and O^{2-} .

Exam-style 3.3 ■ 3 marks

Describe, in terms of electron transfer, how the ionic bond forms in calcium fluoride, CaF_2 .

Solution 3.3

Method: Ionic bonding

Worked steps

each calcium atom loses 2 electrons to form Ca^{2+} (M1); each of two fluorine atoms gains 1 electron to form F^- (M1); the oppositely charged ions attract in a lattice (A1).

Exam-style 3.4 ■ 2 marks

Explain why magnesium oxide has a higher melting point than sodium chloride.

Solution 3.4

Worked steps

MgO has ions with higher charges ($2+/2-$ vs $1+/1-$) **M1**, so a stronger electrostatic attraction needing more energy to break **A1**.