

# Non Sibi High School

Andover's Chem 300: Accelerated/Honors Chemistry

## Chapter 8, Review Quiz 1 Answers

### 1

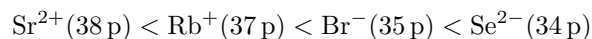
Rank each group of atoms and ions from smallest to largest radius:

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

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

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

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  $\text{Ar} < \text{Cl} < \text{Ba} < \text{Cs}$ , and from lowest to highest first ionization energy we have the opposite order,  $\text{Cs} < \text{Ba} < \text{Cl} < \text{Ar}$ .

### 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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