+1–11
+2–24
+3–39

7.5: Electron Configuration and the Periodic Table

*Main group elements tend to either lose or gain the number of electrons needed to achieve the same number of electrons as the nearest noble gas.

Isoelectric: describes two or more species with identical electron configurations

*To write the electron configurations of an ion formed by a main group element,

1. Write the configuration for the atom
2. Either add or remove the appropriate number of electrons

**d*-block elements/transition metals always lose electrons first from the *s* shell with the *highest* value of *n*.

*In general, when a transition metal becomes an ion, it loses electrons first from the *ns* subshell and then from the *(n-1)d* subshell.

7.6: Ionic Radius

*When an atom gains or loses one or more electrons to become an ion, its radius changes.

Ionic Radius: the radius of a cation or anion

- Affects the physical and chemical properties of an ionic compound

*When an atom *loses* an electron and becomes a cation, its radius *decreases* due in part to a reduction in electron-electron repulsions (and consequently a reduction in shielding) in the valence shell.

*When an atom *gains* one or more electrons and becomes an anion, its radius *increases* due to increased electron-electron repulsions. Adding an electron causes the rest of the electrons in the valence shell to spread out and take up more space to maximize the distance between them.

Isoelectric Series: a series of two or more species that have identical electrons configurations but different nuclear charges

*In an isoelectric series, the species with the *smallest* nuclear charge (the smallest atomic number) will have the *largest* radius and the species with the *largest* nuclear charge (the largest atomic number) will have the *smallest* radius.

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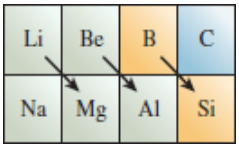
7.7: Periodic Trends in Chemical Properties of the Main Group Elements

*Ionization energy is a measure of how powerfully an atom attracts its own electron.

*Electron affinity is a measure of how powerfully an atom can attract electrons from another source.

Trends:

1. Elements in the same group resemble one another in chemical behavior because they have similar valence electron configurations
   a. This must be applied with caution.
   b. The properties of the first member of each group are different from those of the rest of the members of the same group.
      i. This difference can be attributed to the unusually small size of the first element in each group.



2. **Diagonal Relationship:** similarities in chemical properties of elements that are in different groups but that are positioned diagonally to one another in the periodic table.

Hydrogen ($1s^1$)

- No completely suitable position for hydrogen in the periodic table
- Can be a cation (H^+) or an anion (H^-…called hydride)

Group 1A Elements (ns^1, $n \geq 2$)

- Low ionization energies
- Tend to form M^+ cations
- Very reactive
- React with water to produce $H_2(g)$ and the corresponding metal hydroxide

$$2M(s) + 2H_2O(l) \longrightarrow 2MOH(aq) + H_2(g)$$