

Ionization Energy and the Periodic Table

The periodic table organizes the elements according to their increasing atomic number. This is useful because repeating patterns of physical and chemical properties occur as the atomic number of the elements increases. This is called the periodic law.

Ionization Energy is the amount of attraction an atom has for its own electrons. An element with a high ionization energy attracts its own electrons very strongly. It is not likely to release electrons to participate in chemical reactions. An element with a low ionization energy gives up electrons easily. It is more likely to participate in chemical reactions. Thus, the ionization energy of each element gives us one measure of its reactivity compared to other elements.

This information is particularly useful in predicting how each metallic element will behave chemically. Ionization energy is not as useful for predicting the chemical activity of nonmetals and metalloids. They are more likely to accept or share electrons in chemical reactions rather than to give up their electrons. In this activity you will examine how the ionization energy varies as the atomic number increases.

Procedure:

1. Study the chart of ionization energies and electronegativities found below. The units for ionization energy on this chart are kilojoules/mole.
2. If you are plotting this graph by hand turn the paper horizontally. The x-axis is the **atomic number** and should go to 92 (uranium). The y-axis is **ionization energy (kJ/mol)** and should go from 0 to 2500.
3. Connect the data points with straight lines. Start with the ionization energy for the element with atomic number 1 and connect to atomic number 2 value, then continue with a new straight line to number 3. Label the graph peaks and valleys with the symbol for those elements.
3. Write out in words your conclusions from the graph.

1314 H 2.1	Ionization Energies and Electronegativites															2368 He --	
519 Li 1.0	900 Be 1.5											799 B 2.0	1088 C 2.5	1401 N 3.0	1036 O 3.5	1682 F 4.0	2076 Ne --
498 Na 0.9	736 Mg 1.2											578 Al 1.5	787 Si 1.8	1063 P 2.1	1000 S 2.5	1256 Cl 3.0	1519 Ar --
418 K 0.8	590 Ca 1.0	632 Sc 1.3	661 Ti 1.5	649 V 1.6	653 Cr 1.6	716 Mn 1.5	762 Fe 1.8	757 Co 1.8	736 Ni 1.8	745 Cu 1.9	904 Zn 1.6	578 Ga 1.6	782 Ge 1.8	1013 As 2.0	942 Se 2.4	1142 Br 2.8	1352 Kr --
402 Rb 0.8	548 Sr 1.0	636 Y 1.2	670 Zr 1.4	653 Nb 1.5	695 Mo 1.8	720 Tc 1.9	724 Ru 2.2	745 Rh 2.2	804 Pd 2.2	728 Ag 1.9	866 Cd 1.7	557 In 1.7	707 Sn 1.8	833 Sb 1.9	870 Te 2.1	1008 I 2.5	1172 Xe --
377 Cs 0.7	502 Ba 0.9	540 La 1.1	531 Hf 1.3	586 Ta 1.5	770 W 1.7	757 Re 1.9	841 Os 2.2	887 Ir 2.2	862 Pt 2.2	887 Au 2.4	1008 Hg 1.9	590 Tl 1.8	716 Pb 1.8	770 Bi 1.9	820 Po 2.0	-- At 2.2	1038 Rn --
-- Fr 0.7	510 Ra 0.9	678 Ac 1.1	-- Ku --														
1008 – ionization energy	665 Ce 1.1	557 Pr 1.1	607 Nd 1.1	-- Pm 1.1	540 Sm 1.1	548 Eu 1.1	594 Gd 1.1	649 Tb 1.1	657 Dy 1.1	-- Ho 1.1	-- Er 1.1	-- Tm 1.1	598 Yb 1.1	481 Lu 1.2			
C - symbol 2.5 - electro- negativity	-- Th 1.3	-- Pa 1.5	385 U 1.7	-- Np 1.3	-- Pu 1.3	-- Am 1.3	-- Cm 1.3	-- Bk 1.3	-- Cf 1.3	-- Es 1.3	-- Fm 1.3	-- Md 1.3	-- No 1.3	-- Lr --			