Trends of the Periodic Table

Mendeleev's periodic table (1869)

Atomic Radius

- distance from center of atom to outermost ring of electron cloud.

Trend

- As we move across (→) the radius decreases
  Why? The # of p^+ (control) increases w/ no new rings added
- As we move (↓) a column, the radius increases
  Why? Each row adds a new ring

Na vs S Which is larger?

- 3 rings
- $11p^+$
- less control our e^-

- 3 rings
- $16p^+$
- more control of e^-

O vs Se Which is smaller?

* O has 2 ring
* Se has 4 rings
* O has more control over e^-

Ionic Radius

distance from center of ion to the outermost ring of electron cloud.

Trend

- As we move across (→) the radius decreases
  Why? The p^+ increase w/ no new rings added

BUT! (Hiccup) The trend starts over (larger → smaller) at the switch from cations to anions

- As we move ↓ a column, the radius increases
  Why? New rows = new rings.

Li^+ vs K^+ larger?

* Li^+ has 1 ring
* K^+ has 3 rings
* Li^+ has more control of e^-

Rb^+ vs Se^{2-} Smaller?

* Both have 4 rings
* Rb^+ has more p^+
* Rb^+ has more control over e^-

Atom vs Ion

Atom - the simplest form of an element (neutral)

Ion - an atom w/ a charge

Trend

cation - positively charged atom

↳ lost e-, lost ring

Cation is always smaller than its atom.

Smaller?

Ca vs Ca^{2+}

* Ca has 4 rings
* Ca^{2+} has 3 rings
* Ca^{2+} has more control over e-

anions - negatively charged atom

↳ gain e-, fill outer ring

* Electrostatic Repulsion - electrons repel each other

☆ Anions will Always be larger than its atom

Ca vs Ca^{2+} Smaller?

* Ca has 4 rings
* Ca^{2+} has 3 ring
* more control over e-

Bigger? O vs O^{2-}

* Both have 2 rings

Ionization Energy IE

- The energy required to remove an e⁻

Trend

As we move (→) across IE increases

Why? more p⁺, more control

As we move (↓) down, IE decreases

Why? more rings, less control over e⁻

N vs O Which has more IE?

* Both have 2 rings
* O has more p⁺
* O has more control

Mg vs Ca Which has less IE?

* Ca has more rings
* Ca has less control

2nd Ionization Energy

Energy required to remove a second electron

Trend

Dependent upon 1st IE

Column 1 (after 1st IE) would have a full octet (has already lost ve^-) and does not want to lose another.

Column 2 (after 1st IE) still has $1ve^-$ and wants to get rid of it, so small 2nd IE

Rb^+ vs Sr^+

Smaller 2nd IE?

Rb^+ has 4 rings

Sr^+ has 5 rings

Rb^+ has more control (full octet)

Electronegativity

The ability of an atom to attract an electron within a bond (→)

Trend

As we move (→) across, the e⁻ neg increases

Why? more p⁺ for same # ring

As we move ↓ a column, e⁻ neg decrease

Why? more rings, less control

Fr vs U Higher e-neg?

- Both have rings
- U has more control

Reactivity

- How easily it reacts.

Trend

Metals - the less control over e^-, the more reactive it is. (Want to lose)

NON-metals - the more control they have, the more reactive it is. (Want to gain)

Melting Point

- When something is melted (solid → liquid) the bonds are not broken.
  (Boiling is breaking bonds)

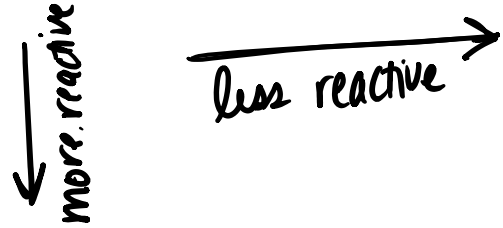
For non-metals
melting point increases down a column

For metals
melting (& boiling) point generally decrease down a column

Metallic Character / Metallic Reactivity

The tendency to lose an electron

Trend - the less control it has, the more reactive it is.



Fr is the most Reactive (least control)

Non-metal Reactivity / Electron Affinity (attraction)

The tendency of an atom to gain an electron

Fluorine is the most reactive non-metal