Review – Periodic table, bonding, and intermolecular forces

Periodic table

1. How does atomic radius change as you go across a period (left to right)? Down a group?
2. What is effective nuclear charge (Zeff)? How does effective nuclear charge help explain the trend for atomic radius as you go across a group?
3. Why does atomic radius tend to increase as you go down a group?
4. Is it easier to remove an outer electron from lithium or potassium? Why?
5. Alkali metals react with air or water, but sodium chloride is fairly non-reactive. How can this difference be explained?
6. What are the characteristics of the following chemical families
   1. Alkali metals
   2. Alkaline earth metals
   3. Halogens
   4. Noble gases
7. How does the electron configuration help explain the features you listed for the families above?

Answer Key

1. Atomic radius decreases from left to right across the periodic table, increases as you go down a group.
2. Effective nuclear charge =number or protons – number of core electrons. As the effective nuclear charge increases, the positive charge “felt” by the outer electrons increases, and that increased positive charge is able to pull electrons in closer.
3. Atomic radius increases as you go down a group because with each row, a new shell of electrons is added, which is further from the nucleus
4. Easier to remove an outer electron from potassium because it has a lower ionization energy (outer electrons are not as tightly held by the nucleus)
5. The sodium in sodium chloride is an ion. It has already lost its valence electrons. The thing that makes alkali metals so reactive is that they have a valence electron which can be removed very easily, resulting in frequently violent reactions.
6. A. light, very reactive metals, form +1 ions

b. reactive, but not as reactive as alkali metals, form +2 ions

c. reactive, diatomic non-metals, form -1 ions

d. inert (non-reactive) gases, do not form ions

7. – metals with only one or two valence electrons in an “s” subshell will easily lose those electrons and form +1 or +2 ions, non-metals with a nearly full “P” subshell will be quite electronegative and easily able to attract an extra electron to form a -1 ion. Noble gases have a full “p” subshell so are very stable and do not readily react.