Aufgabe 10-1: *Schottky* vacancies

For N atoms in a lattice, the equilibrium number n of vacancies is given by *Boltzman* factor:

$$\frac{n}{N-n} = \exp(-\frac{E_V}{k_B T})$$

where E_V is the energy required to take an atom from a lattice site inside the crystal to a lattice site on the surface, k_B is *Boltzman* constant and T is temperature.

Suppose that the energy required to remove a sodium atom from the inside of a sodium crystal to the boundary is 1 eV. Assuming that n $\ll N$, calculates the concentration of *Schottky* vacancies at 300 K.

Aufgabe 10-2: Slip Systems and lines of closest packing

The slip system will consist of the most densely packed crystallographic plane, and within that plane the most closely packed direction.

a) Show that the lines of closet atomic packing are <110> in FCC structure and <111> in BCC structures.
b) Compare planar densities for the (100), (110), and (111) planes for fcc.
c) Compare planar densities for the (100), (110), and (111) planes for bcc.

Aufgabe 10-3: Slip in Single Crystals (*Schmid*'s law)

Schmid's law states that the critically resolved shear stress (τ) is equal to the stress applied to the material (σ) multiplied by the cosine of the angle with the glide plane (ϕ) and the cosine of the angle with the glide direction (λ) which can be expressed as:

$$\tau = \sigma \times m$$

$$m = cos\phi \cos\lambda$$

where m is known as the *Schmid* factor.

Consider a single crystal of silver oriented such that a tensile stress is applied along a [001] direction. If slip occurs on a (111) plane and in a direction [$\bar{1}$01], and is initiated at an applied tensile stress of 1.1 MPa (160 psi), compute the critical resolved shear stress.