University of Zurich[UZH]

Solid State Physics
Exercise Sheet 1

FS17
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Discussion on 1st March

Due on 8th March

Exercise 1 *Crystal lattice*
Why is there no tetragonal base-centred crystal lattice? (Draw a figure!)

Exercise 2 *Cubic lattice system*
For simple cubic, bcc, and fcc lattices with lattice constant a, calculate the following quantities expressed in units of a:

- Volume of the conventional unit cell
- Number of primitive lattice points per unit cell
- Volume of the primitive cell
- Number of nearest neighbours (coordination number)
- Distance between nearest neighbours
- Packing density for spherical and touching atoms

Exercise 3 *Lattice constant of silver*
Silver has a cubic fcc lattice and a density of $10.49\,\mathrm{g/cm^3}$. Calculate the lattice constant, the distance between nearest neighbours, and the radius of a silver atom if they were touching spheres.

Exercise 4 *Wigner-Seitz cell*
Construct the Wigner-Seitz cell of the orthorhombic base-centred lattice for $a_1 : a_2 : a_3 = 4 : 2 : 3$.

Exercise 5 *Sphere packings*
Calculate the ratio c/a of an ideal hexagonal dense sphere packing (hcp) and its packing density. Compare the packing density to that of an fcc lattice and explain your findings.