Physics 422 **Name (Print):** _____
Fall 2018
Homework assignemnt 1
Due: 9/4/2018

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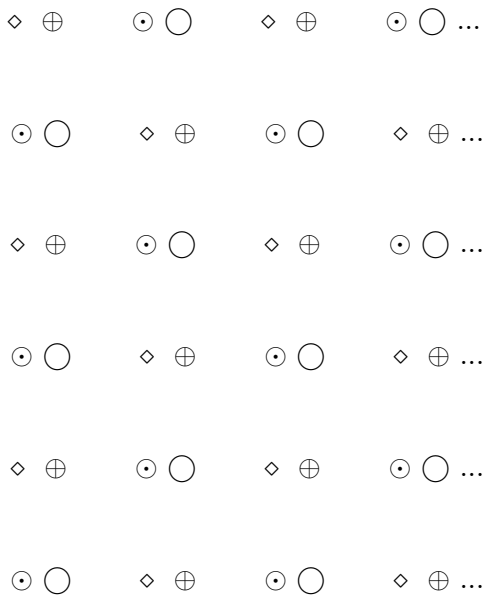
1. Consider the pattern

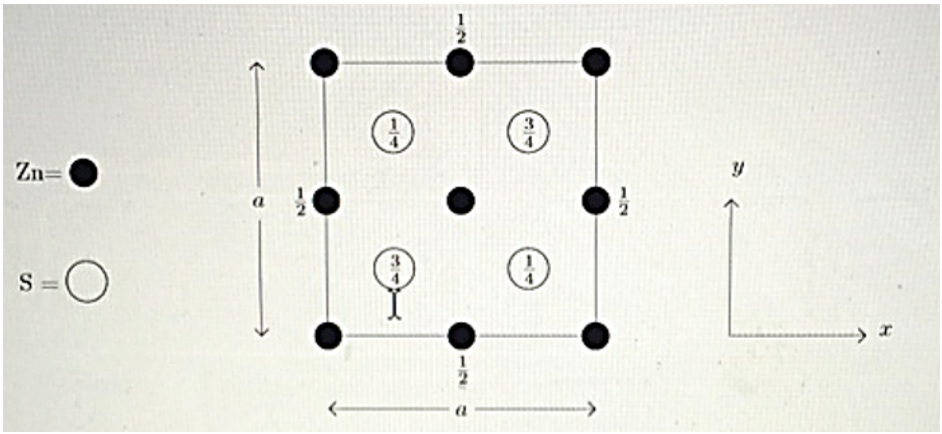


Indicate the following:

- a rectangular unit cell
- a primitive unit cell
- the basis of this "crystal" (how many symbols are in the basis)

2. a) What are the number of nearest neighbors to each lattice point in the simple cubic, BCC, and FCC lattices.
   b) If the conventional unit cell has sides of length a, what are the distances between nearest neighbors in each case?

3. This figure shows a "plan view" of a structure of cubic ZnS (zincblende) looking down the z axis. The numbers attached to atoms represent the heights of the atoms above the $z = 0$ plane as expressed in units of a (unlabeled atoms are at $z = 0$ and $z = a$).



a) What is the Bravais Lattice type?
b) Describe the basis.
c) Given that $a = 0.541$ nm, calculate the nearest neighbor Zn-Zn, Zn-S, and S-S distances.

4. The packing fraction is the percent of the volume of a unit cell that is occupied by atoms. Imagine a FCC lattice with a one atom basis. Determine the packing fraction of this crystal by modelling the atoms as hard spheres that touch nearest neighbours.