

Non Sibi High School

Andover's Chem 550/580: Advanced Chemistry

Chapter 8, Review Quiz 1 Answers

1

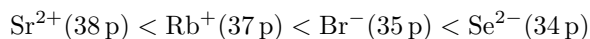
Rank each group of atoms and ions from smallest to largest radius:

- a. N, O, P^{3-} , P
- b. Ca, K, Mg^{2+} , Mg
- c. Br^- , Rb^+ , Se^{2-} , Sr^{2+}

a. For neutral atoms, closest to upper right corner of periodic table = smallest atomic radius, so neutral atoms are ranked $O < N < P$. Neutral atoms will be smaller than anions of the same element, so $P < P^{3-}$. Therefore, the final ranking will be $O < N < P < P^{3-}$.

b. Neutral atoms are ranked $Mg < Ca < K$. Neutral atoms will be larger than cations of the same element, so $Mg^{2+} < Mg$. Therefore, the final ranking will be $Mg^{2+} < Mg < Ca < K$.

c. All are isoelectronic with 36 electrons. More protons = greater effective nuclear charge = smaller ionic radius, so from smallest to largest we have:



2

Rank Ar, Ba, Cl, and Cs from smallest to largest atomic radius and lowest to highest first ionization energy.

Closest to the upper right corner of the periodic table = smallest atomic radius = highest first ionization energy. Therefore, from smallest to largest atomic radius we have $Ar < Cl < Ba < Cs$, and from lowest to highest first ionization energy we have the opposite order, $Cs < Ba < Cl < Ar$.

3

Explain the huge increase in ionization energy between I_4 and I_5 for carbon.

Carbon has the complete electron configuration $1s^2 2s^2 2p^2$. The ionization energies will increase gradually from I_1 through I_4 as the two valence $2p$ electrons and then two valence $2s$ electrons are removed, but then I_5 will be enormous compared to I_4 as the 5th electron removed from carbon comes from the non-valence $1s$ orbital and, thus, requires a huge amount of energy for removal.



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