

Exercise walk-through

Atomic Structure and Electron Configuration ■ 1.5

eXercise

You must be able to

- describe an atom as a nucleus of protons and neutrons with **electrons** 电子 in shells
- write an **electron configuration** 电子排布 by filling lowest-energy subshells first
- recall the filling order (including 4s before 3d)
- check that the superscripts sum to the electron count

Method — Filling order

Electrons fill from lowest energy up: $1s$ $2s$ $2p$ $3s$ $3p$ $4s$ $3d$... Each s holds 2, each p holds 6, each d holds 10.

Method — Writing a configuration

Oxygen (8 electrons): $1s^2 2s^2 2p^4$. Sodium (11): $1s^2 2s^2 2p^6 3s^1$.

Method — Check the sum

The superscripts must add to the total electron count. For sodium, $2 + 2 + 6 + 1 = 11$.

Practice 2.1 ■ 2 marks

Write the electron configuration of oxygen (8 electrons).

Solution 2.1

Method: Writing a configuration

Worked steps

$1s^2 2s^2 2p^4$ **M1** **A1**.

Practice 2.2 ■ 1 mark

Which subshell fills first, $4s$ or $3d$?

Solution 2.2

Worked steps

4s **B1**.

Practice 2.3 ■ 1 mark

The configuration $1s^2 2s^2 2p^6 3s^1$ has how many electrons?

Solution 2.3

Method: Writing a configuration

Worked steps

11 **B1**.

Practice 2.4 ■ 1 mark

What holds the electrons to the nucleus?

Solution 2.4

Method: Filling order

Worked steps

Coulombic (electrostatic) attraction **B1**.

Exam-style 3.1 ■ 1 mark

In an atom, the electrons are held to the nucleus by

- A** gravity
- B** Coulombic (electrostatic) attraction
- C** magnetism
- D** friction

Solution 3.1

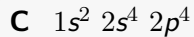
- A gravity
- B Coulombic (electrostatic) attraction** 
- C magnetism
- D friction

Worked steps

B — Coulombic attraction.

Exam-style 3.2 ■ 1 mark

The electron configuration of neon (10 electrons) is



Solution 3.2

Method: Writing a configuration

A $1s^2 2s^2 2p^6$



B $1s^2 2s^2 2p^4$

C $1s^2 2s^4 2p^4$

D $1s^2 2s^2 2p^8$

Worked steps

A — $1s^2 2s^2 2p^6$ ($2 + 2 + 6 = 10$).

Exam-style 3.3 ■ 2 marks

Consider the element magnesium (12 electrons).

- (a) Write its electron configuration.
- (b) State how many electrons are in its outer (3s) shell.

Solution 3.3

Method: Writing a configuration

Worked steps

(a) $1s^2 2s^2 2p^6 3s^2$ **M1** **A1**. (b) 2 **B1**.

Exam-style 3.4 ■ 2 marks

An atom has the configuration $1s^2 2s^2 2p^6 3s^2 3p^4$.

- (a) Find the total number of electrons.
- (b) State whether inner-shell or outer-shell electrons are harder to remove.

Solution 3.4

Method: Writing a configuration

Worked steps

(a) $2 + 2 + 6 + 2 + 4 = 16$ **M1** **A1**. (b) Inner-shell electrons **B1**.