Edgenuity

Warm-Up | Periodic Trends

Lesson Objectives

By the end of this lesson, you should be able to:

- Use the periodic table to predict trends in atomic radii and ionic radii.
- Use the periodic table to identify and explain periodic trends in ionization energy.
- Use the periodic table to identify trends in electronegativity and electron affinity.

Science Practice: Given two elements, make predictions that compare their radii, ionization energy, electronegativity, and/or electron affinity.

Words to Know

Write the letter of the definition next to the matching word as you work through the lesson. You may use the glossary to help you.

B electronegativity

E ionization energy

A atomic radius

D ionic radius

C electron affinity

A. a term for half the distance between two identical atoms in a diatomic molecule

B. the ability of an atom to attract electrons from another atom in a chemical compound

C. the energy required to add an electron to a neutral atom in the gas phase

D. a measure of the size of an ion

E. the energy required to remove an electron from an atom or ion in the gas phase

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Slide 1

Lesson Question What trends become apparent from the arrangement of electrons in the periodic table?

Slide 2

Trends of Atomic Radii

Atomic radius is half the [distance] between two identical atoms in a diatomic molecule.

Electrons are added:

- to the same [energy] level across a period.
- to a higher energy level down a group.

Atomic radii tend to:

- decrease across a [period].

- [increase] down a group.

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Trends of Ionic Radii

Ionic radius is a measure of the [size] of an ion.

Anion

Cation

Ionic radii:

- increase down a [group].
- decrease for [cations] across a period.
- [decrease] for anions across a period.
- increase when switching from cations to [anions] across a period.

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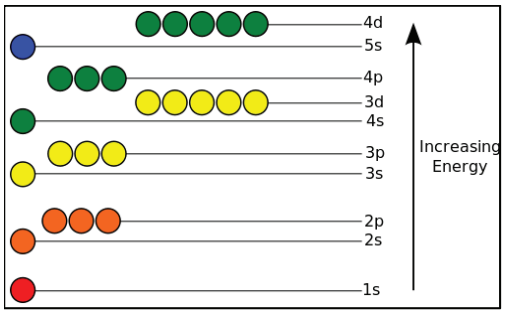
Transition Metal Exceptions

For the transition metals:

- the *d* sublevels are filled across a period.
- atomic radii decrease slightly and then start to increase across a period.
- cation radii vary slightly, but not in a regular way.



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Ionization Energy

Ionization energy is the energy required to remove an electron from an atom or ion in the gas phase.

Ionization depends on:

- the nuclear charge.
- the distance of the electron from the nucleus.
- the number of electrons removed.

First ionization energy
$Energy + X \rightarrow X^{+} + e^{-}$

Second ionization energy
$Energy + X^{+} \rightarrow X^{2+} +$ e^{-}

Third ionization energy
$Energy + X^{2+} \rightarrow X^{3+} + e^{-}$

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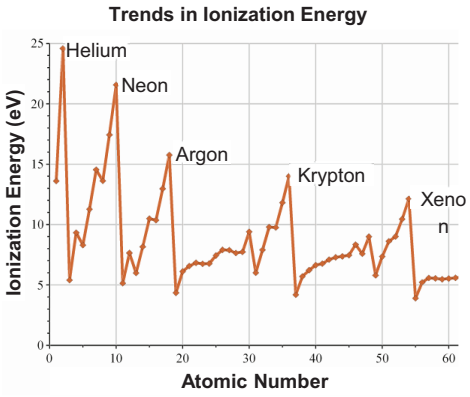
Trends in Ionization Energy

In the main group, first ionization energy tends to:

- increase across each [period].
- decrease between [Groups] 2 and 13.
- decrease between Groups 15 and 16.
- [decrease] across each group.



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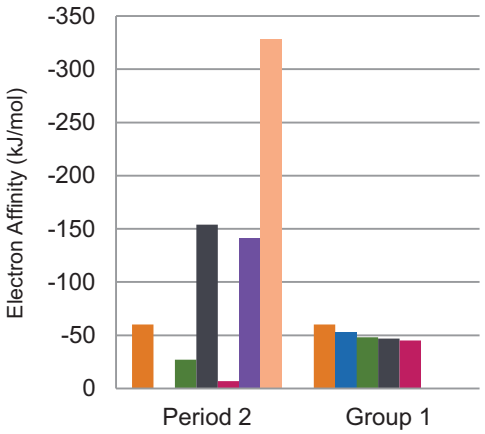
Trends in Electron Affinity

Electron affinity is the [energy] required to add an electron to a [neutral] atom in the [gas] phase.

$X + e^- \rightarrow$ [X^-] + **Energy**



Electron affinity tends to become:

- more negative across a period.
- less [negative] down a group.

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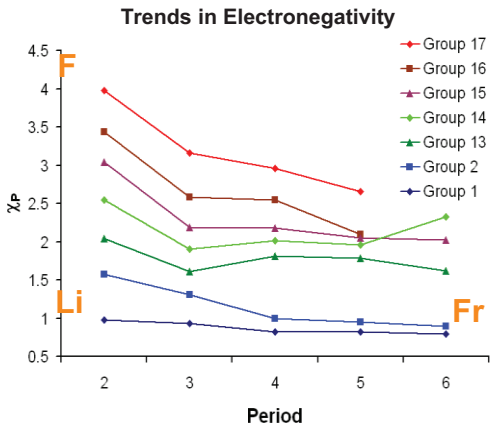
Trends in Electronegativity

Electronegativity is the ability of an [atom] to attract electrons from another atom in a [chemical] compound.

Electronegativity tends to:

- [increase] across a period.
- decrease [down] a group.



Summary | Periodic Trends

Lesson Question

What trends become apparent from the arrangement of electrons in the periodic table?

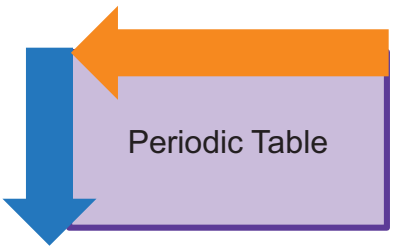
Answer

(Sample answer) The trends that become apparent from the arrangement of electrons in the periodic table are atomic radii, ionic radii, ionization energy, electron affinity, and electronegativity.

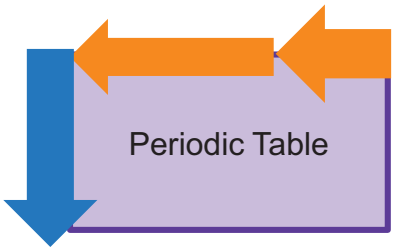
Slide 2

Atomic Radii and Ionic Radii

Increasing nuclear [charge] decreases radii. Increasing energy levels increases radii.



Atomic radii [increase] down a group and decrease across a period.



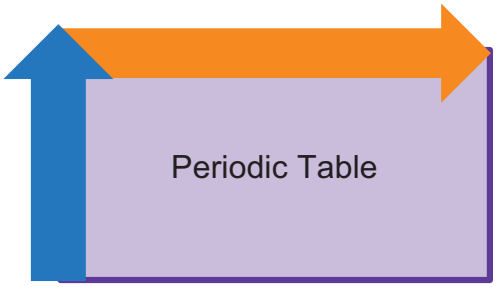
Ionic radii increase down a group, and decrease across a period for [cations] and then for anions.

Summary | Periodic Trends

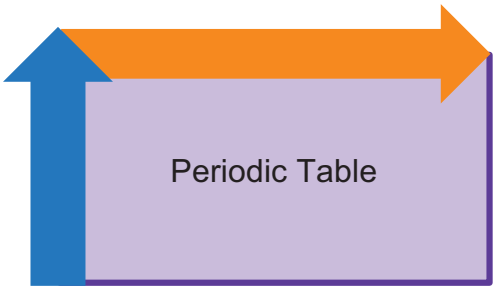
Slide 2

Ionization Energy

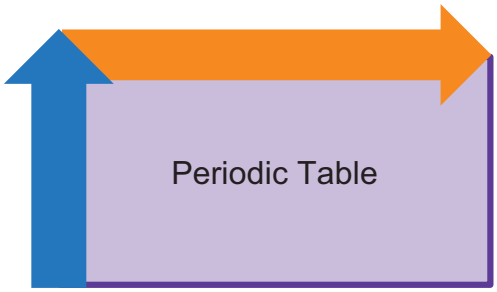
- Ionization energy is the energy required to remove an electron from an atom or [ion] in the gas phase.
- An increasing nuclear charge makes it harder to remove an [electron].
- Increasing the distance of an electron from the nucleus makes it easier to remove.



Electron Affinity and Electronegativity



Electron affinity is the [energy] required to add an electron to a neutral atom in the gas phase.



Electronegativity is the ability of an atom to attract electrons from another atom in a [compound].

Summary | Periodic Trends

Use this space to write any questions or thoughts about this lesson.