3. Atomic Structure

1. Predict each of the following

(a) Larger radius: Co or Ni
(b) Higher ionization energy: Sn or Sb
(c) Lower ionization energy: Be\(^+\) or Be\(^2+\)
(d) Lower electron affinity: Ga or Ge
(e) Smaller radius: I or Br
(f) Larger radius: Zn or Ag
(g) Lower electronegativity: Sn or Pb
(h) Lower ionization energy: K or Ca
(i) Smaller radius: Cs\(^+\) or Ba\(^2+\)
(j) Lower ionization energy: Mg or K
(k) Smaller radius: Ba or Ba\(^2+\)
(l) Higher electronegativity: Se or Te
(m) Lower ionization energy: Ne or Cl
(n) Higher ionization energy: N or Si
(o) Lower electronegativity: Cs or Ba
(p) Lower ionization energy: N or P
(q) Larger radius: Rb or Cs
(r) Smaller radius: Al or Si
(s) Smaller radius: S or S\(^2-\)
(t) Larger radius: Br\(^-\) or Rb\(^+\)
(u) Larger radius: Se\(^+\) or Kr
(v) Higher ionization energy: Ca or Sr
(w) Higher electronegativity: Na or Mg
(x) Smaller radius: I or Ba\(^2+\)
(y) Greater electron affinity: Cl or Br
(z) Larger radius: Cs or Cs\(^+\)
(aa) Larger radius: Br or Br\(^-\)
(bb) Smaller radius: I or Po
(cc) Higher Ionization energy: Ca\(^+\) or Ca\(^2+\)

2. Provide a scientific explanation of the following trends.

(a) The radius of the Br atom (0.111 nm) is less than the radius of Br\(^+\) ion (0.196 nm).

(b) A calcium atom (1.76 Å) is larger than a zinc atom (1.22 Å).
(c) The radius of a chlorine atom (0.99 Å) is smaller than the radius of the chlorine ion, Cl\(^-\) (1.81 Å).

(d) The radius of Ca\(^{2+}\) (0.99 Å) is smaller than the radius of Cl\(^-\) (1.81 Å), even though they are isoelectric.

(e) Potassium (418.8 kJ/mol) has a lower first-ionization energy than sodium (495.8 kJ/mol).

(f) The first ionization energies of Si, P, and Cl are 786, 1012, and 1251 kJ/mol respectively.

(g) The first ionization energy of selenium (941.0 kJ/mol) is less than bromine (1139.9 kJ/mol), but greater than tellurium (896.3 kJ/mol).

(h) The second ionization energy of K (3052 kJ/mol) is greater than the second ionization energy of Ca (1145 kJ/mol).