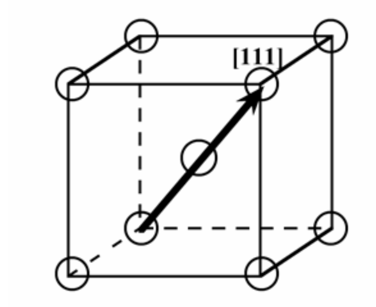

For although the [111] direction vector shown passes through the centers of three atoms, there is an equivalence of only two atoms associated with this unit cell—one-half of each of the two atoms at the end of the vector, in addition to the center atom belongs entirely to the unit cell. Furthermore, the length of the vector shown is equal to 4*R*, since all of the atoms whose centers the vector passes through touch one another. Therefore, the linear density is equal to

$$\mathrm{LD}_{111} = \frac{\text{number of atoms centered on [111] direction vector}}{\text{length of [111] direction vector}}$$

$$= \frac{2 \text{ atoms}}{4R} = \frac{1}{2R}$$

(b) From the table inside the front cover, the atomic radius for iron is 0.124 nm. Therefore, the linear density for the [110] direction is

$$\mathrm{LD}_{110}(\mathrm{Fe}) = \frac{\sqrt{3}}{4R\sqrt{2}} = \frac{\sqrt{3}}{(4)(0.124 \text{ nm})\sqrt{2}} = 2.47 \text{ nm}^{-1} = 2.47 \times 10^{9} \text{ m}^{-1}$$

While for the [111] direction

$$\mathrm{LD}_{111}(\mathrm{Fe}) = \frac{1}{2R} = \frac{1}{(2)(0.124 \text{ nm})} = 4.03 \text{ nm}^{-1} = 4.03 \times 10^{9} \text{ m}^{-1}$$