

Periodic Trends

Read from **Lesson 4: Periodic Trends** in the **Chemistry Tutorial Section, Chapter 5** of **The Physics Classroom**:

Part a: [The Periodic Law Revisited](#)

Part b: [Atomic Size](#)

Part c: [Ionization Energy](#)

Part d: [Electronegativity](#)

Why do trends occur across the period or down a group on the periodic table? These are based on the attraction or pull between the positively charged nucleus and the negatively charged valence electrons. The explanation for the trends will be based on:

1. *Electron Shielding*: this refers to the balance between the pull of the protons on valence electrons and the repulsion forces from core electrons. As you move down a group, additional energy levels of electrons are added. The shielding effect increases because core electrons partially block the attraction between the protons and the valence electrons.

2. *Nuclear Charge*: this refers to the strength of the nucleus, which is determined by the number of protons it contains. As the atomic number increases, the nuclear charge also increases, resulting in a stronger attraction between the protons and the surrounding electrons.

Image Source: [Wikipedia](#)

Part 1: Atomic Size

- The element in Period 3 with the largest atomic size is a(an) _____.
 - alkali metal
 - alkaline earth metal
 - halogen
 - noble gas
- Atoms of metallic elements are likely to _____.
 - lose electrons, form positive ions, and the resulting metallic ion is smaller than the metallic atom.
 - gain electrons, form positive ions, and the resulting metallic ion is bigger than the metallic atom.
 - lose electrons, form negative ions and the resulting metallic ion is smaller than the metallic atom.
 - gain electrons, form negative ions, and the resulting metallic ion is bigger than the metallic atom.
- State which of the following in each pair, has a larger atomic size and why.
 - K or Rb
 - Pb or At
 - Sc or S

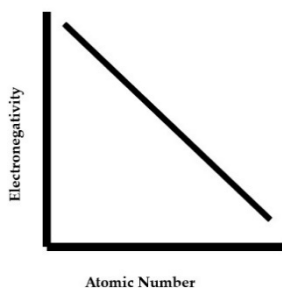
Part 2: Ionization Energy

- Silicon has a first ionization energy of 787 kJ/mole. Predict which of the following will have a higher first ionization than silicon. Predict which of the following will have a lower first ionization than silicon.
 - neon, Ne
 - sodium, Na
 - chlorine, Cl
 - germanium, Ge
- Explain why the ionization energy of sulfur (S) is lower than that of oxygen (O), even though sulfur has a greater atomic number.
- As you move from left to right across Period 6 on the periodic table, atomic size ____ and first ionization energy _____.
 - increases, increases
 - decreases, decreases
 - decreases, increases
 - increases, decreases

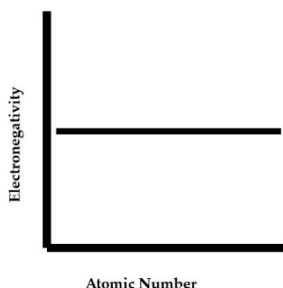
Early Models of the Atom

Part 3: Electronegativity

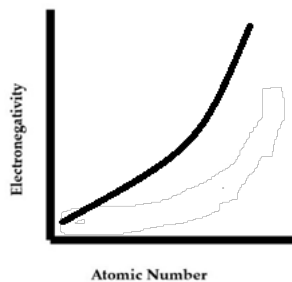
- Which of the following does not affect the electronegativity of an atom?
 - the distance between valence electrons and the nucleus
 - the number of neutrons in the nucleus
 - the number of energy levels in the atom
 - the overall charge of the nucleus
- Which of the following graphs best shows the relationship between electronegativity and the atomic number of period 2 elements?



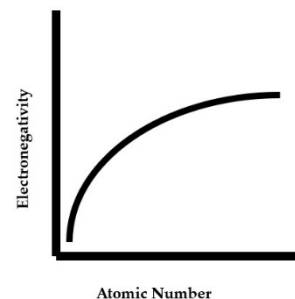
a.



b.



c.



d.

- Rank the following in order of increasing electronegativity. Explain how electron shielding or nuclear charge played a role in your answer.
 - Cs, K, Rb
 - In, Te, Sn
 - P, Cl, Sr
 - F, P, S, As
 - Si, S, Ge, Se