4.5 Periodic Trends

1. Atomic Radius

The size of atom.

Chemocracy!

What do you think, as you go left to right, adding protons, neutrons, and electrons, will atomic radius increase or decrease?

Increase	Decrease

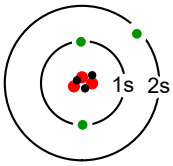
Oct 18-9:32 PM

Radius Trends

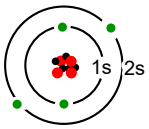
Across a row, size *decreases* from left to right. Odd!

Nucleus has greater pull on electrons going into the SAME energy level.

Example: Lithium vs. Beryllium.



Li - 3 Protons



Be - 4 Protons

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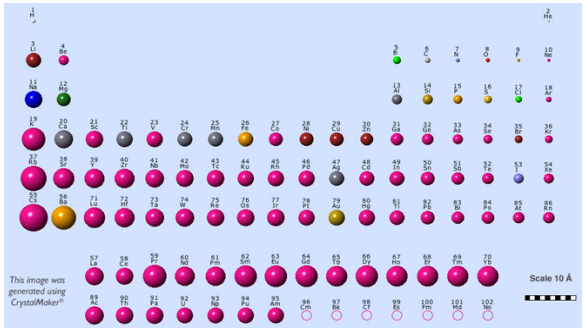
Radius Trends

Radius increases down a group: adding electrons to higher energy levels requires distant orbitals.

Also: inner electrons repel outer ones.



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Ion

Def. – Atom or group of atoms with a net charge.

Positive charge → electron(s) removed.
Called Cations.
Metals lose electrons.

Negative charge → electron(s) added.

Guess what they're called? Not Dogions - Anions
Nonmetals gain electrons.

See Resource page 3.

Writing Ions: use superscript to show charge: O^{2-} K^{+} NO_3^{-}

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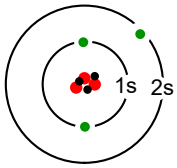
Ionic Radius Trends

Atoms losing electrons get smaller.

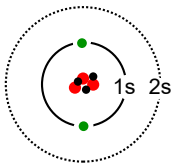
Valence electrons lost – orbitals become empty.

Electrostatic repulsion of electrons is less.

Nuclear pull is proportionally greater.



Lithium Atom



Lithium Ion (Li^+)

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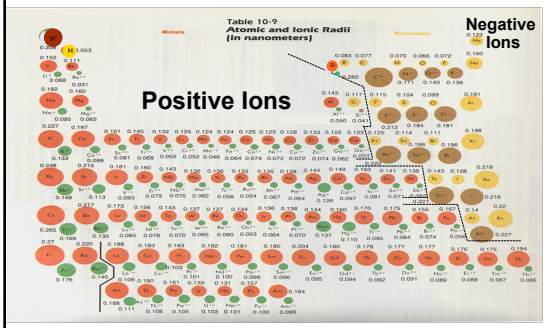
Ionic Radius Trends

Atoms gaining electrons become larger.

A. More repulsion between electrons.

B. Nucleus pulls electrons less (farther away).



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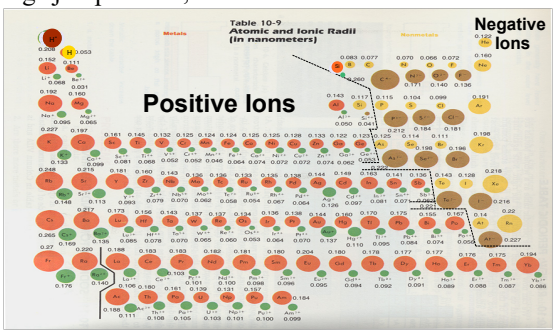
Ionic Radius Trends

Smaller across a period, larger down a group (same as atomic radius trends).

NOTE: as you go from cations to anions, there's a large jump in size, but the trend continues after that.



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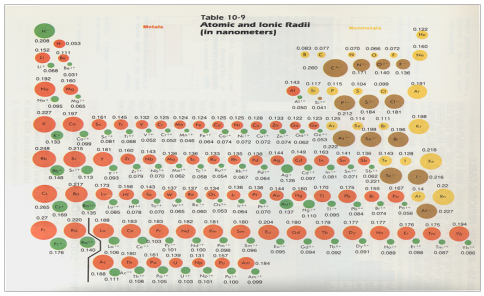
Ionic Trend Review

2. Will a sulfide ion (S^{2-}) be larger or smaller than a sulfur atom?

3. Is a sodium ion (Na^{+}) smaller or larger than a sodium atom?

4. Which is bigger: K^{+} or Zn^{2+}?

5. Why aren't noble gas ions on this chart?



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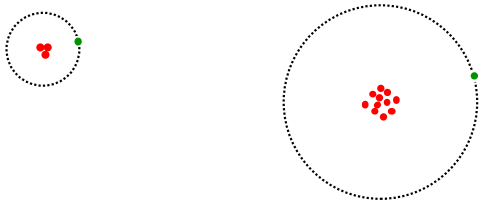
Ionization Energy

Energy required to <u>remove</u> an electron to make a *positive* ion.

Increases from left to right across a period.
Decreases down a group.

Bigger atoms have valence electrons far from nucleus: less attraction to overcome.



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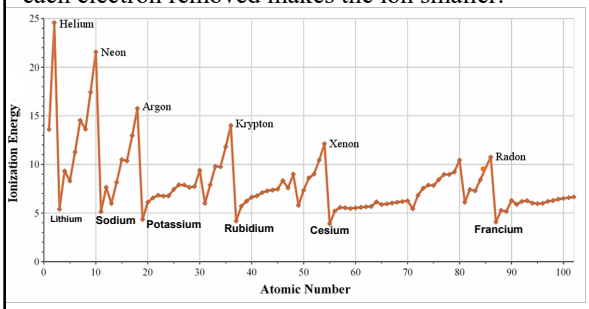
Ionization Energy

More energy is required to remove additional electrons - each electron removed makes the ion smaller.



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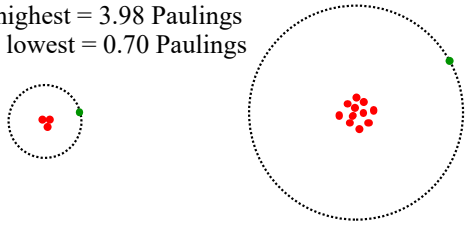
Electronegativity (Resource P. 5)

<u>Def:</u> Relative ability an element has to attract electrons in a chemical bond.

Trends: Generally greater as you go from left to right across a period.

Generally less as you go down a group.

Fluorine highest = 3.98 Paulings
Francium lowest = 0.70 Paulings



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Quick Quiz!

6. Which element is larger, K or Ca?

7. Which element has a higher electronegativity, Si or Ba?

8. Which element has the greater ionic radius, Na^{+} or Rb^{+}?

9. Which element has the greater ionic radius, Ca^{2+} or Se^{2-}?

10. Which is larger: Te or S?

11. Organize the following elements from biggest to smallest:

Li Be B C N O F

Homework

4.5 Problems in your Booklet
Due: Next Class

Oct 18-9:52 PM