

Exercise walk-through

Periodic Trends ■ 1.7

eXercise

You must be able to

- describe the trend in **atomic radius** 原子半径 (shrinks across a period, grows down a group)
- describe the trend in **ionization energy** 电离能 (rises across, falls down)
- describe the trend in **electronegativity** 电负性 (highest at the top right)
- explain the trends using nuclear charge and shielding

Method — Atomic radius

Across a period, more protons pull the same shell in, so the radius shrinks. Down a group, each new shell sits farther out, so the radius grows.

Method — Ionization energy

The energy to remove an electron rises across a period (stronger pull) and falls down a group (electrons farther out and shielded) – the opposite trend to radius.

Method — Electronegativity

An atom's pull on shared electrons is highest at the top right (fluorine, ignoring noble gases) and lowest at the bottom left.

Practice 2.1 ■ 1 mark

State how atomic radius changes across a period from left to right.

Solution 2.1

Method: Atomic radius

Worked steps

It decreases **B1**.

Practice 2.2 ■ 1 mark

Which element is more electronegative, fluorine or sodium?

Solution 2.2

Worked steps

Fluorine **B1**.

Practice 2.3 ■ 1 mark

State how ionization energy changes down a group.

Solution 2.3

Method: Ionization energy

Worked steps

It decreases **B1**.

Practice 2.4 ■ 2 marks

Order Na, Si, and Cl (period 3) from largest to smallest atomic radius.

Solution 2.4

Method: Atomic radius

Worked steps

$\text{Na} > \text{Si} > \text{Cl}$ **M1** **A1**.

Exam-style 3.1 ■ 1 mark

Across a period from left to right, the atomic radius

- A** increases
- B** decreases
- C** stays the same
- D** doubles

Solution 3.1

Method: Atomic radius

A increases

B decreases 

C stays the same

D doubles

Worked steps

B — the atomic radius decreases across a period.

Exam-style 3.2 ■ 1 mark

Which element has the highest electronegativity?

A fluorine

B sodium

C helium

D caesium

Solution 3.2

Method: Electronegativity

A fluorine



B sodium

C helium

D caesium

Worked steps

A — fluorine is the most electronegative.

Exam-style 3.3 ■ 1 mark

Compare sodium (Na) and chlorine (Cl), both in period 3.

- (a) State which has the larger atomic radius.
- (b) Explain your answer in terms of nuclear charge.

Solution 3.3

Method: Atomic radius

Worked steps

(a) Sodium **B1**. (b) Chlorine has more protons pulling the same shell in more tightly, so it is smaller **M1** **A1**.

Exam-style 3.4 ■ 1 mark

Consider ionization energy down group 1 (Li, Na, K).

- (a) State the trend.
- (b) Explain it in terms of shielding and distance.

Solution 3.4

Method: Ionization energy

Worked steps

(a) Ionization energy decreases down the group **B1**. (b) Outer electrons are farther out and shielded by inner shells, so they are easier to remove **M1 A1**.