809.

Problem 53.37 (RHK)

A silicon crystal is doped with phosphorous to a concentration of 10^{22} phosphorous atoms per cubic meter. We have to find, on an average, the distance between these atoms.

Solution:

The concentration of phosphorous atoms per cubic meter is 10^{22} . We assume that on an average the distance between two neighbouring phosphorous atoms be *a* m. That is phosphorous atoms are distributed in a cubic lattice of lattice length *a* m.

We have

$$\frac{1 \text{ m}^3}{a^3 \text{ m}^3} = 10^{22},$$

or
$$a = \left(10^{-22}\right)^{\frac{1}{3}} = 4.64 \times 10^{-8} = 46.4 \times 10^{-9}$$

The average distance between phosphorous atoms is therefore 46.4 nm.