Periodic Trends

Name_____Per____

1. Without looking at the chart on NoteSheet F5 (G1) , and just looking at a periodic chart determine which pair of particles listed is smaller? Explain why?
   a. N or As

   b. N or F

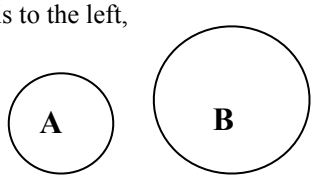
2. Without looking at the chart on Note Sheet F6 (G2), instead only looking at a periodic chart, determine which of each pair of the particles has the larger first ionization energy? Explain why?
   a. Mg or Sr

   b. Na or P

3. Writing Equations to represent electron ionizations:
   a. Write a reaction that represents the first ionization of aluminum?
   b. Write a reaction that would represent the third ionization of aluminum?

4. It's always harder to remove yet another electron from a particle, but there is one particular electron that shows an extraordinary increase in ionization energy over the previous energy. For each atom, state which electron is particularly difficult to remove. (You should be able to do this just by looking at the periodic chart and not to looking at the table on pg 2 of NoteSheet F5)
   a. Ca
   b. P
   c. Cs
   d. Ga

5. Answer the following questions referring to the picture to the right and explain your answers?
   a. If A and B represent the atomic radii of two elements in the same period, which element is to the left, and which is to the right?



   b. If A and B represent the atomic radii of two elements in the same group, which is above, and which is below?

6. The Periodic Table
   a. What's so periodic about the periodic table?

   b. What other things in your life are periodic.

Periodic Trends

ANSWERS

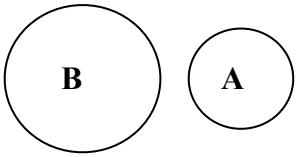
1. Which is smaller?
   a. N is smaller because it has fewer occupied energy levels.
   b. F is smaller because although F has more electrons, the added valence electrons are in the same energy level. That might make you think that N and F would be the same size, but they are not the same, F is smaller because there are more protons pulling on those electrons that are no further away from the nucleus, so the higher effective nuclear charge (ENC) pulls the outer valence electrons in closer.

2. Which has the larger first ionization energy
   a. Mg has a larger ionization energy because more energy is required to remove an electron from a smaller atom, due to fewer occupied energy levels, thus the valence electron would be closer to the nucleus that is holding it in place.
   b. P has a larger ionization energy because more energy is required to remove an electron from a smaller atom due to the increased effective nuclear charge, since the electron would be closer to the nucleus that is holding it in place.

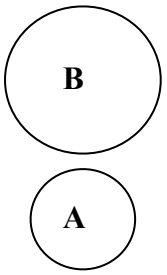
3. Writing equations to represent ionization energy
   a. $Al + IE \rightarrow Al^{+} + e^{-}$
   b. $Al^{2+} + IE \rightarrow Al^{3+} + e^{-}$

4. You should notice that the extraordinarily high increase in IE always occurs at one more than the number of valence electrons. This is because that is when you are trying to ionize an electron from an energy level one level closer to the nucleus than the previous ionization.
   a. Ca has 2 electrons in its 4th energy level, after those valence electrons are all removed, a very large amount of energy is required to remove the third electron because it is being removed from an energy level closer to the nucleus.
   b. P has 5 electrons in its 3rd energy level, after those valence electrons are all removed, a very large amount of energy is required to remove the sixth electron because it is being removed from an energy level closer to the nucleus.
   c. Cs has 1 electrons in its 6th energy level, after that single electron is removed, a very large amount of energy is required to remove the second electron because it is being removed from an energy level closer to the nucleus.
   d. Ga has 3 electrons in its 4th energy level, after those valence electrons are all removed, a very large amount of energy is required to remove the fourth electron because it is being removed from an energy level closer to the nucleus.

5. Consider the model of atoms shown:
   a. A would be to the right of B because the size of atoms get smaller as you proceed across a period (row) due to the increased effective nuclear charge pulling on electrons in the same energy level.



   b. A would be above B because atomic size gets smaller as you proceed up a group (family or column) since there are fewer occupied energy levels.



6. The Periodic Table
   a. The table is called the *periodic* table because there are repeating or cyclical patterns and properties of elements that occur over and over in each row of the chart. The elements with repeating properties are stacked up in each column of the table.
   b. Other things that are periodic are time (hours of the day, days of the week, months of each year, seasons), bell schedule in school, phases of the moon, menstrual cycle in women (notice its called a period !), pay day at work.