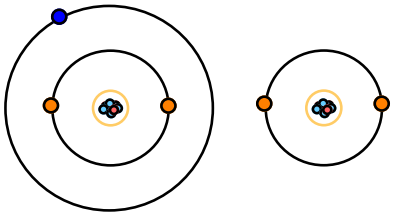
CONCEPT: PERIODIC TREND: IONIC RADIUS

- **Ionic Radius:** Distance between an ion's nucleus and its outer electron shell.
  - □ **Periodic Trend:** Ionic radius _____ as the number of electrons _____.

Ionic Radius

Ionic Radius (Cation)

□ Cations tend to be smaller than their neutral parent form.

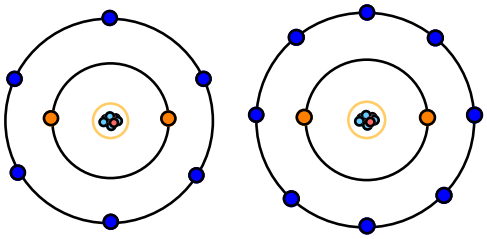


Li atom
$1s^2 2s^1$

Li^+ ion
$1s^2$

Ionic Radius (Anion)

□ Anions tend to be larger than their neutral parent form.



O atom
$1s^2 2s^2 2p^4$

O^{2-} ion
$1s^2 2s^2 2p^6$

□ Losing an electron(s) _____ ionic radius.

□ Gaining an electron(s) _____ ionic radius.

EXAMPLE: Which of the following statements is false?

a) The calcium ion has a smaller ionic radius than the calcium atom.

b) The sulfide ion has a larger ionic radius than the sulfur atom.

c) The cadmium ion has a larger ionic radius than the cadmium atom.

d) The bromide ion has a larger ionic radius than the bromine atom.

Ranking Ionic Radii

- When ranking ionic radii you must determine the total number of electrons for atoms and ions.
  - □ Recall, *isoelectronic* species are atoms or ions that have the same number of electrons.

EXAMPLE: Arrange the atoms and/or ions in order of decreasing ionic radius: Fe^{2+}, Mn^+, Ni^{2+}, Zn^{2+}.

STEP 1: Determine the total number of **electrons** for each element or ion.

□ _____ the number of electrons = _____ ionic radius.

STEP 2: If the atoms or ions have equal electrons (isoelectronic): ____ negative charge = ____ ionic radius.

Isoelectronic Species

□ **For isoelectronic species**: The ____ negative the charge, the ____ ionic radius.

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PRACTICE: Arrange the following atoms and/or ions in the order of increasing size: Br^-, Kr, Rb^+, Sr^{2+}.

PRACTICE: Arrange the following isoelectronic series in order of decreasing radius: F^-, O^{2-}, Mg^{2+}, Na^+.

PRACTICE: For an isoelectronic series of ions, the ion that is the smallest is always

a) The ion with the fewest protons.

b) The least positively charged ion.

c) The ion with the highest atomic number.

d) The ion with the most neutrons.

e) The ion with the most electrons.