

Quiz # 8 (May 27, 2008)

Value: 10 points; Time: 10 minutes

Name _____ KEY _____

Section _____

Compare with problem Z12.99 Explain all parts below:

Element (Valence Electronic Configuration)	1 st Ionization Energy (kJ/mol)	Atomic (Covalent) Radius (pm)	Ionic (M+) Radius (pm)
Li (2s ¹)	520	152	60
Na (3s ¹)	495	186	95
K (4s ¹)	419	227	133
Rb (5s ¹)	409	247	148
Cs (6s ¹)	382	265	169

Q8)a) Does the information of alkali metals (column 1 of the periodic table) in the table (above, 12.9 from the text) confirm the general period trend in the ionization energy?

The general trend in the I.P. or ionization energy (or potential) decreases as one goes down a column, because the electrons are held less tightly, because the principle quantum number, n , is increasing and the effective nuclear charge is not holding the valence electrons as tightly, so it is easier to remove an electron for the larger atoms (when the type of the valence electron remains constant).

b) Does the information of alkali metals in the table (above, 12.9) from the text confirm the general period trend in the atomic radius?

Yes, the radius generally increases as one goes down a column, because the principle quantum number, n , increases and that is consistent with the monotonic increase shown in the table.

c) The wave function for an 'ns' orbital goes as $\Psi_{ns}(r) \sim e^{-\sigma/n}$ where $\sigma = \frac{Zr}{a_0}$. When

using the Aufbau principle to construct the alkali metals, what terms contribute to determining the radius of the alkali metals?

The radius is determined by the trade-off between the effective nuclear charge, Z_{eff} , which is much less than Z and the principle quantum number n . Both increase as one goes down the column. Increasing Z would cause the radius to decrease, and increasing n would cause the radius to increase. {The increase in n dominates and causes the radius to increase.}