1. Chromium crystallizes in a bcc structure. The edge length of the unit cell is 2.884 Ångstroms (1 Å = 10^{-10} m).
   a) Calculate the length of the face diagonal.
   b) Calculate the length of the body diagonal.
   c) Calculate the atomic radius of a Cr atom.
   d) Calculate the density of crystalline chromium in g/cm^3.

2. Aluminum crystallizes in a ccp structure. The aluminum atom has a radius of 1.43 Å.
   a) Calculate the length of the unit cell edge.
   b) Calculate the length of the body diagonal.
   c) Calculate the density of aluminum in g/cm^3.

3. Nickel has an fcc unit cell of volume 0.04376 nm^3.
   a) Determine the atomic radius of nickel.
   b) Determine the density of nickel in g/cm^3.

4. Lithium chloride crystallizes in the rock salt structure. The ionic radii of lithium ion and chloride ion are 0.60 Å and 1.81 Å, respectively.
   a) Show that it is possible to fit a Li^+ ion between Cl^- ions along an edge of the cube without distortion. To do this, calculate the diameter of the octahedral hole between the chloride ions on the corners.
   b) Calculate the density of LiCl in g/cm^3.
   c) Calculate the percent occupied volume in the LiCl lattice.

5. Cesium bromide has the CsCl lattice structure. The unit cell volume is 7.425 x 10^{-23} cm^3.
   a) Calculate the density of the crystal.
   b) Calculate the Cs–Br interionic distance in Ångstroms.

6. Suppose that LiBr crystallized in the zinc blende structure (it doesn’t). The radii of Li^+ and Br^- are 0.60 Å and 1.95 Å, respectively.
   a) Calculate the edge length of the unit cell. Hint: first consider the dimensions of a cubic “mini-cell” which is one-eight of the unit cell.
   b) Calculate the density of this crystal.

7. a) Calculate the lattice energy of potassium bromide using the Born–Lande’ equation.
   b) Calculate the lattice energy of KBr by means of a Born–Haber cycle, using appropriate data from the literature. Compare your two results.

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