

Periodic Trends

The Periodic Table is still considered one of the most useful tools in all of chemistry nearly 150 years after its conception. Its arrangement is reflective of not only the structure of the elements, but also of their chemical and physical properties. Consequently, there are a number of useful trends in elemental properties as we move vertically or horizontally along the table. Being familiar with these trends helps improve your predictive power and hones your understanding of atomic structure.

A very useful online tool for examining periodic trends is the table found at <http://www.ptable.com/>

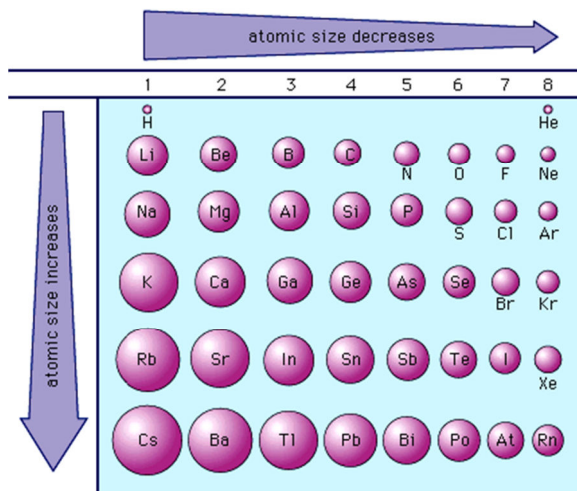
Effective Nuclear Charge

Electrons are held in place by the positive force of attraction exhibited by protons in the nucleus of an atom. The overall force acting on each electron is called the **Effective Nuclear Charge**. As more protons are added to the nucleus, the effective nuclear charge on an electron within a given orbital should increase. Each time a new shell is added, the negative charge of the electrons of inner shells offers a force of repulsion for new electrons. This dampening of the effective nuclear charge is known as the **shielding effect**.

Atomic Radius

Horizontal:

Explanation:

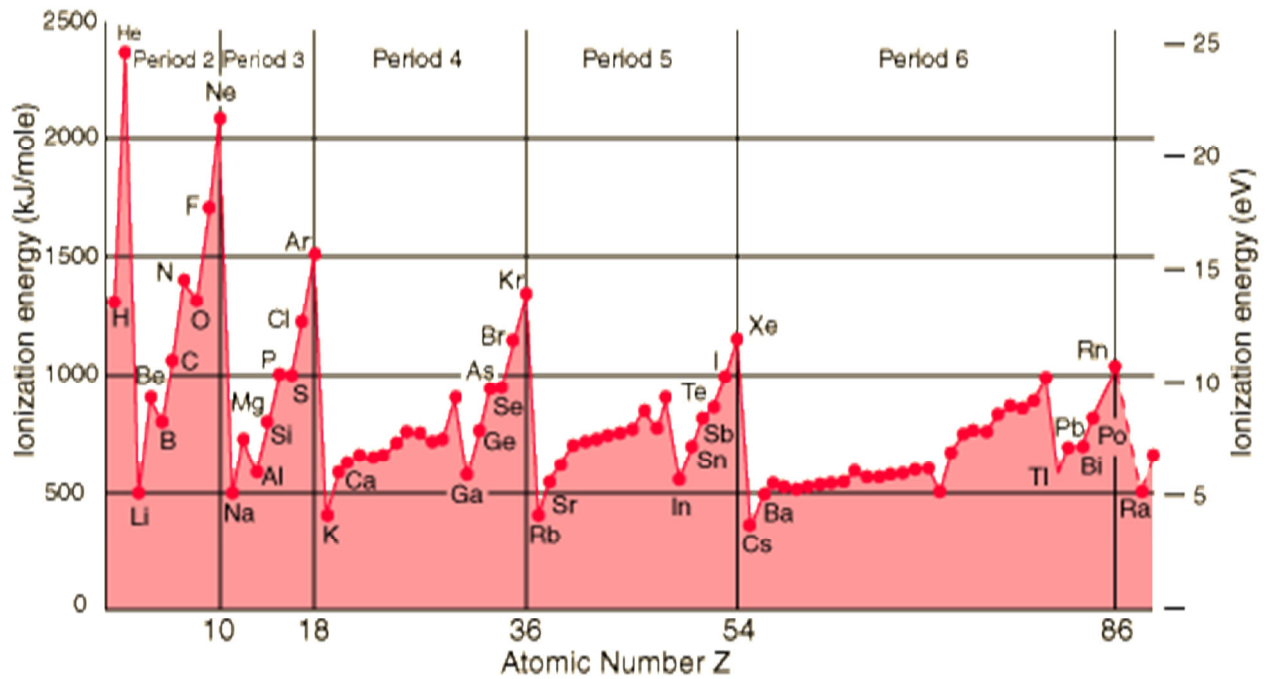


Vertical:

Explanation:

First Ionization Energy

This is a measure of the energy required to remove a single valence electron from an atom or ion in the gaseous state.



Horizontal:

Explanation:

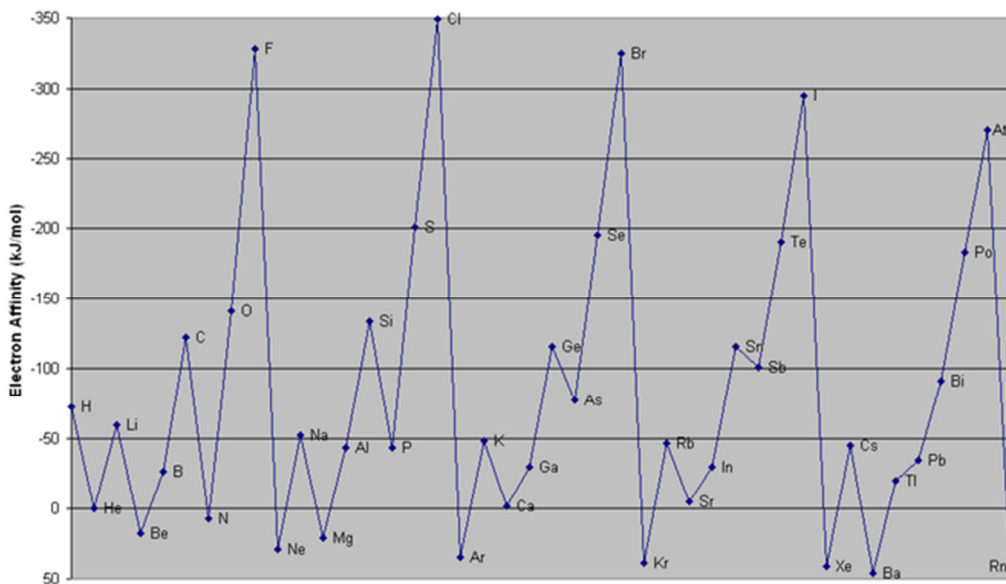
Vertical:

Explanation:

Noble gases have the highest 1st ionization energies in their periods. Predict which group will have the highest 2nd ionization energy? Why?

Electron Affinity

This is a measure of the energy change that occurs when one electron is added to an atom in the gaseous state.



Horizontal:

Explanation:

Vertical:

Explanation:

Follow-up Practice Questions:

1) List the following elements in order of increasing radius: Ba, Cs, O, Sb, Sn

2) List the following elements in order of increasing ionization energy: As, Cs, F, He, P, Sr

3) What group of elements has the lowest electron affinity? Why?

4) a) What is effective nuclear charge?

b) What is the shielding effect and how does it affect the effective nuclear charge?

5) Define ionization energy. Use a chemical equation to clarify your definition.

6) Compare the 3rd ionization energy to the 1st ionization energy of an element. Explain.

7) Explain why helium does not have a 3rd ionization energy.

8) The diagram below shows the change in atomic radius as a result of ion formation. Explain why this occurs of each:

