

1.7 Periodic Trends

Name: _____ Class: _____ Date: _____

Total: 13 marks

Objective

Build the skills to answer exam questions on **periodic trends**.

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

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.

■ 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.

■ 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.

■ Electronegativity

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

2 Practice

Now apply the methods above.

2.1 State how atomic radius changes across a period from left to right. [1]

2.2 Which element is more electronegative, fluorine or sodium? [1]

2.3 State how ionization energy changes down a group. [1]

2.4 Order Na, Si, and Cl (period 3) from largest to smallest atomic radius. [2]

3 Exam-style questions

3.1 Across a period from left to right, the atomic radius [1]

- **A** increases
 - **B** decreases
 - **C** stays the same
 - **D** doubles
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3.2 Which element has the highest electronegativity? [1]

- **A** fluorine
 - **B** sodium
 - **C** helium
 - **D** caesium
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3.3 Compare sodium (Na) and chlorine (Cl), both in period 3.

(a) State which has the larger atomic radius. [1]

(b) Explain your answer in terms of nuclear charge. [2]

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

(a) State the trend. [1]

(b) Explain it in terms of shielding and distance. [2]

4 Go further

You are ready for more on this subtopic:

- work through the interactive **1.7 Periodic Trends** lesson on the **Learn** page;
- read the **Atomic Structure and Properties** section of the AP Chemistry handout on the **Know** page for the full explanation and worked diagrams.

Solutions

2.1 It decreases.

2.2 Fluorine.

2.3 It decreases.

2.4 $\text{Na} > \text{Si} > \text{Cl}$.

3.1 B —the atomic radius decreases across a period.

3.2 A —fluorine is the most electronegative.

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

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