Week 9 Worksheet

Chem 11300-2: Section 33

May 24, 2022

***Problem* 1:** Answer the following questions related to diamond.

a) Describe the structure of diamond and determine the density of diamond given that the C-C bond distance is 1.54 Å.

b) Draw a band diagram for diamond.

***Problem* 2:**

a) If the unit edge-cell in CsCl is 4.1 Å, what is the CsCl bond distance

b) If the Ag-Ag bond distance is 2.54 Å, what is the length of the unit cell edge in silver? *Assume FCC lattice.*

***Problem* 3:** Solid Xenon is known to be very malleable and therefore used for matrix isolation experiments. Given that Xenon forms a close-packed structure with density 5.9 g/cm^3, determine the radius of a xenon atom.

***Problem* 4:** Answer the following questions related to $RhBr_2$.

a) Describe the structure of $RhBr_2$ in terms of close packing given that the radii of Rh^{2+} and Br^- are 160 pm and 50 pm respectively.

b) Given that the average rhodium bromine bond length is 3.13 Å, determine the length of the unit cell edge of $RhBr_2$ in angstroms.

c) Determine the density of $RhBr_2$ in g/cm^3.

***Problem* 5:**

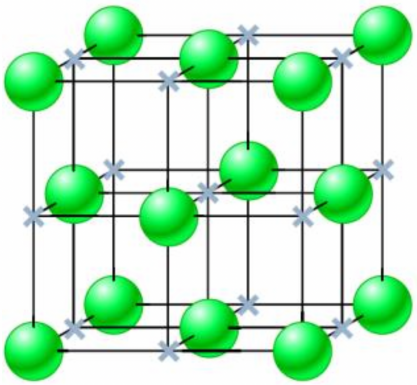
a) Describe the structure of rock salt.

b) Describe the structure of zinc blende.

c) Describe the structure of cesium chloride.

The following problems are written by Professor Mcleod or Head TA. They may mimic homework problems closely, but will be highly beneficial for the midterms and final.

***Problem* 6:** Consider the following unit cell of sodium chloride. Note that the lime green spheres correspond to the chloride ion, and the gray x's correspond to the sodium ion.



a) Sodium atoms are larger than chlorine atoms; however, as can be seen in the image above, sodium ions are smaller than chloride ions. Why do you think this is?

b) Identify whether the unit cell is cubic, body-centered cubic, or face-centered cubic with respect to the chloride ions.

c) How many chloride ions are present in this unit cell?

d) How many sodium ions are present in this unit cell?

e) Are your answers to (c) and (d) consistent with what you know to be the molecular formula for sodium chloride?

***Problem* 7:** Nickel has an FCC structure with a density of 8.90 g/cm^3.

a) Calculate the nearest neighbor distance in crystalline nickel

b) What is the atomic radius of nickel?

c) What is the radius of the largest atom that could fit into the interstices of a nickel lattice approximating the atoms as spheres?