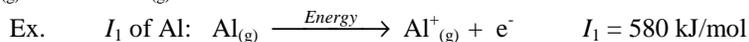
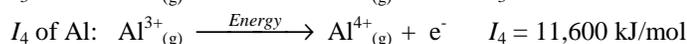
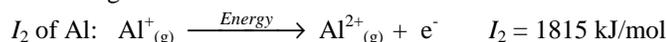


12. Periodic Trends

- a.) **Ionization Energies:** the energy required to remove the most loosely held electron from an gaseous atom or ion. $X_{(g)} \longrightarrow X^+_{(g)} + e^-$



Successive Ionization Energies:



What explains the reason for the increase in successive ionization energies?

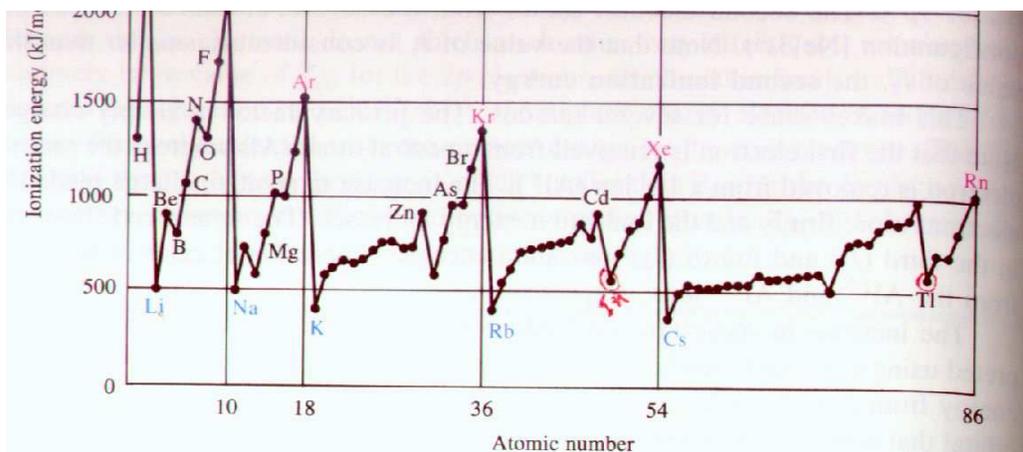
- 1.) Electron is removed from a higher energy orbital, i.e., $3p^1 > 3s^2$
- 2.) Electrons are being removed from an increasingly more positive ion.
- 3.) The largest jump, I_4 , corresponds to the energy needed to remove an electron from the filled 2^{nd} energy level core electrons

1st Ionization Energy Trend:

Shielding Effect: Reduction in attraction of nucleus toward an electron due to distance and number of electrons that effectively repel and block the outer electron..

Across Period: Increases, due to the increase in number of protons, nuclear charge, electrons are not shielded.

Down Family: Decreases down a group. Electrons are farther from the nucleus (easier to remove) and more shielding effect.



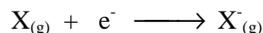
1st Ionization energy vs Z 1

Explain reasoning for reduction in energy of oxygens first ionization energy with that of nitrogens (the dip). Oxygen's electron is paired up. The ionization removes this electron reducing the repulsion from the doubly occupied orbital.

Removing an electron from a filled valence shell requires the greatest amount of energy.

b.) **Electron Affinity**

Energy change associated with the addition of an electron in a gaseous atom.



If releases energy (exothermic) sign carries a negative value.

If requires energy (endothermic) sign carries a positive value.

Trend.

Across: The energy is more negative as you go from left to right. Some exceptions; for example P: when adding an electron, this electron is doubled up in an orbital which creates repulsion compared to the previous neighbor Si.

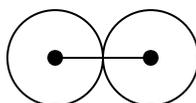
Down a Column: Expect the energy to be more positive, less “favorable” energy released.

Exception: F, Fluorine is less negative than the trend would predict. This is because of the smaller size of the atom. The electrons are very close together there is a large amount of electron-electron repulsion.

Atom	Electron Affinity (kJ/mol)
F	-327.8
Cl	-348.7
Br	-324.5
I	-295.2

c.) **Atomic Radius**

Measured by taking half of the bond length of the diatomic molecule. Not 100% certain



Values are relative. In a bond the interpenetration reduces size.

Isoelectronic Series: Ex. F^- , Ne, Na^+

Homework: P.324 #85, 87, 90, 93, 95, 96, 97, 98, 99, 100, 101, 102, 125, 133, 133, 134, 135