

1.8 Valence Electrons and Ionic Compounds

Name: _____ Class: _____ Date: _____ **Total: 13 marks**

KEY WORDS ionic compound 离子化合物 • cations 阳离子 • anions 阴离子
• valence electrons 价电子 • nucleus 原子核

Objective

Build the skills to answer exam questions on **valence electrons and ionic compounds**.

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

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ Valence electrons and ions

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

■ Balancing charges

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



■ Criss-cross

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

2 Practice

Now apply the methods above.

2.1 State where valence electrons are located in an atom. [1]

2.2 A metal atom loses electrons. State the sign of the ion it forms. [1]

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

2.4 How many Cl^- ions balance one Al^{3+} ion? [1]

3 Exam-style questions

3.1 Valence electrons are found in the [1]

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

3.2 The neutral formula from Ca^{2+} and Cl^- is [1]

- **A** CaCl
- **B** CaCl_2
- **C** Ca_2Cl
- **D** CaCl_3

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

(a) Write the neutral ionic formula.

[2]

(b) State the method you used to balance the charges.

[1]

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

(a) Write the formula of the compound they make.

[1]

(b) State whether M is more likely a metal or a nonmetal, and why.

[2]

Solutions

2.1 In the outermost shell.

2.2 Positive (a cation).

2.3 MgCl_2 (one 2+ needs two 1-).

2.4 Three.

3.1 C — the outermost shell.

3.2 B — CaCl_2 .

3.3 (a) Al_2O_3 . (b) Criss-cross the charge magnitudes into subscripts (so total + equals total -).

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