Teacher's Tools® Chemistry
Atomic Structure: Periodic Trends: Worksheet 4

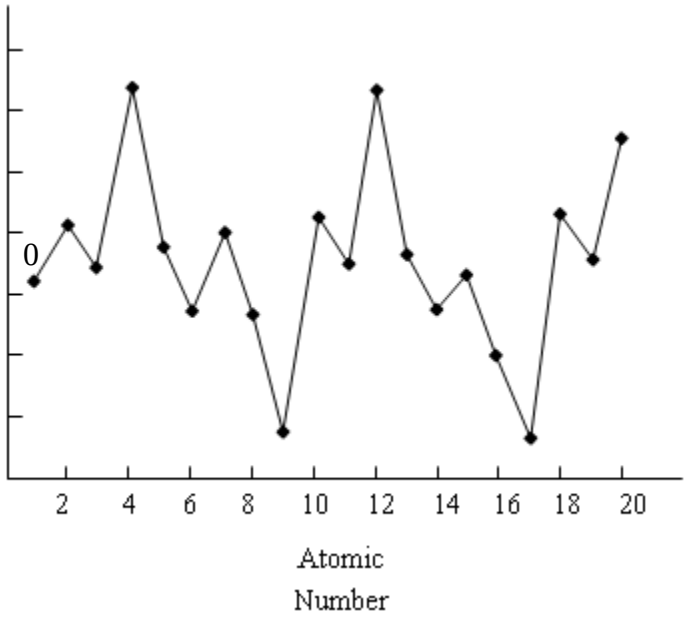
1. Arrange the following atoms or ions in order of increasing size:

   (A) Br^-, Ca^{2+}, K^+, Se^{2-}

   (B) Al^{3+}, F^-, Na^+, Mg^{2+}, O^{2-}

   (C) As^{3-}, Ca^{2+}, Cl^-, K^+

2. The following figure shows electron affinity values for the first 20 elements.



(A) Define the term "electron affinity." Electron affinity can sometimes have negative values. Explain this.

(B) Explain why beryllium has a higher value than lithium.

(C) Explain why chlorine has a lower value than sulfur.

(D) Explain why phosphorous has a higher value than silicon.

3. Which element in the following pairs of elements has the larger atomic (or ionic) radius? Reinforce your answer with a sentence or two.

   (A) Kr or Br

   (B) Rb or Br

   (C) Na^+ or F^-

4. Which element in the following pairs has the higher first ionization energy? Reinforce your answer with a sentence or two.

   (A) F or O

   (B) Al or Mg

   (C) Xe or Kr

5. Explain, in terms of electron configurations, orbital diagrams, or shielding why

   (A) the atomic radius of sodium is smaller than that of potassium.

   (B) bromine and iodine have similar chemical properties .

   (C) sulfur atoms are paramagnetic.

6. Explain, in terms of electron configurations, orbital diagrams, or shielding why

   (A) in the Periodic table hydrogen can be placed in either Group 1 or 7.

   (B) the ionization energy Ca^+ is greater than that of K even though they both have 19 electrons.

   (C) Na has a relatively simple atomic spectrum, while Cr has a very complex one.

7. Use modern atomic theory to explain each of the following experimental observations.

(A) Within a family such as the halogens, the ionic radius increases as the atomic number increases.

(B) The radius of the chloride ion, Cl^-, is larger than the radius of the chlorine atom.
(Radii: Cl atom = .99 Å, Cl^- ion = 1.81Å)

(C) The first ionization energy of boron is lower than the first ionization energy of beryllium
(First ionization energies: $_4Be$ = 900 kJ/mol, $_5B$ = 801 kJ/mol)

(D) For calcium, the difference between the second and third ionization energies is much larger than the difference between the first and second ionization energies. (Ionization energies, in kJ/mol, for Ca: 1st = 590, 2nd = 1145, 3rd = 4912)