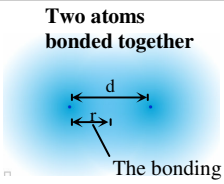
Periodic Trends – Atomic Radius

Name _____

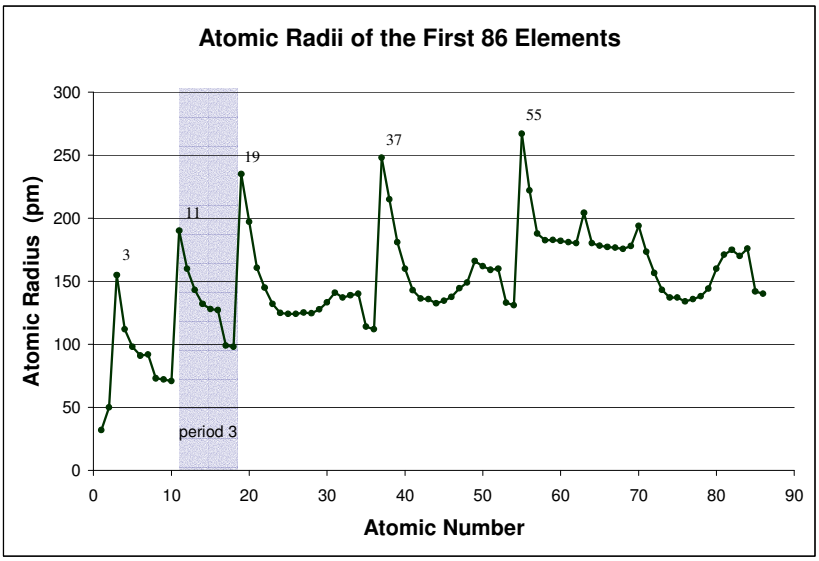
Chem Worksheet 6-1



The bonding atomic radius is half the distance between the nuclei

The radius of an atom describes the distance between the nucleus and the outermost electron. This distance is very small so it is often reported in picometers (10^{-12} m) or angstroms (10^{-10} m). One way of measuring the atomic radius is to observe the distance between bonding atoms. The distance between the nuclei of the bonding atoms is equal to two times the atomic radius. This distance is called the **bonding atomic radius** and is shorter than the non-bonded radius.

A pattern is observed when the atomic radius is plotted against the atomic number. As might be expected the largest atoms are found at the bottom of the periodic table. However as you go across a period, the atomic radius decreases (see highlighted region in the graph below). All of the elements in a period have the same orbitals which have the same energy and same size. The elements that lay on the right side of the periodic table have more protons though. This results in a larger attraction for the electrons and a smaller radius. This explains why argon (z = 18) has a smaller radius than sodium (z = 11).



Answer the following questions.

1. Estimate the size of the smallest atom in the chart above. Estimate the size of the largest.
2. Which five elements are represented by the tallest 'peaks' in the graph above?
3. Write the approximate radius for each of the noble gases in the table below.

helium		argon		xenon	
neon		krypton		radon	

4. What is the general trend for atomic radius as you go down the noble gas family?
5. What is the general trend as you move through period 3 (from element 11 to element 18)
6. Carbon (z = 6) and neon (z = 10) both have their outermost electrons in 2p orbitals. Explain why neon is smaller than carbon even though it has more electrons.
7. The graph shows a sudden increase in atomic radius for lithium, sodium, potassium, rubidium, and cesium. Explain why there is a spike on the graph at element numbers 3, 11, 19, 37, and 55.
8. Bromine (z = 35) forms a diatomic molecule. Sketch a picture of this molecule and determine the distance in picometers between the two bromine nuclei.