

Exercise walk-through

Valence Electrons and Ionic Compounds ■ 1.8

eXercise

You must be able to

- identify **valence electrons** 价电子 as the outermost electrons that drive bonding
- describe how metals form **cations** 阳离子 and nonmetals form **anions** 阴离子
- write the formula of an **ionic compound** 离子化合物 by balancing charges
- apply the octet rule to predict common ion charges

Method — Valence electrons and ions

Metals lose valence electrons to form positive cations; nonmetals gain electrons to form negative anions, each reaching a full octet.

Method — Balancing charges

An ionic compound is neutral overall. Combine ions so the charges cancel:



Method — Criss-cross

The magnitude of each ion's charge becomes the other's subscript. Al^{3+} with O^{2-} gives Al_2O_3 .

Practice 2.1 ■ 1 mark

State where valence electrons are located in an atom.

Solution 2.1

Method: Valence electrons and ions

Worked steps

In the outermost shell **B1**.

Practice 2.2 ■ 1 mark

A metal atom loses electrons. State the sign of the ion it forms.

Solution 2.2

Worked steps

Positive (a cation) **B1**.

Practice 2.3 ■ 2 marks

Write the neutral formula from Mg^{2+} and Cl^- .

Solution 2.3

Method: Balancing charges

Worked steps

MgCl_2 (one $2+$ needs two $1-$) **M1** **A1**.

Practice 2.4 ■ 1 mark

How many Cl^- ions balance one Al^{3+} ion?

Solution 2.4

Method: Balancing charges

Worked steps

Three **B1**.

Exam-style 3.1 ■ 1 mark

Valence electrons are found in the

- A** nucleus
- B** innermost shell
- C** outermost shell
- D** neutrons

Solution 3.1

Method: Valence electrons and ions

- A nucleus
- B innermost shell
- C outermost shell
- D neutrons



Worked steps

C — the outermost shell.

Exam-style 3.2 ■ 1 mark

The neutral formula from Ca^{2+} and Cl^{-} is

A CaCl

B CaCl_2

C Ca_2Cl

D CaCl_3

Solution 3.2

Method: Balancing charges

A CaCl

B CaCl_2



C Ca_2Cl

D CaCl_3

Worked steps

B — CaCl_2 .

Exam-style 3.3 ■ 2 marks

Consider aluminium (Al^{3+}) and oxide (O^{2-}).

- (a) Write the neutral ionic formula.
- (b) State the method you used to balance the charges.

Solution 3.3

Method: Balancing charges

Worked steps

(a) Al_2O_3 **M1** **A1**. (b) Criss-cross the charge magnitudes into subscripts (so total + equals total -) **B1**.

Exam-style 3.4 ■ 1 mark

A metal M forms M^{2+} and a nonmetal X forms X^{-} .

- (a) Write the formula of the compound they make.
- (b) State whether M is more likely a metal or a nonmetal, and why.

Solution 3.4

Method: Balancing charges

Worked steps

(a) MX_2 **B1**. (b) A metal — metals lose electrons to form positive cations like M^{2+} **M1** **A1**.