1. (4 points) Arrange the following elements in order of increasing atomic radius:

P   O   Ba   Si

2. (4 points) When moving from the left to the right across a period of the periodic table, the ionization energy typically increases. When moving from Group 2 to Group 3, however, one typically finds the ionization energy decreases. Thoroughly explain the reason for this apparent anomaly. The word “thoroughly” means include examples, diagrams, whatever you need to address the question.

3. (4 points) State for each of the following sets of quantum numbers whether or not the combination of quantum numbers is possible. If not, state the reason the set of numbers is not possible.

a. $n = 4, \ell = 5, m_\ell = -3, m_s = +1/2$

b. $n = 3, \ell = 2, m_\ell = -1, m_s = -1/2$

c. $n = -1, \ell = 0, m_\ell = 0, m_s = +1/2$

d. $n = 7, \ell = 4, m_\ell = -5, m_s = +1/2$
4. (4 points) Write the expected electron configuration for the following species. You may use the condensed format (noble gas core) if you wish.

   a. Ge

   b. Mn

   c. Pm

   d. S

5. (4 points) Circle the following species that are isoelectronic with As\(^{3-}\).

   a. O\(^{2-}\)

   b. Kr

   c. Sr\(^{2+}\)

   d. Se\(^{2+}\)