Answer on Question #73152-Physics-Other

A metallic element has a density of 10.22 g cm−3 , an atomic weight of 95.94 amu and an atomic radius of 0.136nm. Determine whether its lattice structure is bcc or fcc

Solution

In order to determine whether metallic element has an FCC or a BCC crystal structure, we need to compute its density for each of the crystal structures.

FCC:

$$\rho = \frac{nA}{\left(2\sqrt{2}R\right)^3 N_A}$$

$$\rho = \frac{(4)(95.94)}{\left(2\sqrt{2}\cdot 0.136\cdot 10^{-9}\right)^3 (6.023\cdot 10^{23})} = 11.19\frac{g}{cm^3}$$

BCC:

$$\rho = \frac{nA}{\left(2\sqrt{2}R\right)^3 N_A}$$

$$\rho = \frac{(2)(95.94)}{\left(\frac{4}{\sqrt{3}}\cdot 0.136\cdot 10^{-9}\right)^3 (6.023\cdot 10^{23})} = 10.22\frac{g}{cm^3}$$

which is the value provided in the problem. Therefore, metallic element has a BCC crystal structure.