51233, Physics, Solid State Physics

Question A metallic element has a density of 7.15 g cm^{-3}, a lattice constant of 2.880 $\mathring{A}$, and an atomic weight of 51.9961. Calculate the number of atoms per unit cell of this element and predict its lattice crystal structure

Solution To find number of atoms per unit cell we have to divide mass of lattice by atomic weight of atom. Mass of lattice can be found as

$$m_l = V_l \cdot \rho$$

where $V_l = 2.88^3 \mathring{A}^3$ volume of lattice and $\rho = 7150 kg/m^3$ is density. So

$$m_l = 2.88^3 \cdot 10^{-30} \cdot 7150 \approx 1.7 \cdot 10^{-26}\, kg$$

So, atoms per unit cell:

$$n = \frac{m_l}{m_{atom}} = \frac{1.7 \cdot 10^{-26}}{1,66 \cdot 10^{-27}} \approx 10$$

From this, we can conclude, that element has Body-centered cubic crystal structure.