

3.2 Ionic bonding

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS ionic bonding 离子键 • anion 阴离子 • cation 阳离子 • electrostatic attraction 静电引力
• magnesium oxide 氧化镁

Objective

Build the skills to answer exam questions on **ionic bonding** — defining it and describing it in **sodium chloride** 氯化钠, **magnesium oxide** 氧化镁 and **calcium fluoride** 氟化钙.

You must be able to:

- define ionic bonding as the electrostatic attraction between oppositely charged ions
- describe ionic bonding using NaCl, MgO and CaF₂

1 Worked examples

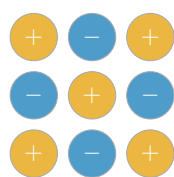
■ Ionic bonding

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.

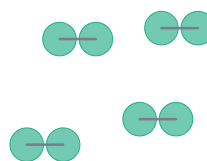


sodium gives its outer electron (×) to chlorine

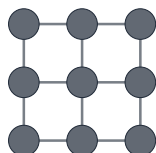
NaCl: sodium transfers its outer electron to chlorine, giving Na⁺ and a full-octet Cl[−]



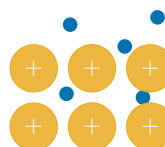
giant ionic
NaCl: high m.p.,
conducts when molten



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



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



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

Ionic bonding builds a giant lattice

In **MgO**, Mg gives two electrons to O → Mg²⁺ and O²⁻. In **CaF₂**, Ca gives one electron to each of two F atoms → Ca²⁺ and two F⁻.

2 Practice

2.1 Define **ionic bonding**.

[2]

2.2 State the charges on the ions in magnesium oxide.

[1]

3 Exam-style questions

3.1 Ionic bonding is best described as: [1]

- **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
-

3.2 Which compound contains ions with charges $2+$ and $2-$? [1]

- **A** NaCl
 - **B** MgO
 - **C** CaF_2
 - **D** HCl
-

3.3 Describe, in terms of electron transfer, how the ionic bond forms in calcium fluoride, CaF_2 . [3]

3.4 Explain why magnesium oxide has a higher melting point than sodium chloride. [2]

Solutions

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

2.2 Mg^{2+} and O^{2-} .

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

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

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

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