SCIENCE FOUNDATIONS

Periodic trends

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how you compare two elements without looking up every number, like predicting that a bigger atom in the same family will give up its outer electron more easily. A battery designer picks a metal for an electrode by knowing which one lets go of electrons more readily. A chemist explaining why lithium batteries work differently from sodium ones starts with the trend down the column. Knowing periodic trends tells you how size, pull, and willingness to give up electrons change as you move across the table, so you can predict behaviour from position alone.



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Rule

Periodic trends: across a period, atoms get smaller and hold their outer electrons more tightly, so ionization energy rises.

Down a group, atoms get larger because each new shell is further out, and outer electrons are held less tightly, so ionization energy falls.

Worked examples

EXAMPLE 1

Q Compare sodium and chlorine in period 3.

SOLUTION

Find their positions: sodium is left, chlorine is right in period 3.

Apply the across trend: atoms get smaller left to right.

Conclude: chlorine is smaller than sodium.

The result is chlorine atom is smaller than sodium atom.

EXAMPLE 2

Q Compare lithium and potassium in group 1.

SOLUTION

Find their positions: lithium is above potassium in group 1.

Apply the down trend: atoms get larger going down.

Conclude: potassium is larger than lithium.

Result: potassium atom is larger than lithium atom.

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Practice questions

1

Compare silicon and chlorine in period 3. Which atom is smaller, and why?

A Chlorine is smaller

B Silicon is smaller

C They are the same size

D Chlorine is larger

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2

Compare magnesium and sulfur in period 3. Which has the higher ionization energy, and why?

A. Sulfur, because atoms hold outer electrons more tightly across a period

B. Magnesium, because atoms hold outer electrons more tightly across a period

C. Sulfur, because atoms get larger across a period

D. Magnesium, because atoms get larger across a period

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3

Compare lithium and rubidium in group 1. Which atom is larger, and why?

A Lithium is larger

B Rubidium is larger

C They are the same size

D Rubidium is smaller

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4 Compare sodium and caesium in group 1. Which has the lower ionization energy, and why?

- **A** Caesium, because outer electrons are held less tightly down a group
- **B** Sodium, because outer electrons are held less tightly down a group
- **C** Caesium, because outer electrons are held more tightly down a group
- **D** Sodium, because atoms get smaller down a group

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5 Across a period, does ionization energy rise or fall?

- **A** Rise
- **B** Fall
- **C** Stay the same
- **D** Rise then fall

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6

Down a group, are outer electrons held more or less tightly?

A Less tightly

B More tightly

C The same

D Not at all

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7

Which is more reactive in group 1: lithium or potassium?

A Lithium

B Potassium

C Both equally

D Neither

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8 Why do atoms get larger down a group?

A They have more electron shells.

B They have fewer electron shells.

C The nucleus pulls harder on the outer shell.

D They have fewer protons.

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9 Why do atoms get smaller across a period?

A Greater nuclear pull on the same shell.

B Less nuclear pull on the same shell.

C More electron shells.

D Fewer protons.

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10

Which period 3 element is largest: sodium or argon?

A Sodium

B Argon

C They are the same size

D Chlorine

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ANSWER KEY

1. Chlorine is smaller

2. Sulfur, because atoms hold outer electrons more tightly across a period

3. Rubidium is larger

4. Caesium, because outer electrons are held less tightly down a group

5. Rise

6. Less tightly

7. Potassium

8. They have more electron shells.

9. Greater nuclear pull on the same shell.

10. Sodium

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