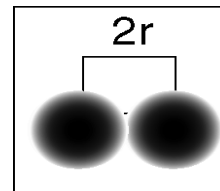


Periodic Trends

The periodic table is designed such that a great deal of information can be deduced by where elements are positioned. We will look at three trends today that will lay important ground work for the next few chapters.

The first periodic trend we will look at is atomic radius. **ATOMIC RADIUS** is defined as half the distance between the nuclei of two like atoms located next to one another. We must measure the radius in this way, as it is difficult to pinpoint the outer energy level of an atom. But, since we can locate the nuclei of the two atoms, dividing this distance in half gives us the radius of one of the atoms.



As a periodic trend, **ATOMIC RADIUS INCREASES AS YOU GO DOWN A GROUP**. This is because energy levels are added and make the distance between the nucleus and the outer electron greater. Also, the added inner electrons reduce the attraction between the outer electrons and the nucleus. This reduction in the attraction between a nucleus and its outer electrons due to the blocking effect of inner electrons is referred to as the **shielding effect**.

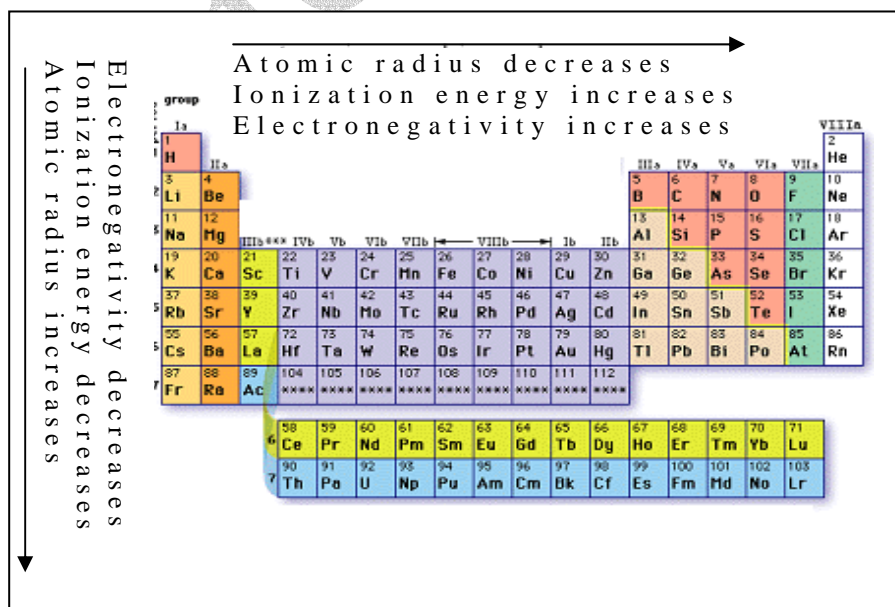
As we go **ACROSS A PERIOD, ATOMIC RADIUS DECREASES**. This occurs because as we go across, we not only increase the number of protons, but we also increase the number of electrons. And, since no energy levels are added, the increased number of protons and electrons creates a greater attraction between the two and thus pull them closer to one another.

The second periodic trend we will study is **IONIZATION ENERGY**. Ionization energy is defined as the amount of energy needed to remove an electron from an atom or ion in its ground state in the gas phase. **AS WE GO DOWN A GROUP, IONIZATION ENERGY DECREASES**. Because atoms gain energy levels of electrons as we move down a group, and inner electrons cause a shielding effect, it is easier to remove an electron from an atom with seven energy levels than it would be to remove an electron from an atom with only 2 energy levels.

AS WE MOVE ACROSS A PERIOD, IONIZATION ENERGY INCREASES. This can be explained by thinking about an element's valence and what it must do to either remove all electrons from its outer energy level, or to fill its outer energy level with eight electrons. Surely, since the elements in Group IA have only one electron in their outer energy level and they tend to give it up to form an ion, it would be easier to remove an electron from them than it would to remove an electron from a halogen which has seven electrons in its outer energy level and only needs one more to fill its outer shell.

ELECTRONEGATIVITY is defined as the tendency for an atom to attract electrons to itself when it is bonded to another atom. **AS WE MOVE DOWN A GROUP ELECTRONEGATIVITY DECREASES**, again due to the shielding effect of the inner electrons.

AS WE MOVE ACROSS A PERIOD, ELECTRONEGATIVITY INCREASES. Consider my explanation above as to valence electrons and an atom's desire to gain or lose an electron based on its valence and this trend makes sense. Certainly in a compound of sodium, Na and chlorine, Cl, sodium would easily allow its outer electron to be attracted to chlorine since sodium wants to give up an electron and chlorine wants to gain one. One important note about **electronegativity** is that it **does not apply to the noble gases**. This is because the noble gas elements do not readily form compounds. To summarize, refer to the diagram above.



- _____ 1. The largest 5th period metal.
- _____ 2. The Group IIIA element that is smaller than Indium, but the most electronegative.
- _____ 3. The fourth period metalloid with the smallest atomic mass.
- _____ 4. The element with the lowest electronegativity that reacts with air and water and has to be stored in oil.
- _____ 5. The nonmetal with an oxidation number of (2-) that has the greatest atomic mass.
- _____ 6. The element with 2 protons less than the most electronegative element.
- _____ 7. The least reactive third period element.
- _____ 8. The element with more protons than Sulfur that has the lowest ionization energy.
- _____ 9. The Alkaline Earth metal which is larger than Calcium but the lowest electronegativity.

- _____ 10. The synthetic element with the smallest atomic number.
- _____ 11. The transition element with the smallest atomic radius.
- _____ 12. The largest 4th period non-metal.
- _____ 13. The third period metalloid with the largest atomic mass.
- _____ 14. The element with the highest electronegativity that reacts with air and water and has to be stored in oil.
- _____ 15. The nonmetal with an oxidation number of (1-) that has the smallest atomic mass.
- _____ 16. The element with 12 protons more than the most electronegative element.
- _____ 17. The fifth period element with the electron configuration ending in p^3 .
- _____ 18. The element with the electron configuration $5d^6$.
- _____ 19. A non-reactive element with the highest ionization energy that also has a higher atomic mass than Argon.
- _____ 20. The element with 13 more protons than the least electronegative second period element.
- _____ 21. The largest 4th period metal.
- _____ 22. The Group IIIA element that is smaller than Indium and the least electronegative.
- _____ 23. The fourth period metalloid with the largest atomic mass.
- _____ 24. The element with 5 protons more than the alkali element with the lowest electronegativity.
- _____ 25. The nonmetal with an oxidation number of (3-) that has the greatest atomic mass.
- _____ 26. The element with 2 protons more than the most electronegative element.
- _____ 27. The element with the electron configuration $3d^3$.
- _____ 28. The least electronegative third period element.
- _____ 29. The element with more protons than Sulfur that has the highest ionization energy.
- _____ 30. The Group IVA metal that has the highest ionization energy.
- _____ 31. Your favorite element. ☺
- _____ 32. The transition element with the smallest atomic mass.
- _____ 33. The third period element with the electron configuration ending in p^3 .
- _____ 34. The element with the electron configuration $4d^6$.
- _____ 35. An element with 73 protons.
- _____ 36. The element with 7 more protons than the least electronegative third period element.
- _____ 37. The smallest of the Group IIB elements.
- _____ 38. The smallest of the Alkaline Earth Metals.
- _____ 39. What do you do with dead people?
- _____ 40. The heaviest metalloid
- _____ 41. An alkali in the fourth period.
- _____ 42. A transition element whose d orbital configuration is $3d^6$.
- _____ 43. The halogen in the fourth period.
- _____ 44. Noble gas element whose atoms are the heaviest.
- _____ 45. Atom whose electron configuration ends in $4p^1$.
- _____ 46. A second period element with a 2- oxidation number.
- _____ 47. An element with the largest atoms in the first period.
- _____ 48. A third period inert gas.
- _____ 49. Smallest atom of all the elements.
- _____ 50. Lightest atom of all the elements.
- _____ 51. Sixth period element whose configuration ends with p^6 .
- _____ 52. The second period element with the lowest electronegativity.
- _____ 53. The fifth period element with the highest ionization energy.
- _____ 54. The element with the lowest electronegativity.
- _____ 55. An atom whose oxidation number is 0 and is the second largest in its group.

- _____ 56. The chalcogen metal with the lowest ionization energy.
- _____ 57. The third period alkali metal.
- _____ 58. The smallest of the Group IIA elements.
- _____ 59. The largest of the Alkaline Earth Metals.
- _____ 60. The largest atom among the Alkali Group.
- _____ 61. The most electronegative non-metal.
- _____ 62. An alkali in the third period.
- _____ 63. A transition element whose d orbital configuration is $3d^3$.
- _____ 64. The halogen in the fifth period.
- _____ 65. Noble gas element whose atoms are the smallest.
- _____ 66. Atom whose electron configuration ends in $4p^3$.
- _____ 67. A third period element with a 2- oxidation number.
- _____ 68. An element with the smallest atoms in the third period.
- _____ 69. A first period inert gas.
- _____ 70. Smallest atom of all the elements.
71. What is atomic radius?
72. How is atomic radius measured?
73. What is the shielding effect?
74. What is ionization energy?
75. What is electronegativity?
76. When writing the periodic trend for electronegativity, why aren't the noble gases included?
77. List the symbols of all the synthetic elements.
78. List the symbols of all seven alkali elements.
79. List the symbols of all six alkaline earth metals.
80. List the symbols of all seven metalloids.
81. List the symbols of all five chalcogens.
82. List the symbols of all five halogens.
83. List the symbols of all six noble gases.
84. List the symbols of all ten non-metals.
85. List the symbols of the two elements that are liquid at room temperature.
86. List the symbols of the eleven elements that are gases at room temperature.

For each of the following statements, determine which term it best describes. Use: **metal, metalloid** or **nonmetal**. You will use some terms more than once.

87. _____ These elements are brittle or gases.
88. _____ These elements generally form cations.
89. _____ This group of elements contains solids, liquids & gases at room temperature.
90. _____ All d block and f block elements belong to this group.
91. _____ These elements are malleable and ductile.
92. _____ These elements generally gain electrons when they form ions.
93. _____ These elements have high melting points.
94. _____ These elements are good conductors of heat and electricity.
95. _____ These elements have a shiny metallic appearance.
96. _____ These elements have properties of metals and nonmetals.
97. _____ These elements are used as semiconductors.
98. _____ These elements are poor conductors of heat & electricity.
99. _____ These elements have high densities.
100. _____ These elements have high ionization energies.

For each of the following statements, determine which term it best describes. Use: **alkali, halogen, chalcogen, metalloid, alkaline earth, lanthanide, actinide, transition elements, noble gas, or synthetic**. You will use some terms more than once.

101. _____ This group contains a metal, metalloid and non-metals.
102. _____ The elements in this group are harder and denser than the alkali metals.
103. _____ This term refers to elements that have properties of both metals and non-metals.
104. _____ This group has a one valence electron.
105. _____ This group contains solid, liquid & gaseous elements at room temperature.
106. _____ This group of elements loses 2 electrons when they form ions.
107. _____ These elements are metals with high electrical conductivity.
108. _____ This group reacts with water and air.
109. _____ This group contains the most reactive non-metals.
110. _____ The elements in this group are inert.
111. _____ All of the members in this family are gases.
112. _____ _____ These two series of elements are known as Rare Earth elements.
113. _____ This group of elements contains mostly synthetic elements.
114. _____ These elements are stored in oil.
115. _____ These elements are man-made.
116. _____ These elements are referred to as B group elements.
117. _____ This group has an oxidation number of 2+.
118. _____ These elements have the highest electronegativities in their period.