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: $1s\ 2s\ 2p\ 3s\ 3p\ 4s\ 3d \ldots$ 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

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

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

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

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

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.