

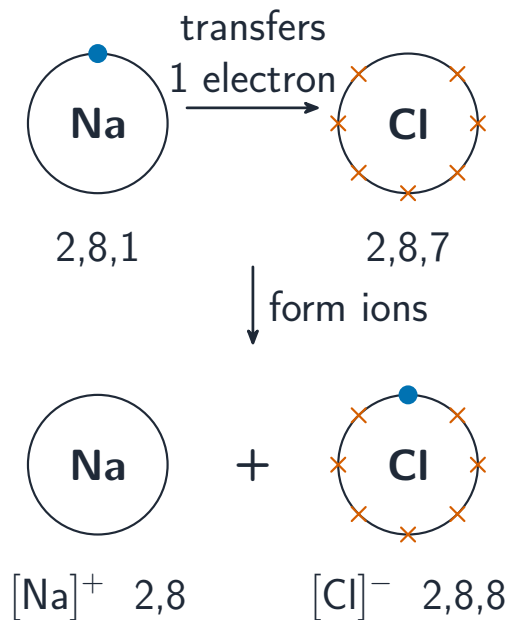
Exercise walk-through

2.4

Ions and ionic bonds

IGCSE Chemistry

Ionic bonding



opposite charges
attract:
a strong **ionic
bond**

A metal **gives** electrons to a non-metal; both reach full shells.

- metal → positive **cation**
- non-metal → negative **anion**

An **ionic bond** is the pull between + and - ions.

Dot-and-cross diagrams, and what the bonding explains

a dot-and-cross diagram

draw each atom's **outer-shell** electrons – dots for one element, crosses for the other – and show where they end up

ionic

electrons are **transferred**; show the ion charges and use square brackets

covalent

electrons are **shared**; show the overlapping outer shells

electrostatic attraction

the strong force between oppositely charged ions – so ionic compounds have high melting points

electrical conductivity

an **ionic compound** conducts only when molten or dissolved, because the ions must be **free to move**

metals

delocalised electrons give conductivity, **ductility**, and malleability

Draw **only the outer shell** unless asked otherwise, and label which atom the dots came from. Both are marked.

Exam tips

- Number of neutrons = mass number — proton number. The **proton number** is what decides which element an atom is.
- **Isotopes** have the same chemical properties because reactions involve only electrons, and isotopes share the same electron configuration; only the mass differs.
- Match structure to properties: **ionic** = giant lattice (high melting point; conducts only when molten or aqueous); **simple molecular** = weak forces *between* molecules (low melting point; no conduction); **giant covalent** = very hard, very high melting point.
- **Graphite** conducts and is slippery (one free electron per carbon; layers slide); **diamond** does neither (all four electrons bonded, so hard and non-conducting). Metals conduct and bend thanks to the sea of **delocalised electrons**.
- For relative atomic mass, take the weighted average:

$$A_r = \frac{\sum(\text{isotope mass} \times \text{abundance})}{100}.$$

Exercises 2.1·2.2

2.1 State the charge on an ion formed when a metal atom loses electrons. [1]

2.2 Define an ionic bond. [1]

Exercises 2.1·2.2

2.1 State the charge on an ion formed when a metal atom loses electrons. [1]

2.1

- a metal atom **loses** electrons
 - the ion has a **positive** charge (a cation)
-

2.2 Define an ionic bond. [1]

2.2

- an ionic bond is the **strong electrostatic attraction between oppositely charged ions**

Exercise 3.1

3.1 Ionic compounds conduct electricity when:

[1]

☐

A solid

B molten or in solution

C never

D only as a gas

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3.1 Ionic compounds conduct electricity when:

[1]

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A solid

B molten or in solution

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3.1 B

- ionic compounds conduct when **molten or in solution** (ions can move)
- A is the solid lattice; C and D are wrong

Exercise 3.2 (a)

3.2 Sodium (2, 8, 1) reacts with chlorine (2, 8, 7) to form sodium chloride.

(a) Describe what happens to the electrons, and give the charges of the two ions. [3]

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(a) Describe what happens to the electrons, and give the charges of the two ions. [3]

(a)

- sodium gives its one outer electron to chlorine
- sodium becomes Na^+ and chlorine becomes Cl^-
- both then have **full outer shells**

Exercise 3.2 (b)

3.2 Sodium (2, 8, 1) reacts with chlorine (2, 8, 7) to form sodium chloride.

(b) Explain why sodium chloride has a high melting point.

[2]

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(b) Explain why sodium chloride has a high melting point.

[2]

(b)

- **strong electrostatic attraction** between opposite ions in the lattice
- **a lot of energy** is needed to break it, so the melting point is high

Exercise 3.3

3.3 Explain why solid sodium chloride does not conduct electricity but molten sodium chloride does. [2]

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3.3

- in the solid the ions are **fixed** and cannot move
- when molten the ions are **free to move** and carry charge